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Los Angeles Museum, Exposition Park, Los Angeles, Cal.
FURTHER NOTES ON THE DESERT SNAILS OF RIVERSIDE COUNTY, CALIFORNIA

By G. Willett

During a recent trip to the desert of Riverside County, the writer and his wife visited three mountain ranges new to their experience, and succeeded in securing small series of Micrariontas in each of them. The Coxcomb and McCoy Mountains are volcanic ranges, their slopes covered with lava rock in which no snails were found. In both regions, however, heavy rains have torn gullies through the surface lava and into granite and sandstone, and in rock slides along the sides of these gullies specimens were secured. In the Granite Range, which, as the name indicates, is made up mostly of granite, snails were taken in the usual locality, rock slides on the mountain slopes.

The shell taken in the Coxcombs, near the southern end of the range, is so nearly identical with Micrarionta rowelli unifasciata Willett, from Newberry Springs, San Bernardino County, that it seems advisable to refer it to that form. Specimens taken in the other two ranges, however, differ from previously known races in various ways, and are here named and described, as follows:

Micrarionta granitensis, new species.

Description: Shell almost circular, rather small; aperture slightly wider than high; pillar of inner lip encroaching somewhat on the umbilicus; papillation on nuclear whorls as in M. rowelli. Color light horn, with narrow chestnut band on the periphery of the last whorl.

From M. rowelli unifasciata, its nearest neighbor on the west, this form differs principally in larger size and rounder outline. In these characters is similar to M. rowelli bakerensis Pilsbry and Lowe, but differs from that form in narrower chestnut band, thinner lip, rounder (higher) aperture, and smaller umbilicus.
Type: No. 1043, Los Angeles Museum, collected by Ora A. Willett, at the northwest end of the Granite Mountains, Riverside County, California, March 5, 1935. In addition to the type (a dead shell), five living, immature specimens and ten dead ones were secured at the same time and place. This locality is about one mile southeast of the road running from Desert Center to Rice.

Measurements of type: Diam., 14.8 mm.; alt., 8.5 mm.; number of whorls, 4½.

_Micrarionta mccoiiana_, new species.

Description: Shell small, fragile, depressed; aperture nearly circular, the inner lip encroaching slightly on the umbilicus; papillation on early whorls as in _M. rowelli_. Early whorls light brown in color; last whorl white, irregularly clouded with light amber; most specimens show an extremely narrow, light brown band on the periphery, but this is absent in a few examples.

Similar in size and shape to _M. r. unifasciata_, but more depressed, with more descending last whorl, and much lighter in color. In color, much like _M. r. desertorum_ Pilsbry and Ferriss, but smaller, more fragile, and lacking the heavily reflected lip of that form; also most specimens of _mccoiiana_ show the thin peripheral brown line which is absent in the majority of _desertorum_.

Type: No. 1044, Los Angeles Museum, collected by G. Willett, with thirty additional specimens, at McCoy Well, McCoy Mountains, Riverside County, California, March 6, 1935. The type and one immature specimen were living when found, the others dead and more or less faded.

Measurements of type: Diam., 12.8 mm.; alt., 7 mm.; number of whorls, 4½.

Both the above may be races of _M. rowelli_, but further investigation is necessary before this can be demonstrated satisfactorily.

Los Angeles Museum, Los Angeles, California
March 14, 1935
A NEW VARIETY OF OPUNTIA ERINACEA
ENGELMANN

By M. B. Dunkle

This new cactus is found outside the reported range of O. erinacea Engelmann which is commonly given as the Mohave Desert and eastward. This new variety is found on the flanks and foothills of Santa Rosa Mountain in Riverside County. There is considerable variation in the new form in the form and coloration of the joints, the color of the flower, and the length and abundance of spines. It is marked particularly by the absence or shortness of spines on the lower half of the joints.

Opuntia erinacea Engelmann, variety paucispina Dunkle new variety. Main stems prostrate with younger joints erect, main stems greatly thickened and closely invested with enlarged glochids; joints narrowly elliptical to obovate, rarely orbicular, indistinctly tuberculate, light green or rarely purplish-tinged, up to 15 cm. long; areoles approximate, less than 1 cm. apart, glochids yellow to olive-brown; spines few or none on the basal half of the joint, above one to four in a cluster, 2 to 75 mm. long, acicular, white or light brown, reflexed or spreading, longer spines on upper margin of joint, usually one spine in a cluster greatly exceeding the others; flowers bright yellow to salmon yellow, 3 to 5 cm. long; fruit subglobose, dry, white, 15 to 20 mm. in diameter, with several to many white reflexed spines up to 15 mm. long.

Caules prostrati; articuli erecti, elliptici vel obovati, quotcumque 15 cm. longi; spinae paucae vel nullae in infera dimidia parte articuli, in supera parte 1 ad 4 in fascicule, albae, aciculiformes, plerumque una spina in fasciculo praelongior reliquio; flores flavi vel lutei, quotcumque 6 cm. diametro; fructi globosi, sicci, cum spinis reflexis, quotcumque 2 cm. diametro.

Granitic sand in chaparral from 4,000 to 5,000 feet, Santa Rosa Mountain and foothills. The type specimen is Dunkle No. 4236, from Ribbonwood at the head of Palm Springs Canyon.
A REVISION OF THE GENUS PLEOCOMA

By A. C. Davis

U. S. Dept. of Agriculture. Bureau of Entomology and Plant Quarantine

Continued from Vol. XXXIII, No. 3, p. 130

Characters, Methods, and Terms

The characters upon which the species of Pleocoma are separated are fairly numerous. Among the most important are the number of joints in the antennal club, the hairiness of the pronotum and the scutellum, and the sculpture of various parts of the body. A few species, such as P. staff and P. hoppingi, have characters that set them apart from the others immediately, but the worker in the group must depend chiefly upon an aggregate of minor characters, rather than upon one or two diagnostic ones. With the exception of the number of joints in the antennal club and the hairiness of the pronotum and scutellum, there are few characters that are not subject to great variation.

The parts of the head used in classification are illustrated in Figure 1, A and B.

**FIGURE 1**

Pleocoma badia fall: A—One-half of dorsal view of head. B—Outline of profile of head: 1. apex of clypeus; 2. emargination of clypeus; 3. ocular canthus; 4. eye; 5. horn of vertex; 6. clypeus.
PLATE 1
The sketches of the antennae (Pl. 1) are not drawn to scale, but are in correct proportion, most of them having been drawn with the camera lucida. Of necessity they are diagrammatic, as the antennae are so bent and the lamellae so overlap one another that a drawing of them as they actually are would mean very little. For this reason, in the accompanying sketches, the joints are brought as nearly into one plane as possible and drawn from the dorsal aspect, so that comparison may be made. Measurements of the antennae were made, either directly from the specimen with a pair of very fine calipers and a finely divided millimeter scale, or with a micrometer eyepiece in a binocular microscope. Measurements of parts other than the antennae were made directly, with the calipers. The proportions of the pronota and elytra were made with the specimen so tipped that the margins of the parts to be measured were as nearly as possible on a horizontal plane all around. The length of the elytron was measured from the anterior margin at the point where it extends beneath the scutellum to the apex.

In speaking of the antennae the terms "length" and "width" are reversed when referring to the joints forming the club, i.e., joints produced into projections or lamellae the relative lengths of which it is necessary to compare. In these cases "length" means the length of the joint and projection or lamella together, across the long axis of the antennae.

It might be well to state here that in the past some writers, in speaking of the antennal club in this genus, have considered the extent of projection of the lamellae anteriorly as the index of length, overlooking the fact that the joints are not even at their bases. Thus, for example, the ninth joint may project beyond the tenth at the apex, and is noted as "longer than the tenth," whereas actually the base of the tenth joint may project farther posteriorly than that of the ninth, the joint and lamella being distinctly longer than the ninth. In the present paper the measurements of these joints from base to apex are compared.

Total length was measured from the tip of one of the clypeal horns to the apex of the elytron on the same side.

The following key is made as brief as possible consistent with accuracy, and will serve to separate fairly typical male specimens. I have attempted to make it absolute, so that the identification of a single specimen may be made without referring to others. This has not been possible in all cases, especially in _P. behrensii_ and _P. fimбриata_, where exact locality is not known. Since separation of a given species from others of the genus sometimes depends, as in those just mentioned, upon a number of minor characters, it was considered advisable, even at the risk of apparent repetition, to give descriptions following the table in detail, with notes upon the variations encountered.

Of the females, some are not known at all; others are represented by two or three specimens only; and there are so few important characters in the female specimens that a workable key could not be produced for them.
KEY TO THE SPECIES OF PLEOCOMA

1. Club of antenna 4-jointed .................................................. 2
   Club of antenna 7-jointed .................................................. 13

2. 3rd joint of antenna $\frac{3}{4}$ or less than $\frac{3}{4}$ long as 1st........ 3
   3rd joint of antenna more than $\frac{3}{4}$ as long as 1st;
   scutellum covered with hair .......................................... remota Davis

3. Hairs of underside dark brown or black .............................. 4
   Hairs of underside yellow or rufous .................................. 6

4. Scutellum not hairy .......................................................... 5
   Scutellum hairy and coarsely punctate; middle and hind
   tarsi distinctly shorter than the tibiae .............................. shastensis Van Dyke

5. Larger (26-31 mm.); length of pronotum at mid-line
   less than $\frac{1}{2}$ the greatest width; hind angles distinct;
   elytral intervals not rugose ............................................. puncticollis Rivers
   Smaller (20-23 mm.); length of pronotum at mid-line
   about $\frac{2}{3}$ the greatest width, hind angles rounded;
   elytral intervals rugose .................................................. rickseckeri Horn

6. 11th joint of antenna subequal to the 10th ....................... 7
   11th joint of antenna distinctly shorter than the 10th ....... 8

7. Unicolorous, shining black, less robust ............ australis Fall
   Bicolorous, pronotum piceous, elytra reddish brown,
   more robust .................................................. bicolor Linsley*

8. Scutellum hairy; color brown .......................................... 9
   Scutellum not hairy; color deep brown or black ............... 10

9. Unicolorous; anterior median impression of pronotum
   longitudinal, narrow, deep, and coarsely and closely
   punctate and hairy ..................................................... simi Davis
   Bicolorous, the pronotum darker than the elytra; an-
   terior median impression of pronotum shallow, wide,
   involving $\frac{1}{2}$ the width of pronotum ....... oregonensis Leach

10. Pronotum finely, rather sparsely punctate ..................... 11
    Pronotum more coarsely punctate .................................. 12

11. Basal angles of pronotum less prominent .. fimbriata LeConte
    Basal angles of pronotum prominent .............. tularensis Leach

* Pleocoma bicolor Linsley and P. sonomae Linsley were described (Pan-Pac. Ent. 11: 11-15, January 1935) after the present paper was in process of publication. The
   writer has not seen specimens of either species, but has placed them in the key
   as well as possible by the descriptions.
12. Lamella of 7th antennal joint \( \frac{1}{2} \) to \( \frac{2}{3} \) as long as that of 8th ........................................... *behrensi* LeConte
Seventh joint hardly more than transverse, without lamella ........................................... *sonomae* Linsley*

13. Pronotum convex in front, or with a slight depression ........................... 14
Pronotum retuse in front, i.e., suddenly declivous in front of and broadly impressed behind a transverse elevation ................................................................. 17

14. Pronotum hairy .............................................................................. 15
Pronotum not hairy, or at most with a few hairs near the anterior edge .................. 16

15. Robust, convex; color deep chestnut brown, pronotum gray or black .................... *hirticollis* Schaufuss
Less robust, dorsum flattened, sides more nearly parallel; color light brown ............. *hoppingi* Fall

16. Larger (23.5-28.5 mm.); color brown ........................................... *badia* Fall
Smaller (23.5 mm.); color black; anterior median impression of pronotum not or sparsely hairy, punctuation light .................................................. *conjungens* Horn
Very hairy; anterior median impression of pronotum closely punctate and hairy .......................... *hirsutus* n. var.

17. Scutellum not hairy; color brown .................................................. 15
Scutellum covered with hair:
Bicolorous; elytra bright red-brown, pronotum darker ........................................... *staff* Schaufuss
Unicolorous; black or very dark brown ................................................................. *dubitabilis* n. var.

18. 4th joint of antenna produced in a process about \( \frac{1}{2} \) as long as that of the 5th; basal angles of pronotum broadly rounded ........................................... *edwardsi* LeConte
4th joint of antenna merely transverse, not produced;
basal angles of pronotum distinct ................................................................. *ulkei* Horn

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*Pleocoma bicolor* Linsley and *P. sonomae* Linsley, *idem.*

*Pleocoma remotaa* Davis (2)

Broadly oval, robust, dorsum slightly flattened, fimbriate and clothed beneath with yellow hair. Head very dark brown or blackish, closely punctate above, ocular canthi impunctate; eyes moderately prominent, much flattened, slightly cut into in front by the ocular canthi, and rather deeply behind by lobes of the genae, so that about two-thirds of the total area is ventral, set into the head obliquely with the anterior margins each about 0.3 mm. nearer the mid line than the posterior margins, where they disappear under the pronotum; clypeus small, heavy, reflexed.
sharply obtusely emarginate at apex, the anterior margins sinuate, apices bluntly rounded and nearly truncate, lateral margins rounded; anterior margins of ocular canthi sinuate, inclined posteriorly from a right angle to the mid line, apical angles and posterior margins broadly rounded; horn of vertex fairly long, heavy, rounded at apex, quadrate in cross section, the anterior angles of the horn continued as oblique ridges on the frons, terminating on each side at the junction of the ocular canthus with the clypeus.

Pronotum black, glabrous, less than twice as wide as long, widest at basal two-fifths; anterior angles, sides, and basal angles all included in one sweeping curved margin; disc evenly, moderately coarsely, and rather closely punctate, posterior median impression distinct, anterior median impression broad and deep, giving a retuse appearance to the profile of the pronotum.

Scutellum subtriangular, almost covered with tawny hair.

Elytra chestnut brown, wider at the humeri than the base of the pronotum, conjointly nearly as wide as long, widest at about the apical third; costae hardly elevated, smooth, impunctate; geminate striae distinct but not deep, not attaining the apices of the elytra, delimited by large, shallow punctures; sutural striae moderately deep; elytral intervals coarsely, sparsely punctate and slightly rugose.

Body beneath castaneous, femora darker, and tibiae nearly black.

Length 22.5 mm., maximum width 14 mm.

Antennae (Pl. 1, fig. 9) brown. First joint conical; second subglobular, transverse, four-fifths as wide as first; third subcylindrical, pentagonal as viewed from above, seven-tenths as long as the first joint, widest at apical fifth; joints 2 and 3 together almost or quite equal in length to the first; fourth joint shorter than the third and about equal in width, pentagonal in outline; fifth joint wider than the fourth and about as long, joints 4 and 5 together shorter than the third; sixth joint transverse, angulate, with a short process; seventh joint with a short lamella a little more than one-third as long as the joint and lamella of the eighth; joints 8 to 11 forming the club, the ninth joint longest, the tenth nearly as long, the eleventh shorter than the tenth, and the eighth shorter than the eleventh.

Type locality. Utah.

The female of this species is not known.

The thorax in profile is distinctly retuse, although not so pronouncedly so as in P. staff and P. edwardsii. The geminate striae do not reach the apex of the elytra, a peculiarity found also in staff. The first geminate stria is interrupted behind the mid-
dle by an offset laterally of about its own width, the inner stria resuming on a line with the outer one, and terminating abruptly a short distance posterior to this point.

*P. remota* differs from *P. behrensii* and *P. fimbriata* in color, in the hairy scutellum (which was probably completely covered with hair when the specimen was first taken), in the different proportions of the antennal joints, the blunt apical horn, and the elytral characters. The species resembles *P. staff* very closely in all except the number of joints in the antennal club, and might easily be mistaken for an off-color specimen of that species. Since the unique type is labeled "Utah" and is from the collection of J. B. Smith, there is little doubt that this is the specimen concerning which the note (25) upon Utah as a new territory for *Pleocoma behrensii* was written.

*Pleocoma shastensis* Van Dyke (27)

Broadly oval, robust, dorsum flattened, black, fimbriate and clothed beneath with very dark brown hair. Head above rather coarsely and closely punctate; eyes round, very prominent; elytral reflexed, obtusely emarginate at apex, apices acutely rounded; ocular canthi with anterior margins sinuate, directed slightly forward of a right angle to the midline, apical angle lacking, postero-lateral angle broadly rounded, smooth and shining above, with an oblique carina; horn of vertex short, subconical, pointed at apex.

Pronotum distinctly less than twice as wide as long (7 by 11.6 mm.), widest at about the basal third, smoothly and evenly convex in profile, rather sparsely punctate; apical angles rounded, basal angles rounded but distinct; both anterior and posterior median impressions very vague.

Scutellum subtriangular, apex and sides broadly rounded, surface nearly covered with hair.

Elytra conjointly about one-fourth longer than wide, sides nearly parallel from the humeri but widening slightly to the apical third; sutural striae faint in front, rather deep apically; costae not or barely elevated. minutely punctate, rugose; geminate striae moderately well defined basally, disappearing at about the apical third; intervals very sparsely punctate and rugose.

Body beneath and legs clothed with dark brown hair. Legs robust, middle and hind tarsi distinctly shorter than the tibiae.

Length 25 mm., width 13 mm.

Antennae (Pl. 1, fig. 15) brown. First joint subconical; second transverse; third elongate, pentagonal in outline, widest at apical third, less than half as long as first, joints 2 and 3 together slightly over half as long as the first; fourth joint sub-
globular; fifth transverse; sixth transverse with a short projection. Joints 4, 5, and 6 together equal in length to the third; seventh joint with a projection almost half as long as that of the eighth. Joints 8 to 11 form the club, the tenth joint longest, the ninth almost as long, the eleventh shorter than the ninth, and the eighth about six-sevenths as long as the eleventh.

The female of this species is unknown.

The type locality of this species is near Pondosa, Siskiyou County, California, where specimens were collected by K. A. Salman on October 22, 1932.

Pleocoma puncticollis Rivers (20)

Shining black, fimbriate with black or rusty-black hair. Head above sparsely punctate; clypeus deeply emarginate, the apices blunt, rounded, or truncate; anterior margins of the ocular canthi nearly straight, almost at right angles to the mid line or slightly inclined forward, apices rounded and moderately sharp, posterior margins rounded; horn of vertex with sides almost parallel and with a very slight emargination at apex.

Pronotum twice as wide as long, basal angles rounded but distinct, disc coarsely and closely punctured, more closely toward the sides, median anterior and basal impressions shallow to moderately deep.

Elytra equal to or slightly narrower at base than the base of the pronotum, from two-twelfths to three-fifths longer than wide; costae barely elevated, smooth, impunctate; geminate striae indicated by rows of shallow punctures at wide intervals; elytral intervals smooth, shining, very finely and sparsely punctate.

Body beneath and legs clothed with black, slate-black, or brownish-black hair.

Length 26-31 mm.

Antennae (Pl. 1, fig. 3) piceous with a tendency for the apices of the joints to be brownish, club rusty gray. First joint conical, elongate; second globular, tending to quadrate in outline, two-thirds as wide as the first; third joint narrower than the second, slightly more than two-thirds as long as the first, constricted at the basal third and widest near the apex, joints 2 and 3 together nearly equal to the first in length; fourth joint quadrate, very slightly if at all wider than the third, and one-half as long; fifth joint subequal in length to the fourth and wider, joints 4 and 5 together almost exactly equal to the third in length, or slightly longer; sixth joint transverse, angulate, pentagonal in outline, nearly as long and twice as wide as the fifth; seventh joint subequal to the sixth in length and about twice as wide, with a short projection. Joints 8 to 11 form the club, the tenth longest.
the ninth slightly shorter, and the eleventh distinctly shorter. The lamella of the ninth joint projects farthest forward, the tenth slightly less.

I have never seen a female of this species, and it may be unknown.

In the key this species falls closest to *P. rickseckeri*. The characters of the shape and relative proportions of the pronotum may not be reliable, and not enough specimens have been available to make an accurate determination of the amount of variation. According to Rivers (20) “*puncticollis* differs from *rickseckeri* by the former being heavily punctured all over the disc of the thorax, while in the latter the same part is sparsely and lightly punctured.” Allowing for the difference in size between the two species, the males of *rickseckeri* seem to be about as heavily punctate as those of *puncticollis*. The posterior margin of the pronotum is less divergent from the center in *puncticollis* which, with the sharper basal angles, makes these appear to project beyond the humeri. The elytra of *puncticollis* are smooth and shining, the sutural striae shallow, the geminate striae feebly indicated, and the intervals very finely and sparsely punctate, while the elytra of *rickseckeri* have the sutural striae deeper, the geminate striae more clearly indicated although not deep, and the intervals are distinctly rugose. The tenth joint of the antenna is almost equal to the ninth in *puncticollis*, distinctly shorter in *rickseckeri*. *P. rickseckeri* is found in Sonoma County, Calif. (Sylvania), and has never been taken elsewhere to my knowledge while *puncticollis* is found in the southern part of the state. The locality and size alone almost suffice to distinguish the two species.

I have the following records of capture for this species, all in California:4

Type locality “8 miles from Julian, Calif.” (San Diego County); Alamo, Lower California (F); Del Mar, San Diego County (F, D); Cuyamaca (CAS); Beverly Hills, Los Angeles County (LAM).

*Pleocoma rickseckeri* Horn (8 and 9)

Male: Shining black, margins fimbriate with black hair. Head above coarsely and closely punctate; apical emargination of Clypeus usually deep and rounded, apices acutely rounded; ocular canthi with anterior margins rounded, the middle in advance of either end, apical angles broadly rounded, posterior margins nearly straight; horn of vertex with sides nearly parallel, obtusely triangularly emarginate at apex.

4 The collections from which records were obtained are designated as follows: (F), H. C. Fall; (D), A. C. Davis; (LAM), Los Angeles Museum; (CAS), California Academy of Sciences; (Frost), C. A. Frost; (U. S.), United States National Museum.
Pronotum slightly less than twice as wide as long (Horn says more than twice as wide as long), widest at basal angles, which are distinct in most specimens but very obtuse; disc heavily and closely punctured, the punctation slightly less dense toward the sides; basal median impression lacking or very faint, anterior median impression faint.

Elytra conjointly somewhat less than one-sixth longer than wide, wider at the humeri than the base of the pronotum, widest slightly behind the middle; sutural striae moderately deep; costae slightly elevated, rugose; geminate striae outlined by rows of confluent wrinkles (not punctures); elytral intervals rugose.

Body beneath black, clothed with black hair.

Length 20-23 mm.

Antennae (Pl. 1, fig. 7) piceous to ferruginous. First joint elongate, conical, curved; second subglobular, slightly narrower than the first; third joint cylindrical, slightly curved, three-fifths as long and wide as the first; the second and third joints together somewhat over two-thirds the length of the first; fourth joint two-thirds as long as the third and somewhat wider; fifth joint angulate, equal in length to and somewhat wider than the fourth; joints 4 and 5 together one-fourth longer than the third; sixth joint transverse, angulate, pentagonal in outline. Joints 7 to 11 form the club, the seventh with its lamella about half as long as the eighth, the ninth join longest.

Female: Castaneous, head and elytra darker than the pronotum. Head above coarsely and closely punctate; clypeus slightly reflexed, anterior margin rounded or squarely truncate, not or very slightly emarginate; ocular canthi about the same as in the male, but with the anterior margin straighter and not advanced so far; horn of vertex short, stout, emarginate at apex.

Pronotum about twice as wide as long, basal angles distinct but rounded; disc coarsely and moderately closely punctate; basal and anterior median impressions shallow.

Elytra with sutural striae moderately deep, shallower than in the male; geminate striae very faint; elytral intervals rather coarsely but very shallowly rugose.

Length, 28-34 mm.

Antennae (Pl. 1, fig. 16) brown. First joint conical and somewhat more than one-half as wide as long; second subglobular, two-thirds as wide as first; third cylindrical, one-fourth as long as the first; joints 4 and 5 subequal in length, wider than the third and together somewhat longer; sixth joint transverse, equal in length to the fifth but wider; seventh shorter and wider than the sixth. Joints 8 to 11 form the club, the ninth distinctly longest, joint 10 shorter, and joint 11 shorter than the tenth. In one specimen seen the ninth and tenth joints were subequal in length.
*Pleocoma rickseckeri* seems to be peculiar to Sonoma County. The type locality is Sylvania, Calif.

*Pleocoma australis* Fall (5)

Male: Ovate, less robust than *P. fimbriata*, dorsum flattened, black, shining, fimbriate with reddish-yellow hair. Head above finely and closely punctured; eyes round, prominent; clypeus reflexed, deeply emarginate, the apices sharply rounded, not truncate; ocular canthi with the anterior margins nearly straight, inclined slightly forward, apical angles rounded, posterior margins broadly rounded; horn of vertex with sides converging toward the apex, apex with a small emargination.

Pronotum less than twice as wide as long, basal angles distinct but rounded; disc coarsely and closely punctured, a little more closely so toward the sides; basal and anterior median impressions vaguely indicated, the former nearly or quite impunctate.

Elytra conjointly from one-seventh to one-fifth longer than wide, wider at the humeri than the base of the pronotum, sides nearly parallel; sutural striæ well defined; costae very little if at all elevated; elytral intervals finely, sparsely punctate, with a secondary rugose sculpture more or less evident.

Body beneath castaneous, clothed with reddish-yellow hair.

Length 24-28 mm.

Antennae (Pl. 1, fig. 4) dark brown, club gray-brown. First joint conical, elongate; second subglobular, somewhat wider than long, two-thirds as wide as the first; third more than one-half as long as the first, widest at apical third, joints 2 and 3 together five-sixths as long as the first; fourth joint shorter, wider than the third, quadrate; fifth wider than the fourth, joints 4 and 5 together equal to or slightly longer than the third; sixth joint transverse, angulate, wider than the fifth; seventh joint with a short lamella, a little more than one-third as long as the joint and lamella of the eighth. Joints 8 to 11 form the club, the tenth longest, the eleventh very nearly or quite as long, the ninth shorter. Joints 9 to 11 have their apices very nearly even in front.

Female: Robust, ovate, castaneous, head and pronotum darker, fimbriate with yellow hair. Head moderately closely and coarsely punctate; eyes hardly visible from above; clypeus reflexed and broadly, obtusely emarginate, the apices rounded; ocular canthi as in the male, but broader and heavier; horn of vertex heavy, conical, truncate, deeply grooved on the median line before and behind, but not emarginate at apex.

Pronotum slightly less than twice as wide as long, basal angles distinct but rounded; disc with very heavy, coarse, close punctuation, the punctures confluent over much of the surface; basal and anterior median impressions vague, and on each side of the midline a small impunctate area.
Elytra thin, semi-transparent, widest at apical third; sutural striae merely rows of punctures; costae not elevated; geminate striae hardly visible; elytral intervals very finely and sparsely punctate.

Body beneath and legs clothed with yellow hair.

Length 40 mm.

Antennae (Pl. 1, fig. 22) brown, the club darker. First joint conical, elongate, one-half as wide as long; second subglobular, one-half as wide as first; third subconical, at base one-half as wide as the second, at apex two-thirds to three-fourths as wide as the second, one-half as long as the first, joints 2 and 3 together two-thirds as long as the first; fourth joint shorter, wider than the third; fifth joint shorter, wider than the second, joints 4 and 5 together equal to the third in length; sixth joint transverse, almost equal to the fifth in length, but one-third wider; seventh joint shorter and wider than the sixth. Joints 8 to 11 form the club, the ninth longest, the tenth almost or quite as long, the eighth and eleventh successively shorter.

This species seems to be related to *rickseckeri*, *puncticollis*, and *fimbriata*, resembling the last-named species most closely. From the first two it may be distinguished at once by its yellow vestiture. From *P. fimbriata* it differs relatively less. The antennae are nearly the same except that in *fimbriata* they are less robust, the joints being more cylindrical and longer in proportion. In *australis* the eleventh joint of the antenna is subequal to the tenth, while in *fimbriata* it is distinctly shorter. In addition, *fimbriata* is more robust, the thorax has usually a brownish tinge, and the punctuation of the pronotum is finer and sparser than in *australis*.

The type locality is Bailey Canyon, near Sierra Madre, Calif., and the species is also found in the Santa Anita Canyon, some three miles east.

**Pleocoma bicolor** Linsley

Distinguished from other species with 4-jointed antennal clubs by the color and the more sparsely and finely punctate pronotum.

**Pleocoma simi** Davis (2)

Broadly oval, robust, dorsum flattened, fimbriate and clothed beneath with yellow hair. Head dark brown, closely but rather lightly punctate, densely clothed with long yellow hair; clypeus reflexed, not or very slightly emarginate at apex, angles sharply rounded, lateral margins rounded, upper surface densely clothed with yellow hair; anterior margins of ocular canthi at right angles to the midline of the body, anterior and posterior angles lacking, the outer half being very nearly semicircular in outline as viewed
from above, upper surface smooth, impunctate; eyes prominent, round; horn of vertex moderately long, subconical, pointed at apex.

Pronotum chestnut brown, less than twice as wide as long (6.5 by 11.8 mm.), of even maximum width from about the middle to the posterior fifth, anterior and posterior angles broadly rounded; disc finely and sparsely punctate at the median base, coarsely and closely punctate toward the sides, where the punctures tend to confluence; posterior median impression distinct, anterior median impression long, groovelike, involving the anterior three-fifths of the length of the pronotum, fairly wide and deep, coarsely and extremely closely punctured, and with sparse, long yellow hairs. At each side of the disc, equally distant from the midline and the lateral margin and at about the basal third, is a large, shallow circular pit. The pronotum has a retuse appearance in profile.

Scutellum transverse, posterior margin rounded, punctate and clothed with yellow hair, which, with that of the base of the pronotum, nearly conceals the surface.

Elytra chestnut brown, wider at the humeri than the base of the pronotum, one-sixth longer than wide conjointly, widest at apical third; sutural striae moderately deep; costae slightly elevated, smooth, impunctate, not attaining the apices of the elytra; geminate striae faint, consisting of small, shallow, widely spaced punctures; elytral intervals finely and sparsely punctate.

Body beneath and legs castaneous, densely clothed with long yellow hair.

Length 24 mm., maximum width 13.5 mm.

Antennae (Pl. 1, fig. 5) brown. First joint subconical; second transverse; third almost twice as long as wide, subconical, joints 2 and 3 together exactly four-fifths as long as the first in the type; fourth joint transverse; fifth joint of about the same length, but wider, angulate; sixth joint transverse, longer than the fifth, twice as wide as long; seventh joint as long as the sixth, with a short process. Joints 8 to 11 form the club, the ninth and tenth equal and longest, the eleventh shorter, and the ninth shorter than the eleventh.

Type locality, Cleveland, Oregon.

This species may be distinguished from P. behrensii and P. fimbriata by the color, the hairy scutellum, and by the groove-like, densely punctate and hairy anterior median impression. From P. oregonensis, as far as I can tell without actually seeing the type, it differs in being unicolorous, in the characters of the anterior median impression, the very shallowly emarginate clypeus, and the less abrupt declivity of the pronotum.

Two male specimens of Pleocoma from Shasta County, Calif., given me some years ago by E. O. Essig of the University of California, probably represent an undescribed species very close
to *simi* and *oregonensis*, being brown, and having the scutella hairy. Unfortunately the antennae of both are lacking and they cannot be described at this time.

**Pleocoma oregonensis** Leach (10)

The following description is taken from that of Leach:

Form robust, rounded, bicolorous and shining above, clothed underneath with long dense golden brown hair; densely fimbriate on prothorax, lightly on elytra.

Head piceous, coarsely and densely punctured except on ocular canthi which are smooth, shining, wide and broadly rounded at apex; clypeus deeply emarginate, angles acute; horn of vertex moderate in size, round, and acute at apex.

Pronotum dark brown above, widest slightly behind the middle, broadly rounded at sides and basal angles; disc finely and closely punctured, the punctures coarser and confluent at sides and front; posterior median impression narrow, shallow, impunctate, with a smaller depression on each side, laterally; anterior median impression involving one-half of the width of the pronotum, forming a declivity in front.

Scutellum with the surface hidden by dense long golden-brown hair.

Elytra light red brown; at humeri very slightly wider than the base of the pronotum, widest at middle; sutural striae deeply impressed their entire length, the costae not widened at apex; geminate striae distinct but not deep, not attaining the apex of the elytra.

Legs stout, posterior tarsi much shorter than the tibiae (4.8 mm. to 6.2 mm.).

Length 23 mm., width 13 mm.

Antennae with first joint heavy and subconical; second transverse; third almost three times as long as the second and three-fourths as long as the first; sixth with a slight lobe; seventh with a lamina almost one-half as long as those on the joints 8 to 11, which form the club.

Type locality, Wasco, Oregon.

**Pleocoma fimbriata** Le Conte (11, pp. 24-25).

Male: Dorsum depressed, shiny black, sometimes with a castaneous tinge, fimbriate with yellow hair. Head above very finely and sparsely punctate, almost impunctate; clypeus deep and heavy as viewed from the side, sharply reflexed, rather deeply emarginate, the apices acutely rounded; anterior margins of ocular canthi nearly straight, inclined slightly forward of a right angle to the midline of the body in most cases, apices and posterior margins rounded; horn of vertex with sides parallel or slightly converging near the apex, which is obtusely emarginate.
Pronotum about or slightly more than twice as wide as long, basal angles distinct but rounded; disc finely and sparsely punctate.

Elytra with the sutural striae shallow; geminate striae feebly indicated by fine punctures at wide intervals; costae slightly elevated, smooth; elytral intervals very finely and sparsely punctate.

Body beneath and legs castaneous, clothed with long yellow hair.

Antennae (Pl. 1, fig. 11) deep chestnut brown, club gray-brown. First joint conical, elongate; second subglobular, three-fourths as wide as the first; third cylindrical, slightly constricted at the basal fourth, about two-thirds as long as the first joint, joints 2 and 3 together averaging slightly more than four-fifths the length of the first, but varying from two-thirds to twelve-thirteenth as long; joints 4 and 5 subequal in length, slightly wider than the third and together about equal to it in length; sixth joint with a short projection or lamella; seventh with a lamella one-half to two-thirds as long as that of the eighth, in reality forming part of the club. Joints 8 to 11 form the club, the ninth usually longest, the tenth nearly as long.

Female: Light yellow brown in color, pronotum and head slightly darker. Head in front moderately coarsely and closely punctate; eyes hardly visible from above; clypeus very slightly reflexed, very broadly, shallowly emarginate at apex; ocular canthi much as in the male, but shorter, broader, and with the anterior margins at right angles to the midline of the body and the posterior margins nearly straight; horn of vertex short, stout, subconical, deeply triangularly emarginate at apex.

Pronotum less than twice as wide as long, basal angles rounded but distinct; disc coarsely and closely punctured, more closely toward the sides, basal and anterior median impressions feebly indicated, and a narrow impressed impunctate median line in the center of the disc.

Elytra of the usual form, widest at middle; sutural striae distinct but shallow; geminate striae very feebly indicated; costae not, or hardly, elevated, smooth; elytral intervals finely, sparsely punctate.

Body beneath clothed with short yellow hair.

Length 27-34 mm.

Antennae (Pl. 1, fig. 20) brown. First joint conical; second globular, two-thirds as wide as the first; third conical, one-half as wide as the second at the base and almost or quite three-fourths as wide at the apex, one-third as long as the first, joints 2 and 3 together two-thirds as long as the first; fourth joint one-half as long as the third and slightly wider; fifth joint shorter than the fourth, joints 4 and 5 together equal to the third in length; sixth joint shorter, transverse, one-fourth wider than the fifth, almond-shaped; seventh about equal to the sixth in length, one-third wider.
Joints 8 to 11 form the club, the ninth longest, the eighth three-fourths as long, the tenth shorter than the ninth, and the eleventh shorter than the tenth.

The characters of this species are subject to such great variation that it is necessary to take all of them into account in determination rather than to rely greatly upon one or two characters.

P. *fimbriata* seems to be the most common and widely distributed species of the genus. I have records of capture from the following localities, all in California:

Camp Greely, Fresno County (D, F); “Above Dunlop,” Fresno County (D); Fresno County (D, F, CAS); Tulare County (D, F); Kaweah, Tulare County (F); Badger, Tulare County (Frost); Placer County (F); Eldorado County (CAS).

Horn (9) reported the species from Fresno and Eldorado Counties. The type locality is given as merely “California.” Le Conte (12, p. 71) records the finding of fragments of this beetle “in the stomach of a woodpecker” at Fort Tejon, Kern County, Calif., just across the Los Angeles County line. The specimen to which the latter record refers was possibly *P. conjungcns* var. hirsutus.

**Pleocoma fimbriata** Le Conte, var. *tularensis* Leach (10)

The following is taken from Leach’s description:

Form robust, oval, black, shining above, fimbriate at sides of prothorax and elytra, clothed underneath with long dark brown hair.

Head piceous, moderately punctured; clypeus deeply emarginate, angles slightly divergent; horn of vertex long, flattened, and emarginate at tip.

Pronotum twice as wide as long (13 by 6.3 mm. in type), angled at the sides and convergent in front, widest at base; basal angles prominent; surface finely punctate as in *fimbriata*; median anterior and posterior impressions vague.

Elytra at humeri as wide as the base of the pronotum, widest slightly behind the middle; sutural striae more deeply impressed apically, where the intervals, or costae, are slightly widened; geminate striae feeble.

Legs moderately short, the hind tarsi longer than the tibiae (7.6 to 7 mm.).

Length of type 26.5 mm., width 14.6 mm. Varies from 23.5 to 28.5 mm. in length.

Antennae with the third joint almost three times as long as the second, and three-fourths as long as the first; sixth joint with a lobe shorter than its length; seventh with a lobe slightly longer than its length; joints 8 to 11 with long lamellae of increasing
length, the last being slightly the longest and equal in length to the first nine segments.

Recorded from Sequoia National Park and from Badger, both in Tulare County, Calif.

As I have stated, the characters upon which the species of *Pleocoma* may be separated are, with a few exceptions, extremely variable, and *P. fimbriata* seems to vary more than the others, perhaps because of its wider distribution. I have attempted to separate *tularensis* from *fimbriata* with little success in most cases. The shape and relative proportions of the pronotum vary too much within *fimbriata* to be of much assistance. Careful measurements of the lengths of the antennal joints of the series of both species at hand gave the following results:

<table>
<thead>
<tr>
<th>Joint No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
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<tbody>
<tr>
<td><strong>Fimbriata</strong></td>
<td>1.3</td>
<td>0.3</td>
<td>0.7</td>
<td>2.25</td>
<td>3.95</td>
<td>4.45</td>
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<td>4.2</td>
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<td>0.3</td>
<td>0.9</td>
<td>1.5</td>
<td>3.4</td>
<td>4.0</td>
<td>3.9</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>0.3</td>
<td>0.8</td>
<td>1.8</td>
<td>3.4</td>
<td>4.0</td>
<td>3.9</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>0.3</td>
<td>0.8</td>
<td>1.3</td>
<td>3.8</td>
<td>4.2</td>
<td>4.3*</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>1.7</td>
<td>0.4</td>
<td>0.6</td>
<td>1.0</td>
<td>3.1</td>
<td>3.6</td>
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<td>3.4</td>
</tr>
<tr>
<td></td>
<td>1.6</td>
<td>0.35</td>
<td>0.65</td>
<td>2.4</td>
<td>4.4*</td>
<td>4.3</td>
<td>4.15</td>
<td>4.1</td>
</tr>
<tr>
<td><strong>Tularensis</strong></td>
<td>1.3</td>
<td>0.3</td>
<td>0.65</td>
<td>1.4</td>
<td>3.7</td>
<td>4.25</td>
<td>4.3</td>
<td>4.15</td>
</tr>
<tr>
<td></td>
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<td>0.3</td>
<td>0.75</td>
<td>1.15</td>
<td>3.2</td>
<td>4.0</td>
<td>4.0</td>
<td>3.95</td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>0.25</td>
<td>0.7</td>
<td>1.1</td>
<td>3.1</td>
<td>4.15</td>
<td>4.2</td>
<td>4.1</td>
</tr>
</tbody>
</table>

Examination of the table shows that the tenth joint is longer than the eleventh, and subequal to or longer than the ninth in *tularensis*. In *fimbriata* the ninth joint is usually the longest, but unfortunately this is not always the case, as shown by the figures marked with an asterisk in the table for *fimbriata*.

The specimen of *fimbriata* with the 9 mm. third antennal joint agrees rather closely with *tularensis* in all respects except color, but was taken in the same flight with *fimbriata* at Camp Greely, Fresno County, Calif. This specimen was compared with the type of *P. fimbriata* by P. J. Darlington, Jr., who states that the third joint is relatively a little shorter in the type, joints 2 and 3 together being shorter than the first; antennal club about a sixth smaller. The pronotum in this specimen is almost exactly twice as wide as long, basal angles rounded but rather distinct, pronotum widest at base. Mr. Darlington says that in the type of *fimbriata* the proportions of the pronotum are about the same, and that the basal angles are slightly less well defined.

The proportions of the first three antennal joints seem to me to be too nearly the same in both species to be relied upon for separation.
The sculpture of *tularensis* is in some cases nearly or quite lacking but in some specimens the elytra are more rugose than in some *fimbriata*.

*P. fimbriata* var. *tularensis* will have to be separated from *fimbriata*, if at all, by locality, general appearance, and the relative lengths of antennal joints 9 and 10. I do not believe that it represents more than a variety of *fimbriata*.

**Pleocoma behrensi** Le Conte (13)

Male: Robust, oval, convex, dorsum flattened, black in color. Pronotum with a brownish tinge, fimbriate and clothed beneath with yellow hair. Head above rather finely punctured; eyes large, prominent; clypeus rather small in proportion, reflexed, rather broadly emarginate, apices acute; ocular canthi small, anterior margin a little rounded and inclined forward, angles and posterior margins rounded; horn of vertex with sides parallel and apex broadly triangularly emarginate.

Pronotum very variable in its proportions, basal angles rounded and not distinct in some specimens; disc finely and rather sparsely punctate, the punctations finer and sparser toward the sides; median impressions feeble.

Elytra conjointly varying from one-ninth to one-seventh longer than wide, wider at the humeri than the base of the pronotum; sutural striae well defined; geminate striae distinct; costae slightly elevated, smooth; elytral intervals rugose.

Body beneath and legs castaneous, clothed with long yellow or brownish-yellow hair.

Length 21-27 mm.

Antennae (Pl. 1, fig. 14) brown, club lighter in color. First joint conical, elongate; second subglobose with a tendency to be pentagonal in outline as viewed from above, almost as wide as the first; third joint elongate, at base one-half as wide as the second, widest at apical third, one-half as long as the first joint, joints 2 and 3 together about two-thirds as long as the first; fourth joint wider and shorter than the third, distinctly pentagonal in outline as viewed from above; fifth joint shorter and wider than the fourth, the anterior base angulated, joints 4 and 5 together longer than the third; sixth joint transverse, longer than the fifth, the anterior base produced in a sharp spur; seventh joint shorter, with its projection from one-half to two-thirds as long as the eighth. Joints 8 to 11 form the club, the ninth and tenth longest and subequal, the eleventh shorter, and the eighth shorter than the eleventh.

Female: Robust, convex, castaneous, fimbriate with yellow hair. Head above rather finely, very closely punctate; eyes visible from above; clypeus short, broad, slightly reflexed at anterior
margin, which is rounded, sometimes with a small notch at the midline, but usually without; ocular canthi with the anterior and posterior margins about equally rounded, the anterior angle rounded but distinct; horn of vertex short, stout, deeply emarginate at apex.

Pronotum with the hind angles rounded, disc moderately coarsely and closely punctate, the punctures showing a tendency to confluease as in *P. australis*; basal median impression vague or absent, anterior median impression not indicated.

Elytra thin; widest at apical third; sutural striae distinct; geminate striae moderately well defined in most specimens; costae elevated; elytral intervals with sparse punctation.

Body beneath and legs clothed with short yellow hair.

Length 26-34 mm.

Antennae (Pl. 1, fig. 21) brown, the club darker. First joint conical, elongate; second subconical, two-thirds as wide as first; third conical, at base one-third, at apex two-thirds to three-fourths as wide as second. Joints 2 and 3 together two-thirds as long as the first; fourth joint shorter, wider than the third; fifth joint shorter, wider than the fourth, joints 4 and 5 together as long as the third; sixth joint transverse; seventh very short, transverse, slightly produced, the joint and projection together one-half as long as the eighth. Joints 8 to 11 forming the club, the ninth longest, eighth five-sixths as long as the ninth; tenth slightly shorter than the ninth, and the eleventh shorter than the tenth. In some specimens the antennae are more robust, and the differences in the width of the joints are less.

In most of the specimens of *P. behrensii* that I have seen the pronotum is widest at base, but in a few it is widest at the middle. One of my specimens has the seventh antennal joint three-fourths as long as the eighth. On other specimens the rugosity of the elytral intervals is not marked, and the color may be very deep brown rather than black.

This species may be separated at once from *P. puncticollis* and *P. rickseckeri* by the yellow vestiture. From *australis* it differs in the more convex dorsum and in the fact that the eleventh joint of the antenna is distinctly shorter than the tenth. In *australis* the sutural striae are not deep, the geminate striae are feebly indicated, and the elytral intervals are finely and sparsely punctate. In *behrensii* the sutural striae are deeper, the geminate striae plainer, and the intervals in typical specimens are rugose, approaching *rickseckeri* in this respect. From *fimbriata*, to which it seems most closely related, typical *behrensii* differs in the characters given in the key, as well as in the less prominent basal angles of the pronotum. In some cases it is almost impossible to be sure with which species one is dealing. In the collection of the Academy of Natural Sciences of Philadelphia there is a
short series of what I am almost certain is P. fimbriata from Eldorado County, Calif. These specimens resemble typical behrensii more closely than do some examples of the latter species, being small and convex, with the elytral intervals rugose. P. fimbriata seems to be confined to the Sierra Nevada range, and P. behrensii to the coastal mountains, but they probably represent races of the same original species.

I have the following records of capture for P. behrensii:

Type locality "near San Francisco," Calif.; Alameda County, Calif. (F, D); Berkeley, Calif. (D, CAS); Oakland, Calif. (F, D); Fort McDowell, Angel Island, Calif. (in San Francisco Bay) (CAS); San Mateo County, Calif. (F, D); Cypress Ridge, Marin County, Calif. (CAS); Sausalito, Calif. (recorded by Horn, 9); Mt. St. Helena, Calif. (CAS); Sonoma County, Calif. (F, D, CAS).

Pleocoma sonomae Linsley

Distinguished from P. behrensi Lec., to which it seems most closely related, by the lack of processes upon the 6th and 7th antennal joints, "broadly oval (rather than oblong-oval), robust form, the broad, subparallel frontal horn, more deeply impressed sutural striae of the elytra . . . ."

Pleocoma hirticollis Schaufuss (23)

Male: Robust, convex, dorsum slightly flattened, fimbriate with yellow-brown hair. Head above coarsely and rather closely punctate, with impunctate areas about the base of the vertical horn; eyes prominent, round; clypeus small, reflexed, the sides nearly parallel, obtusely emarginate, the depth of the notch very variable, apices broadly rounded; ocular canthi short, front margins slightly sinuate and inclined posteriorly, apices sharply rounded, posterior margins rounded or sinuate; horn of vertex stout, subconical, truncate or very slightly notched at apex.

Pronotum very slightly less than twice as wide as long, widest at base, hind angles distinct but obtusely rounded, sides nearly parallel to the middle, thence strongly narrowed to the apex; disc coarsely punctate and sparsely clothed with long, semierect yellow hairs.

Scutellum more transverse than in other species, being almost semicircular.

Elytra conjointly very slightly longer than wide, wider at the humeri than the base of the pronotum, widest at apical third; sutural striae moderately deep, the sutural costae very broad; geminate striae well defined; costae distinct, elevated, rather wide, smooth; elytral intervals finely and sparsely punctate, sometimes rugose.

Body beneath castaneous, clothed with yellow hair.
Length 20-21 mm. One very small specimen in the collection of the Academy of Natural Sciences of Philadelphia measures only 17.3 mm. in length.

Antennae (Pl. 1, fig. 12) brown, club grayish. First joint conical, elongate, one-half as wide as long; second globular, three-fourths as wide as first; third at base one-half, at apex three-fifths as wide as second, curved, nearly or quite as long as the first, joints 2 and 3 together longer than the first; fourth joint about two-fifths as long as the third and slightly wider, transverse, with a short projection anteriorly. Joints 5 to 11 form the club, the fifth with its lamella equal to three-fifths of the sixth, eighth joint longest, the joints progressively shorter in the following order: Ninth, tenth, eleventh, seventh, sixth, and fifth. The whole club is very strongly curved outward toward the apex.

The following description of the female is taken from Horn's revision, no specimen being available to me at this time:

"Ovate, robust, convex, reddish brown. Clypeal horn short, broad and feebly emarginate, vertical horn short, rather deeply emarginate. Thorax similar in outline to the male, but not more than twice as wide as long, not impressed in front, moderately strongly and closely punctate, nearly equally over the entire surface, median line smooth, without erect hairs. Elytra broadest behind the middle, sutural striae not deeply impressed, the interval not wider behind, geminate striae very faintly indicated, surface more sparsely punctate than the thorax. Legs very robust. Length 1.32 inch; 33 mm.

"The antennae of the female (Pl. 1, fig. 23) are of the same type as the male, but much shorter and with the lamellae short. First joint conical, second globular as well (wide?) as first, third more slender, half as long as first, fourth short, transverse, angulate on the inner side, fifth prolonged in a lamella, three-fourths as long as sixth, joints six to ten nearly equal in length, the eleventh shorter.

"When the leaves of the lamella are closed the apices are contiguous, but the joints at the middle are separated."

The notch between the ocular canthi and the base of the clypeus of the male, pointed out by Horn, is nearly as often lacking as present. The dimensions of the pronotae as given in most of the earlier descriptions are not reliable. As Fall (3) points out, the measurements were apparently taken with the specimen upright, giving a greatly foreshortened measurement for the length, as Schaufuss (23, p. 58) says that the thorax is almost three times as wide as long, and Horn (9) describes it as more than twice as wide as long, where as a matter of fact, it is about or less than twice as wide as long. In my single male specimen and in one other that I have seen the ninth antennal joints have been the longest, not the eighth, as is usually the case.
This species falls into the group with the hairy pronota. From *P. hoppingi* it may be separated at once by the color, the greater convexity and robustness, and the shape of the ocular canthi.

I have the following records of capture for *hirticollis*, all in California: San Joaquin (F, US); Bennett Valley, Santa Rosa (County?) (F, LAM); Nevada City, Horn (9); Alameda County (CAS); Alameda (US); Sonoma County (US, CAS); Marysville (CAS); Eldridge (CAS). The type locality was given merely as “Calif.”

*Pleocoma hoppingi* Fall (4)

Male: Ovate, elongate, dorsum much flattened, almost gibbous. Light brown in color, shining, fimbriate with yellow hair. Head small, frons very sparsely and moderately finely punctate; eyes prominent, round; clypeus reflexed, triangularly emarginate, very broadly rounded at apices; ocular canthi (Pl. 1, fig. 24) with the anterior margins strongly bisinuate, slightly inclined posteriorly, apical angle distinct, rounded, posterior margins angulated, the apical portion parallel to the long axis of the body and notched at center, the posterior portion inclined slightly forward; horn of vertex stout, sides nearly parallel, apex with a rounded emargination.

Pronotum exactly twice as wide as long, basal angles rounded but distinct, sides converging very strongly from middle to apex; disc shining, densely punctate, the punctures fine at the sides, coarser near the posterior margin, and still coarser at the middle in front, a small impunctate area near the middle of each half; basal median impression distinct but small, anterior median impression rather deep, transverse.

Elytra conjointly more than one-third longer than wide, wider at the humeri than the base of the pronotum, sides nearly paralleled; sutural striae moderately deep; geminate striae well defined; costae slightly elevated; elytral intervals finely and sparsely punctate, more strongly toward the sides.

Length 23-26 mm.

Antennae (Pl. 1, fig. 6) brown, club gray-brown. First joint conical, elongate; second subglobular, three-fourths as wide as first; third a little shorter than the first, and as wide, the anterior edge being raised into a thick angulate keel involving the whole length of the joint and causing it to appear pentagonal in outline as viewed from above; fourth joint short, with a short lamella. Joints 5 to 11 form the club, 8 and 9 subequal and longest, the remaining joints decreasing in length in the following order: Tenth, eleventh, sixth, fifth.

Female: Robust, convex, castaneous, prothorax and head darker, fimbriate with rather short yellow hair. Head above mod-
erately finely punctate; eyes flat, not prominent; clypeus with a shallow triangular emargination, apices broadly rounded; ocular canthi of the same form as those of the male, but stouter; horn of vertex very short, with a deep notch at apex.

Pronotum less than twice as wide as long, of about the same form as that of the male, punctation about the same; basal median impression round, well defined; anterior impression lacking.

Elytra wider at the humeri than the base of the pronotum, a little less than a third longer than wide; sutural striae feeble; geminate striae defined by rows of shallow punctures; costae elevated, smooth, and of a somewhat darker shade than the rest of the elytra; elytra intervals finely, moderately closely punctate.

Body beneath and legs clothed with short yellow hairs.

Length 30-35 mm.

Antennae (Pl. 1, fig. 18) brown, club gray-brown. First joint conical, elongate; second globular, two-thirds as wide as the first; third about, or slightly less than, one-half as long as the first, at base one-half, at apex two-thirds as wide, widest at apical third, slightly curved; fourth joint quadrate, transverse, about one-third wider than the third. Joints 5 to 11 form the club, the ninth longest, joints 7 and 8 subequal and shorter, then 10, 6, 11, and 5 in order of decreasing length.

*Pleocoma hoppingi* is the most easily distinguished of the genus. The hairy pronotum distinguishes it as once from all but *hirticollis*, from which it differs in color, the broad, rounding apices of the clypeus, the quadrate ocular canthi, and the peculiar shape of the third antennal joint.

The type locality is the South Fork of the Kaweah River, Tulare County, Calif. I have records also from Colony Road, Tulare County, Calif. (F); and Millwood, Fresno County, Calif. (CAS).

*Pleocoma badia* Fall (6)

Male: Robust, ovate, dorsum depressed, brown in color, fimbriate with yellow-brown hair. Head above rather closely and coarsely punctate; eyes large, prominent; clypeus reflexed, with a deep, rounded emargination, apices acutely rounded; ocular canthi with the anterior margins arcuate, inclined forward of a right angle to the long axis of the body, apices rounded, posterior angle and margin broadly rounded.

Pronotum about, or a little less than, twice as wide as long, variable in shape; disc finely and sparsely punctured, except for the area included in the anterior median impression, which is heavily and coarsely punctured; anterior median impression usually distinct, with long yellow hairs from the anterior edge; basal median impression small or lacking.
Elytra conjointly about one-fifth longer than wide, brown, transparent, showing the folded wings beneath them; sutural striae shallow; geminate striae feebly defined; costae not appreciably elevated, smooth; elytral intervals finely and sparsely punctate.

Body beneath and legs clothed with yellow hair.

Length 23.5-28.5 mm.

Antennae (Pl. 1, fig. 1) brown, club grayish. First joint conical, elongate, curved; second globular, about two-thirds as wide as the first; third elongate, nearly cylindrical, dilated at apical third, at base one-half as wide as the first joint, joints 2 and 3 together nearly as long as the first; fourth joint wider than the third, transverse or with a short projection anteriorly. Joints 5 to 11 form the club, the ninth and tenth longest and subequal, the eighth and seventh successively shorter, the other joints decreasing in the order 11, 6, and 5, the fifth being two-thirds to three-fourths as long as the sixth.

Female: Robust, dorsum very slightly flattened, castaneous, head and pronotum darker, fimbriate with short yellow hair. Head in front coarsely and closely punctate; clypeus slightly reflexed, with a broadly rounded emargination; ocular canthi of the same form as those of the male, but stouter; horn of vertex short, stout, deeply triangularly emarginate at apex.

Pronotum less than twice as wide as long, the hind angles broadly and obtusely rounded but usually distinguishable; disc coarsely and closely punctate, the punctures tending to coalesce into transverse impressed lines, giving a rugose appearance; anterior and basal median impressions usually present, but small.

Elytra at the humeri wider than the base of the pronotum, transparent, the abortive wings and dorsal abdominal segments visible through them; sutural striae distinct but not deep; geminate striae feebly indicated by rows of fine, widely spaced punctures; costae hardly elevated.

Body beneath and legs castaneous, clothed with short yellow-brown hair.

Length 32-43 mm.

Antennae (Pl. 1, fig. 17) brown. First joint conical, elongate; second globular, three-fourths as wide as the first; third elongate, as base one-half as wide as the second, a little dilated at apex; joints 2 and 3 together subequal in length to the first; fourth joint transverse, angulate. Joints 5 to 11 form the club, the ninth longest, eighth and tenth shorter and subequal, then, in order of decreasing length, 7, 11, and 6.

The brown color and the form of the ocular canthi, which seem to be fairly constant, set badia apart at once from con-jungens, nearest to which it runs in the key. The transparent elytra, through which the folded wings may be seen, are peculiar
to this species, at least in the case of the male. After several years in the cabinet the elytra may become opaque, but several in my own series remain clear after sixteen years. The pronotum is very variable, and no dependence is to be placed upon characters of the relative proportions or the prominence of the basal angles.

_Pleocoma badia_ has been taken only upon the south slope of Mt. Wilson, near Pasadena, Calif., at an altitude of from 3,500 to 4,000 feet. It may occur also at Pine Flats, about fifteen miles farther north. The nearest capture of _badia_ to the territory of _australis_ is about five miles by trail, and it would not be surprising if the territories of the two were found to overlap somewhat.

_Pleocoma conjungens_ Horn (8, 9)

Male: Robust, oval, dark brown to black in color, dorsum slightly flattened, fimbrilate with yellow hair. Head above finely and closely punctate, sparsely clothed with yellow hairs; clypeus reflexed, obtusely emarginate, the emargination broadly rounded at the bottom, apices acutely rounded, anterior margins rounded; ocular canthi with anterior margins sinuate, almost at right angles to the long axis of the body or slightly inclined posteriorly from this, apices rounded, posterior margins rounded; horn of vertex long, the sides nearly parallel for most of their length, approaching apically, apex deeply and rather broadly emarginate.

Pronotum very slightly more than twice as wide as long, widest at basal angles, black, chestnut brown along the lateral margins; disc moderately finely and not very closely punctate (slightly more coarsely than _rickseckeri_, and about as sparsely), the punctures tending toward confluence, especially in the center of the disc; apical angles rounded, basal angles rounded but distinct; basal median impression lacking, being represented by an evenly convex median impunctate line; anterior median impression moderate; profile of pronotum about as in _hirticollis_.

Elytra conjointly one-eighth longer than wide, widest at apical third; very deep brown or black; sutural striae shallow; geminate striae consisting of little more than rows of shallow punctures; costae hardly elevated, nearly impunctate; elytral intervals finely, sparsely punctate, with a very slight rugosity.

Body beneath and legs castaneous, covered with yellow hair.

Length 22.5-23.5 mm.

Antennae (Pl. 1, fig. 10) dark brown. First joint conical, elongate; second subglobular, almost as wide as the first, wider than long; third elongate, somewhat curved, at base one-half, at apex slightly more than one-half, as wide as the maximum width of the first, widest at apical fifth or fourth, longer than the first, joints 2 and 3 together one-third longer than the first; fourth joint transverse, with a slight projection. Joints 5 to 11 form the
club, the eighth and ninth equal in length and longest, tenth shorter, seventh shorter than the tenth, sixth and eleventh subequal in length and shorter than the seventh, fifth shortest, about five-eighths as long as the sixth.

So far as I can discover there are no females of this species available, and I can find no description, although Rivers (22) states that the female is known.

The type locality is given by Horn (9) as Santa Cruz City, Calif. E. C. Van Dyke once told me that he had on one occasion picked up, in the streets of Carmel, 100 miles or so south of Santa Cruz, elytra that he was almost certain belonged to this species. E. R. Leach (10) notes that specimens of *P. conjungens* in the collection of the California Academy of Sciences are from Mokelumne Hill, Calaveras County, Calif.

*Pleocoma conjungens* Horn var. *hirsutus* Davis (3)

Male: Broadly oval, convex, dorsum flattened, shining black, margins heavily fimbriate, clothed beneath with long yellow-brown hair. Head above, including ocular canthi, closely covered with long yellow-brown hair; ocular canthi with the anterior margins curving forward of a right angle with the midline of the body, apices acute, rounded, lateral margins nearly straight, posterior angles obtuse but distinct; horn of vertex with the sides nearly or quite parallel.

Pronotum slightly less than twice as wide as long (6 by 11.8 mm.), black, brown at sides, with an occasional hair upon its surface; punctation as in *conjungens*; posterior median impression nearly lacking; lateral pits lacking; transverse ridge lacking, the basal part of the pronotum being smoothly and evenly convex to the declivity; anterior median impression distinct and moderately deep, very heavily and coarsely punctate and rather densely clothed with long yellow hairs.

Scutellum brown, sparsely and finely punctate and sparsely clothed with short hair. Long yellow-brown hair growing thickly from the base of the pronotum nearly conceals the basal half.

Elytra as in *conjungens*, costae attaining the apices.

Legs and body beneath brown, very densely clothed with long yellow-brown hair.

Antennae almost exactly as in the specimen of *P. conjungens* labeled as the type in the collection of the Academy of Natural Sciences of Philadelphia, except in the proportions of the antennal joints 1 to 3, which are 1.2, 0.3, and 1.0 mm. in length respectively, compared with 0.7, 0.25, and 0.8 in the type.

Type locality: Between Lebec and Saugus, in Los Angeles County, Calif., in the Sierra Madre Mountains.
This variety, while close to *P. conjungens*, may be distinguished from it by the extreme hairiness, the different shape of the ocular canthi, the more parallel sides of the horn of the vertex, the hairiness of the head and anterior part of the pronotum, the heavily punctate anterior median impression, and the different relative proportions of the first three antennal joints.

*Pleocoma staff* Schauffuss var. *dubitabilis* n. var.

I have not seen the type of *P. staff*, and, since the description of that species must be largely by comparison, the variety is placed first for convenience.

**Male:** Dorsum depressed, dark brown or black above, castaneous beneath, fimbriate and densely clothed beneath with yellow-brown hair. Head above moderately closely and coarsely punctate; clypeus varying from deeply triangularly emarginate to broadly rounded, apices rather acutely rounded; ocular canthi variable, but tending toward quadrate, the anterior margin curved and usually inclined a little forward; angles broadly rounded, posterior margin at first rounded and nearly parallel to the long axis of the body, thence rounding in to the head; horn of vertex short, conical, pointed at apex, not emarginate.

Pronotum less than twice as wide as long, widest at from slightly behind the middle to the basal fifth; retuse in front, hind angles broadly rounded and not distinguishable in many specimens; disc finely and sparsely punctate, basal and apical median impressions distinct before and behind a broad, rounded, transverse ridge a little behind the center of the disc.

Scutellum completely covered with tawny hair.

Elytra jointly one-fifth longer than wide, wider at the humeri than the base of the pronotum, widest behind the middle; sutural striae deep, the sutural costa rather wide; geminate striae distinct; costa elevated, rugose; elytral interspaces finely and rather closely punctate, the punctures tending to confluesce, giving a rugose effect in many cases.

Length 23-29 mm.

Antennae (Pl. 1, fig. 2) brown. First joint conical, one-half as wide as long; second globular, slightly transverse; third elongate, at base two-thirds as wide as, at apex as wide as, the second, joints 2 and 3 together about one-fourth longer than the first; fourth joint short, transverse, angulated or with a short projection. Joints 5 to 11 form the club, the ninth longest, the eighth and tenth subequal and very slightly shorter, and, in order of decreasing length, joints 11, 7, 6, and 5. The sixth joint is about five-sixths as long as the seventh, and the fifth two-fifths as long as the sixth.

**Female:** Convex, dorsum slightly but distinctly flattened in most cases, castaneous, fimbriate and clothed beneath with yel-
lowish hair. Head above coarsely and moderately closely punctate; eyes not prominent; clypeus reflexed, rounded, with a broad, rounded emargination, apices retracted and sharply rounded; horn of vertex represented by two tubercles with deep obtuse longitudinal groove between them.

Pronotum less than twice as wide as long, widest at or slightly before the middle, hind angles broadly rounded, evenly convex to slightly retuse in front; disc moderately finely, closely punctate, especially toward the sides and front; basal median impression distinct, anterior median impression represented by a short, impunctate, longitudinal groove.

Elytra wider at the humeri than the base of the pronotum, about or slightly less than one-fifth longer than wide, widest behind the middle; sutural striae rather deep; geminate striae distinct; costae elevated; elytral intervals varying from finely, sparsely, confluently punctate to rugose.

Length 25-32 mm.

Antennae (Pl. 1, fig. 19) brown. First point conical, three-fifths longer than wide; second globular; third elongate, at base one-third, at apex two-thirds or three-fourths, as wide as the second, joints 2 and 3 together almost equal to the first in length; fourth joint short, wider than the third; fifth transverse, angulate. Joints 5 to 11 form the club, the ninth and tenth subequal and longest, the eighth and eleventh subequal and shorter, slightly longer than the seventh, sixth about three-fourths as long as the seventh, and fifth merely transverse.

The ordinary characters of this variety are more variable than those of any other of the genus, but the scutellum invariably seems to be covered with hair, and this character, with the 7-jointed antennal club, the black or very dark color, and the retuse pronotum, will serve to distinguish it from the other species.

I have the following records of capture for this variety: Clakamas County, Oreg. (CAS); Dilley, Oreg. (F. D, US); Forest Grove, Oreg. (CAS, D).

This is the form that passes in collections in the United States and elsewhere as *Pleocoma staff*. As will be seen by reference to the following description, its differs rather markedly from *staff* in several particulars, and, since the status of *staff* in the genus has been a source of trouble for some years, I have thought it well to give the variety a name. A representative pair of cotypes will be deposited in the collection of the United States National Museum.

*Pleocoma staff* Schaufuss (23)

Male: Robust, convex, dorsum slightly depressed, bicolorous, the pronotum dark brown, somewhat lighter at the base, the elytra bright reddish-brown. Head above very coarsely, moderately
closely punctate; clypeus with a deep oval emargination, apices obtusely rounded, blackish-brown in color; ocular canthi subquadrate, anterior margin inclined slightly forward, anterior angles projecting somewhat beyond the posterior ones.

Pronotum less than twice as wide as long (7 by 13 mm.), retuse in front, the transverse ridge prominent at about the center, occupying about three-fifths of the total length of the pronotum, disc very finely and sparsely punctate; anterior and posterior median impressions distinct; hind angles of pronotum rather sharply rounded.

Scutellum very sparsely hairy. (This hair has undoubtedly been rubbed off, since Schaufuss specifically mentions that the scutellum is hairy.)

Elytra bright reddish-brown, striae deep; costae prominent, elevated; punctuation extremely fine and sparse, rugosity very indistinct.

Length 26 mm., width 14 mm.

Antennae as in var. dabitabilis.

The above description was drawn up from data sent me by Dr. Hans Sachtleben and Mr. R. Korschefsky. Two specimens for my series of "staff" were very kindly compared with the type of that species by Mr. Korschefsky, who says:

"The Schaufuss type of Pleocoma staff is labeled 'Californ. mer.' Perhaps the color of the type is not fully developed. The type was preserved in liquor; therefore the hairs were much pasted so that it is very difficult to state how the hairiness was distributed originally on head and thorax. The type differs so much from your specimen 1 that this might be probably another form. The type is larger, the sculpture on the elytra is much less marked, the striae are more distinct. Besides the type differs from specimen 1 in having the transverse ridge of the thorax much developed."

Specimen 1 above referred to is about representative of all specimens that I have seen as far as concerns the development of the transverse ridge. From this I take it that the profile of the pronotum in staff resembles that in ulcii and edwardsii. From what is known of the life history of Pleocoma it seems very unlikely that the type is an immature specimen, not fully colored.

The history of this species in our literature is rather interesting. In 1870 Schaufuss named it for the General Staff of the German army, "rubbing in" a rather silly error that he said had appeared in one of the Paris newspapers. Le Conte disapproved of the name on the grounds of its source and the motive for giving it, and suppressed it (13), substituting "edwardsii," and redescribing the species. Sharp (24) made some comments upon Le Conte's action, and gave it as his opinion that the name staff
should stand, regardless of the motives that led to its giving. Horn (8, 9) then redescribed the species and reestablished the name staff. Both Le Conte and Horn undoubtedly had the same specimen before them at the time these descriptions were written, as each notes that the specimen had only five antennal joints. It is quite surprising at this late date to discover, after the controversy is over, that edwardsii seems to be different from staff.

**Pleocoma edwardsii** Le Conte (13)

Male: Broadly oval, robust, convex, dorsum slightly flattened, fimbriate and clothed beneath with yellow hair. Head above moderately coarsely and closely punctate, nearly black in color; eyes round, prominent; clypeus reflexed, the apical emargination deep and broadly rounded, apices not acute, sides broadly rounded, base a little narrower than apex; horn of vertex short, conical, not emarginate at apex; ocular canthi quadrate, margins rounded.

Pronotum nearly black, slightly less than twice as wide as long, widest at middle; anterior angles, sides, and basal angles all included in one broadly sweeping curved margin; disc finely and rather sparsely punctate; basal median impression deep; anterior median impression shallow in front of an extremely prominent transverse ridge, giving a very retuse profile.

Scutellum transverse, shining, not hairy.

Elytra chestnut brown in color, conjointly about one-fifth longer than wide, not wider at the humeri than the base of the pronotum, widest at or slightly behind the middle; sutural striae deep; geminate striae distinct, entire; costae wide, elevated, finely, sparsely punctate, and sinuate, diverging from the midline at about the apical third, and again becoming nearly parallel to it near the humeri, where they are also much wider; elytral intervals sparsely, rather coarsely punctate.

Length 27.2 mm.

Antennae (Pl. 1, fig. 13) brown. First joint conical, about one-half as wide as long; second globular, slightly transverse; third elongate, at base one-half, at apex twice, as wide as the second, pentagonal in outline; fourth joint bearing a process, the joint and process together about two-fifth as long as the joint and process of the fifth; fifth joint lamellate. Joints 6 to 11 are missing from the type, the only known specimen of this species.

A peculiarity of this species that may prove to be constant when more specimens come to hand is the situation of the second costa. At about the basal third the costa diverges from the midline rather abruptly, becoming much wider as it approaches the humerus, just before reaching which it again becomes nearly parallel to the mid line. The first costa follows the second, but not to the same degree, being much straighter. I have seen this
peculiarity indicated to a very slight extent in some specimens of P. behreunii and P. hirticollis, but it is never prominent, and the first costa is straight in all that I have seen.

In spite of the fact that the antennal clubs are missing, P. edwardsii may be placed in the key quite easily. From P. staff it differs in the glabrous scutellum, the less convex shape, and in the development of the transverse ridge of the pronotum. The geminate striae are not so deep as those of staff, but are complete, not having the same tendency to disappear apically. The elytral intervals of staff are extremely finely and sparsely punctate, while the punctuations of the intervals of edwardsii are coarse and less sparse. From staff var. dubitabilis, edwardsii is distinguished by the color and the glabrous scutellum.

The type and only known locality for this species is “Calif."

I am of the opinion that Pleocoma edwardsii LeC. is a valid species, represented by the single type in the Le Conte collection at Cambridge, Mass. Notwithstanding its being mistaken for staff by Le Conte (13) and accepted as such by Horn (9) (there is little doubt, from the description given, that Horn had this identical specimen before him when he wrote that description), the fact remains that Le Conte gave a recognizable description of the species, and, furthermore, referred it to a definite individual specimen which still exists and is available for reference. In other words, he described a species under the impression that he was redescribing one. In view of the facts just stated, it is necessary to restore edwardsii to full specific standing, from the position it now occupies as a synonym for P. staff.

Pleocoma ulkei Horn (8, 9)

Broadly oval, depressed, fimbriate and clothed beneath with yellow hair. Head above very dark brown, nearly black, coarsely and closely punctate, covered sparsely with yellow hair; eyes prominent, round; clypeus sharply reflexed, the apical emargination deep, rounded at bottom, apices sharply pointed, lateral margins as viewed from above parallel to the long axis of the body for about half their length, thence approaching the midline rather abruptly, making the base distinctly narrower than the apex; ocular canthi with the sides about equally rounded before and behind, the apical angle rather acute; horn of vertex conical, acute, not emarginate.

Pronotum glabrous, shining, deep blackish brown in color with lighter areas at the sides; very slightly less than twice as wide as long, widest at about the apical two-fifths or one-third; moderately coarsely and rather sparsely punctate, the punctures coarser and closer toward the sides; anterior angles rounded, basal angles distinct but not acute; basal median impression very deep, with a smaller impression at each side; anterior median impression practically lacking; transverse ridge across fully two-
thirds of the width of the pronotum, very prominent, giving the profile a retuse appearance.

Scutellum glabrous, transverse.

Elytra chestnut brown, conjointly a little less than five-sixths as wide at the widest point as long, not wider at the humeri than the base of the pronotum, widest at apical two-fifths; sutural striae deep; geminate striae deep; costae wide, elevated, finely and sparsely punctate, sinuate, diverging from the midline at about the apical third and again becoming parallel to it at about the basal third, and becoming much wider basally; elytral intervals finely, sparsely punctate and slightly rugose.

Length 24 mm.

Antennae (Pl. 1, fig. 8) brown. First joint subconical, elongate, widest at apical third; second subglobular, slightly transverse, as wide as the apex of the first; third elongate, narrower than the second at base and about the same width at apex, widest at apical three-fourths, where it almost equals the maximum width of the first joint, longer than the first, joints 2 and 3 together almost twice as long as the first; fourth joint transverse, with a short process. Joints 5 to 11 form the club, the eighth longest, the ninth subequal to it, the seventh and tenth subequal in length and shorter, the sixth very nearly as long as the seventh, the eleventh shorter than the sixth, and the fifth shorter than the eleventh.

No female of this species has ever been taken.

Type locality: Utah.

Those who know this genus have been very skeptical of the published type locality. That this doubt was well founded is shown by E. R. Leach (10), who records the capture of four males in Nevada County, Calif., in 1933.

Plecocoma ulkei and P. edwardsii are very closely related species, the principal points of difference being in the shape of the pronotum, and the relative lengths of the fourth antennal joint in the two species, that of ulkei being hardly more than transverse, and that of edwardsii being prolonged into a process about half the length of the fifth. If the latter character is not an abnormality it is sufficient to distinguish between the two species. In addition to these points, edwardsii is larger and more convex, and the elytra at the sides are not so parallel as in ulkei. Except for the fourth antennal joint (which is subject to some variation) these points of difference are subject to great variation throughout the genus, and in all others the two types resemble each other very closely indeed. I am inclined to regard them as identical, but in view of the fact that the type of edwardsii lacks the terminal joints of the antennae a positive statement to that effect would be inadvisable.

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BUTTERFLIES OF YOSEMITE NATIONAL PARK

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INTRODUCTORY REMARKS

The Yosemite National Park includes 1,179 square miles of the most diversified territory to be found in the Sierra Nevada. From the edge of the San Joaquin Valley at near sea level it extends to the crest of the Sierran divide, culminating in Mt. Conness, Mt. Dana, and Mt. Lyell, well over 13,000 feet in elevation. Between these extremes occurs a wide range of climatic conditions, giving rise to a wealth of plant and animal life scarcely to be duplicated elsewhere on the North American continent. The vertebrate fauna has been thoroughly investigated and reported upon by Grinnell and Storer, who record 97 species of mammals, 231 birds, and 34 reptiles and amphibians in “Animal Life in the Yosemite.”

It is to be expected that there exists a much larger host of invertebrates, and of insects in particular, creatures often inconspicuous and apparently insignificant, but each performing a vital function in the delicate mechanism of nature’s balance.

The butterflies are a logical group with which to begin the study of insect life in the Yosemite because they flaunt themselves so invitingly before the eyes of every park visitor. Like the many other attractions of our National Parks, they are protected from ruthless destruction by far-sighted legislation. The administration is anxious to assist the worker whose zeal is guided by intelligence; and the park naturalist, with offices in the Yosemite Museum, will issue collecting permits to qualified investigators.

Since the days of the gold rush of ’49 the territory now included as Yosemite National Park has been a favorite butterfly collecting ground. The hermit Lembert established headquarters in the Tuolumne Meadows, from whence he supplied the entomological world with such rarities as Behr’s Sulphur (Eurymus behrrii) and the Nivalis Copper (Lycana nivalis). The pioneer collector Lorquin followed the mother lode to Placerville. Had type localities been designated as carefully in those days as now, we would probably find that many of our California species first saw the inside of a collecting net somewhere in Yosemite. It is the major scientific loss of the state that many of these early type specimens perished in the flames of the devastating earthquake of 1906.

1 Univ. Calif. Press, 1921. The territory included in their Yosemite sector extends beyond actual park boundaries to include a part of the San Joaquin Valley and the Mono Basin.
In comparatively recent years, and particularly since the opening of the Tioga road to tourist traffic in 1915, the more remote portions of the park have been in part accessible by auto, and the Tuolumne Meadows have been the Mecca of many an ardent lepidopterist. The entire northern section and much of the southeastern is still traversable by foot or horseback only, and is virgin territory for the entomologist. Each summer since 1925 a group of twenty students of the Yosemite School of Field Natural History has made an extended excursion into the hinterland under the capable leadership of Dr. Harold C. Bryant, Assistant Director, National Park Service, and Mr. C. A. "Bert" Harwell, Park Naturalist, Yosemite, and director of the school. Begun as a six-day circuit of the already established Hi-Sierra Camps, the "back-country trip" has developed into an independent pack caravan which loses itself among the glaciers for a two-week period and seldom returns without a contribution to the natural history of the park.

In the past three years the Field School has included among its membership several students of insects whose training has made it possible for them accurately to observe and record much valuable information concerning the habits of rarely encountered species, data which, though of a heterogeneous nature, will be of value when correlated with the work of other investigators.

Our knowledge of the butterflies of the California mountains has reached a critical point. While past investigators have confined themselves almost exclusively to the naming of species and lesser categories, this field is now practically exhausted. The species are known; their major races have been described; there remains only the doubtfully advisable procedure of cataloguing individual variants. A change in emphasis is taking place among more serious workers, who have turned their attention to the accumulation of data on life histories, exact distribution, habitat, and other ecologic factors. The indefatigable team of Dr. J. A. Comstock and Commander C. M. Dammers has recorded the early stages of practically every butterfly found within a radius of 150 miles of Los Angeles; but of the metamorphoses of many of the species of Yosemite and of the Sierra in general, as little is known as in the days of Edwards, Behr, Dyar, and Lembert.

The butterflies in a given area roughly approximate the birds in number of species, if only those actually residing (nesting) in the region be enumerated. This is a fair comparison if it be remembered that there are very few truly migratory butterflies. Thus we have a compact group small enough to be comprehended by the amateur "nature lover" in a season, yet sufficiently diversified to intrigue the professional biologist into returning year after year to solve the baffling problems of habitat and distribution which they present. Of the 236 species of butterflies occurring in California, 100 are recorded in the following pages as flying in Yosemite; more undoubtedly occur.
The list which follows is based on three seasons' investigation by four members of the Yosemite School of Field Natural History, Mr. Dean Schlobohm, class of '32; Mr. Fred Ziesenhenne and the writer, class of '33, and Mr. Edmund Godwin, class of '34. The period of activity in each case was seven or eight weeks, from mid-June until mid-August. In order to include a number of early June records, data from a student survey conducted in 1926 by E. O. Essig, Professor of Entomology, University of California, has been incorporated. Dr. Essig has returned each year to personally supervise the entomological work of the school. Headquarters for field work has been the Yosemite Museum, in which are deposited a first set of all specimens collected.

The writer wishes to thank Mr. C. A. Harwell, Park Naturalist, for facilities placed at his disposal during a second visit to Yosemite Valley in August, 1934, for the purpose of correlating the investigations of the above-named workers. The manuscripts, "A Check List of the Butterflies of Yosemite National Park," by Dean Schlobohm, and "Report on Lepidoptera—High Sierra Trip," by Edmund Godwin, have been freely drawn upon with the kind permission of the authors. The collections of the Los Angeles Museum have been consulted through the co-operation of the Associate Director, Dr. Comstock. The writer has seen and passed upon the identity of every specimen herein recorded, a feat which would have been impossible had the scope of this paper been extended to include specimens taken by collectors other than those working through the Field School and Yosemite Museum. Acknowledgment to specialists in the various groups will be made as occasion arises.

TRAILS OF YOSEMITE

There are over 700 miles of trail within the park boundaries. While some of the most spectacular butterflies, including the Leto Fritillary (Argynnis leto) and the California Sister (Heterochroa bredowii californica), fly within the confines of the Yosemite Valley itself, the collector who seeks the rarities for which the park is famous must be willing to do some strenuous hiking. The valley walls rise perpendicularly three thousand feet and more; but once their summit is gained a large expanse of comparatively level country is accessible by means of trails which wind through alpine meadows fragrant with wildflowers, a veritable collector's paradise.

Leaving the north side of the valley floor by the Yosemite Falls trail, a two-hour climb, best accomplished in the early morning, places one in a position to select either the Eagle Peak, Yosemite Creek, or North Dome trails for a day among the Parnassians. Likewise, the ascent to Glacier Point by the Ledge or Four-Mile trails allows the collector to choose between the Pohono and Glacier Point trails which parallel the south rim of
the valley along which *Lycana nivalis* is certain to be netter. The “high country” is reached by way of Lake Tenaya or Lake Merced, the habitat of the Arctic (*Oeneis chryrus ivallda*) requiring a second day’s journey. Generally speaking, June is the month for collecting in the valley, July for the valley’s rim, and August for the glacier country.

The accompanying map shows these shorter trails and also the route of the Field School expeditions of 1933 and 1934. The writer and Mr. Ziesenhenne in 1933 covered over 200 miles of trail outside of Yosemite Valley, climbing Mt. Lyell, el. 13,090; Mt. Kuna, el. 12,956, and Mt. Dana, el. 13,050, on successive days. Mr. Schlobohm also ascended Lyell and Dana in 1932 and Dana and Conness, el. 12,560, in 1933. Mr. Godwin traveled even more extensively in his ascent of Matterhorn, el. 12,280, in 1934 and again invaded virgin territory at Ostrander Lake. Thus over a thousand miles of hiking was required to assemble the array of insects herein recorded.

The following discussion of Life Zones and their characteristic butterfly species draws upon the writer’s observations while camping in the Sierra Nevada in the summers of 1922, ’25, ’28, ’29, ’30, ’31, ’33 and ’34 from Monache Meadows on the south to Sonora Pass on the north, as well as in the Yosemite section.

**LIFE ZONES**

The incline from El Portal at the west to the Sierran Crest at the eastern park boundary may be subdivided into five regions or life zones, each supporting a distinctive flora and fauna. These zones, in their ascending order, are Upper Sonoran, Transition, Canadian, Hudsonian, and Arctic-Alpine. A sixth zone, the Lower Sonoran, occurs a few miles west in the San Joaquin Valley, giving the Yosemite region every life zone recognized in temperate North America with the exception of the Subtropical, found only in Florida. In many cases the zones merge imperceptibly, as when a forest predominantly of Jeffry Pine and Incense Cedar, typically Transition, gives way to one predominantly Red Fir and Quaking Aspen (Canadian). Again, the line of demarkation may be startling in its abruptness, as when one toils laboriously up the south slope of a chaparral-clothed Upper Sonoran ridge to step into the open evergreen glades of Transition Zone on the opposite north-facing slope at the same elevation. While it is not intended to enter into a discussion of life zones, the subject having been treated exhaustively elsewhere,² suffice it to say that the factors which determine zones are many and varied, but the following are of paramount importance: latitude, altitude, exposure, prevailing winds, proximity to bodies of water, ascending currents of air from desert regions, quality of soil, and drainage.

BUTTERFLIES AS LIFE ZONE INDICATORS

In reference to life zones, plants and animals may be divided into two groups: (1) those of a more adaptable nature which range over a wide territory and are termed cosmopolitan; (2) those whose specialized mode of living compels them to adhere closely to a given zone. The latter are termed indicators because their presence is considered sufficient to establish the presence of the zone. Such a mammal is the Cony (Ochotona) of the Hudsonian rock slides; such a bird is the Sierra Nevada Rosy Finch (Leucosticte) of the Arctic-Alpine snow banks; such a plant is the greasewood (Adenostoma) of the Upper Sonoran chaparral. Ecologists, though not unanimously, place indicators in the following order of reliability: (1) trees, most reliable indicators; (2) plants other than trees; (3) mammals; (4) birds, least reliable. In attempting to place insects in this scale several factors must be considered: first and most important, the relation of the insect to the host plant; second, the normal wanderings of the insect in quest of food, building materials, or a mate; third, the question of migration. It will be seen that the insect combines at once the fixity of the plant to which it is bound in the larval stage, something of the natural motility of the mammal, though in a restricted sense, in the adult or imago stage, plus a migration in a few cases as definite and periodic as that of a bird, though more often irregular in time and place and as yet imperfectly understood. The writer would list the insect in a median position, having the revised list read (1) trees, (2) plants, (3) insects, (4) mammals, (5) birds. Thus in the insects we have indicators of greater reliability than those upon which much of this ecologic work of the past has been based, i.e., mammals and birds, although their importance in this respect has gone until the present time almost totally unrecognized.

The first attempt at a zonal analysis of the butterflies of California will of necessity be incomplete, and therefore inconclusive. Based upon the specific record of the capture, in some cases, of but a single specimen, the assignment of a species to a given zone must be made without knowledge of its status within that zone, whether as resident or as vagrant. The determination of the larval food plant will eventually settle this point; until then the exact range of the species is largely a matter of conjecture. The introduction of common plants of mundane distribution by the early settlers is responsible for the presence of a few butterflies clearly not indigenous to the Yosemite region; their progress, fortunately, has been sufficiently checked by natural factors so that the original picture has not been obscured.

Upper Sonoran Zone: The chaparral or "elfin forest" which clothes the foothills from 1,500 to 4,000 feet and occasionally higher, constitutes the Upper Sonoran Zone. It is characterized by a great variety of shrubby plants, many of which

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3 C. B. Williams, The Migration of Butterflies; Oliver and Boyd. Edinburgh, 1930. 41
exhibit remarkable adaptations for the conservation of moisture (xerophytes), including anastamosing root systems which check soil erosion. The Digger Pine, California Buckeye, California Jay, Phainopepla, Ring-tailed Cat, Mariposa Brush Rabbit, Boyle King Snake, Poison Oak, and Greasewood (Adenostoma), with its associated butterfly, Strymon adnrostomatis, are characteristic species. The Chalcedon Checker-Spot, California Ringlet, and Sylvan Satyr seldom stray beyond the confines of this zone.

**Transition Zone:** Between the Austral zones (Lower and Upper Sonoran) and Boreal zones (Canadian, Hudsonian, and Arctic-Alpine) lies a broad intermediate area known as Transition Zone. Its coniferous forest contains the trees of greatest commercial value, Big Tree, Western Yellow Pine, Jeffry Pine, Sugar Pine, Incense Cedar, White Fir, and Douglas Fir. The Azalea, Nuttall Dogwood, and Black Cottonwood fringe the streams. Black Oak and Golden Cup Oak clothe the valley floors and dry mountainsides, respectively. The Yosemite Pocket Gopher, Band Tailed Pigeon, California Purple Finch, Rubber Snake, and Coral King are restricted to this zone. The Fritillaries, Leto, Hydaspe, and Zerene, are selected at random to represent a considerable butterfly population. Transition Zone extends from 4,000 to 7,000 feet, merging almost imperceptibly into Canadian along its upper border.

**Canadian Zone:** Red Fir gradually replaces White in the open forest and Quaking Aspen displaces Azalea and Black Cottonwood along the water courses. Lodgepole Pine invades from the upper margin. A secondary chaparral, reminiscent of Upper Sonoran Zone, but composed of matted Ceanothus and Castanopsis (Snow Brush and Chinquapin), covers the steeper slopes. The Allen Chipmunk, Hammond Flycatcher, Green-Tailed Towhee, and Sierra Alligator Lizard are denizens of the Canadian forest. The Western Banded Elfin, Sierra Checker-Spot, and Western Meadow Fritillary are good butterfly indicators. Canadian Zone extends from 7,000 to 9,000 feet.

**Hudsonian Zone:** At the 9,000-foot level, or thereabout, Mountain Hemlock joins the Lodgepole Pine to form the Hudsonian forest, which is discontinuous because of the tremendous rock slides and glacial cirques. The Cony, Sierra Least Weasel, California Pine Grosbeak, and Hudsonian White-Crowned Sparrow nest in this region. Tuolumne Meadows, el. 8,600, is pure Hudsonian and here are found Behr's Sulphur, Podarce Blue, and Mariposa Copper, the former in abundance. The upper

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4 The omission of scientific names for the sake of brevity in the following few paragraphs is permissible in view of the fact that an exact usage of common names has been established, for birds and mammals by Grinnell and Storer in "Animal Life in the Yosemite," for plants by Hall in "A Yosemite Flora," and for butterflies by Comstock in "Butterflies of California."

5 Such an association does not necessarily imply that of larval food plant. In this case the host plant of Strymon adnrostomatis has been proven to be Cedrocarpus betuloides Nutt.
limits of Hudsonian Zone are defined by timber line at approximately 11,000 feet.

Arctic-Alpine Zone: The Alpine Willow, stunted to a height of a few inches, and the Sierra Nevada Rosy Finch inhabit the bleak talus slides and snow banks above timber line. The heathers, *Bryanthus* and *Cassiope*, and Alpine Sorrel cling to meager patches of damp soil. The Ivallda Arctic, Malcolm’s and the Cloud-Born Checker-Spot, and the tiny Yosemite Blue fly from 11,000 feet to the tops of Dana and Lycell, though dropping within the Hudsonian forest for occasional shelter.

FAUNAS

Strictly speaking, a fauna is a subdivision of a life zone occasioned by a difference of atmospheric humidity. Thus, if one were to cross the continent from East to West, keeping always within Transition Zone, he would pass through several faunal districts separated roughly by the Appalachian Mtns., the Rockies, and the Sierra Nevada. If, however, he were to travel from South to North within one faunal division, say the Great Basin, he would transsect several life zones. The writer therefore conceives life zones and faunas as divisions of one another, like squares of a checker board.

The crest of the Sierra Nevada forms a natural boundary between two faunas, the Pacific or Cismontane, and the Great Basin or Desert-Plateau. Since the eastern park boundary coincides with the Sierran divide, this paper concerns the Pacific fauna chiefly, and the Great Basin fauna only as its members stray or have become established within the territory of the Pacific watershed. Five Great Basin butterflies are taken regularly in the park. They are *Parnassius smintheus behrii*, *Euchloe ausonides coloradensis*, *Hesperia comma colorado*, *Thorybes nevada*, and *Polites sabuleti tecumseh*. Of rare occurrence is *Papilio multicaudata*. Expected to stray within the confines of the park because of their permanent establishment on the eastern Sierra slope are *Cercyonis octus*, *Papilio bairdii brucei*, and *Callipsyche behrii*. The Tioga Pass, el. 9,941 and one of the lowest in the Central Sierra, affords easy access from the Mono Basin, and the dry, eastern slopes, clothed with *Juniperus*, *Sedum*, and *Sanicula*, present an avenue of approach into the heart of Yosemite.

The above-named species are all fliers of medium elevations, and so are assumed to range widely across the plateau which lies between the Sierra and the Rockies at an average elevation of 7,000 feet. The boreal fauna, consisting in the Sierra Nevada of such species as *Oenesis chryxus ivallda*, *Neominois ridingsii*, *Eurymus behrii*, *Melitaca malcolmi*, and *Euphydryas nubigena*.

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is not to be thought of, because of the existence of analogous Rocky Mountain species or races, as having been derived via the Great Basin route. Independent invasions from the North have undoubtedly supplied the two ranges with respective races of boreal species which have direct access to one another only in British Columbia, where high latitude nullifies the isolating effect of altitude by allowing alpine species to fly at moderate elevations. (See also the following account, 415 Lycaena hypophlaeas (Bdv.).)

ASSOCIATIONS

A more restricted ecologic division than either life zone or fauna is of value in dealing with the habitats of species. It is known as the association. Thus within the Transition Zone of the Pacific Fauna occurs the canyon live oak association of the steep, hot sides of Yosemite Valley. Two butterflies always found about the Golden Cup Oak (Quercus chrysolepis) are Heterochroa californica and Hypaurotis grunus. Mentioned previously, the Juniperus-Sedum-Sanicula association of the east-facing slopes closely limits the flight of Parnassius smintheus behrii and Papilio indra. The Alpine meadow association finds Eurymus behrii, Plebejus aquilo podarce, and P. saepiolus flying over Shooting Star (Dodecathcon alpinum), although the latter butterfly is taken earlier at lower levels. The stream bank association transcends both zonal and faunal limits to carry Cottonwood and Willow (Populus and Salix), Basilarchia lorquini, Papilio rutulus, and Lycanopsis pseudargiolus echo from the floor of the San Joaquin Valley to the heart of Canadian Zone. Along such a continuous association a seasonal advance takes place, the butterflies first emerging in April at El Portal and not until mid-July at Glen Aulin.

SPECIFIC LOCALITIES AND ABBREVIATIONS

The day has passed in which the designation “Yosemite, Cal.” on a label conveys the necessary information about the habitat of the insect. With territory as varied as it is possible to find in the United States and Canada occurring within park boundaries, it is necessary to restrict ourselves to specific localities, giving their elevation where possible. Sheets of such labels, suitable for pinned specimens, have been printed for a score of localities within Yosemite and may be obtained at the Museum.

To conserve space in the body of the list a standard set of abbreviations has been adopted, following the practice of recent entomological reports of a similar nature.7 The localities are, with one exception, within the present boundaries of Yosemite National Park, which since 1932 have included the Wawona

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KEY

—- Auto Rd. - - - Trails Covered 1933 . . . Trails Covered 1934
Basin and Mariposa Grove. El Portal and the terminus of the Coulterville Road have been chosen as the bit of Upper Sonoran Zone most accessible from the Yosemite Valley.

The following places were visited by the writer and Mr. Ziesenhenne in 1933:

1. **Camp 19**: Headquarters of the Yosemite School of Field Natural History near Sentinel Bridge on the floor of Yosemite Valley. El. 4,000 ft.; Transition Zone.

2. **Camp 9**: Meadow not far from Camp Curry, a favorite collecting ground for *Argynnis leto*. El. 4,000 ft.; Transition Zone.

3. **Dana**: Mt. Dana, el. 13,055. Collecting from base camp in Tuolumne Meadows, el. 8,600, to the summit, Hudsonian and Arctic-Alpine Zone. (*Salix arctica petraea.*)

4. **Eagle**: Eagle Peak Trail from the summit of Yosemite Falls, el. 6,525, to the top of Eagle Peak, el. 7,214. Canadian Zone; meadows.

5. **El Portal, Mariposa Co.**: Collecting along the All-Year Highway from Merced, also a short distance up the Coultervills Road. Elevation 2,200 to 3,000 ft.; Upper Sonoran Zone.

6. **Florence**: Lake Florence, el. 10,500. Collecting on rock slides and in alpine meadows. Hudsonian Zone, in close proximity to Arctic-Alpine.

7. **Glacier**: Glacier Point Trail from Glacier Point Hotel to the summit of Nevada Falls. A large area, originally Transition or Canadian Zone, has been burned over recently. The replacement of chaparral has brought Upper Sonoran species to within half a mile of Glacier Point, el. 7,214.

8. **Glen Aulin**: A High Sierra Camp on the Tuolumne River at the juncture of Conness Creek. El. 7,850; Canadian Zone with strong Transition elements (*Argynnis hydaspe*).

9. **Kuna**: Kuna Crest from Lyell base camp, el. 10,600, to the summit of Kuna Pass, el. 12,000, and down Dana Fork to Tuolumne Meadows, el. 8,600. Hudsonian and Arctic-Alpine zones; glacial cirques, tarns, snow banks, talus, and alpine meadow; an 11-mile trail.

10. **Ledge**: Ledge Trail from Camp Curry, el. 4,000, to Glacier Point, el. 7,214. Transition to Canadian Zone; steep cliffs, springs, rivulets.

11. **Little Yosemite**: A hanging valley above Nevada Falls, el. 6,000. Upper Transition Zone; Jeffry Pine, Western Juniper.
12. **Lyell**: Mt. Lyell and sister peak, Maclure. Collecting from Vogelsang Lake, el. 10,500, to the summit of Lyell, el. 13,095. Hudsonian and Arctic-Alpine zones; glaciers and tarns.

13. **Museum**: Garden plot behind the Yosemite Museum in which plants from all over the park are growing in their proper associations. A diverted stream runs through the garden. Transition Zone; el. 4,000.

14. **Pohono**: Pohono Trail from Glacier Point, el. 7,214, to Old Inspiration Point, el. 5,391. The 11-mile trail parallels the south rim of the Yosemite Valley and includes Sentinel Dome, el. 8,117. Canadian and Transition Zone to the border of Upper Sonoran; stream, meadow, and dry mountainside associations.

15. **Reserve**: Boundary Hill Research Reserve, an area of 25 square miles set aside by park survey as a wilderness. It is bounded by Tioga Road, Yosemite Creek, Cascade Creek, and the north rim of Yosemite Valley. Elevation 6,525 to 9,200 ft., the summit of Research Ridge supporting a few acres of weak Hudsonian Zone (*Tsuga mertensiana*). The rest of the reserve is Canadian. Fir forests, dry eastern slopes, cirques.

16. **Wawona**: Wawona Road from Chinquapin to the Wawona Hotel. Transition Zone; dry hillsides with *Monardella* and *Erysimum* associations.

The following localities were visited by Edmund Godwin in 1934:

17. **Benson**: Lake Benson, el. 8.000. Collecting from Pate Valley over an 8,000 ft. ridge, dropping into Pleasant Valley, el. 7.000, and on to Benson Lake. Transition Zone, with strong Upper Sonoran influence (*Cercyonis sylvestris*) on the Pate Valley side, to Canadian Zone.

18. **Coldwater**: Coldwater Canyon from camp at Virginia Creek to Glen Aulin. Average elevation 8.500 ft.; Canadian Zone.

19. **Kerrick**: Kerrick Pass and Meadows. Collecting begun at Benson Lake and continued through Seavey Pass, el. 9,100, into Kerrick Canyon and upstream to Kerrick Meadows, el. 9,400. Canadian to Hudsonian Zone.

20. **Ostrander**: Lake Ostrander, el. 9.000, in the southern portion of the park. Reached by a 4-mile hike from the Glacier Point Road. Canadian Zone to the border of Hudsonian (*Tsuga mertensiana*).
21. **Pate:** Collecting from Harden Lake, el. 7,575, down a north-facing granite slope into Pate Canyon, el. 4,100. Canadian to Transition Zone; Upper Sonoran present on the opposite, south-facing exposure sending *Coenonympha galactinus* and *Cercyonis silvestris* across. *Monardella* and *Umbellularia* associations.

22. **Slide:** From Kerrick Meadows, el. 9,400, to Snow Lake, el. 10,200, to Slide Creek Canyon, el. 10,000. Hudsonian Zone (*Eurymus behrii*).

23. **Tenaya:** Collecting along McGee Lake Trail from Glen Aulin, el. 7,850, to Tenaya Lake, el. 8,200. Canadian Zone.

**LIST OF SPECIES AND DATA**

The Barnes and Benjamin Check List of Diurnal Lepidoptera of Boreal America (Bull. So. Cal. Acad. Sci., XXV, 1, pp. 3-27, 1926) has been followed with a few exceptions; numbers prefixed are according to this list. A zone name in parentheses indicates that the species is known to be a vagrant in this zone; a zone name in italics implies that only weak elements of that zone were present at the place of capture, as with Hudsonian Zone of Research Reserve. For complete description and illustration of the following species the student is referred to Comstock, "Butterflies of California," for information concerning the host plant and its exact range to Hall, "A Yosemite Flora." These books are in the Yosemite Museum.

7. **Papilio zelicaon** Luc.
   Reserve vii-16-'33.

   THE ANISE SWALLOWTAIL chooses the most exposed situations. Six males were taken at the very summit of Research Ridge. They are partial to the blossoms of the Western Wallflower (*Erysimum asperum*). The possibility of the occurrence of *P. bairdii brucei* Edw. in similar situations should be constantly held in mind, as it has been taken on the eastern Sierran slope at Round Valley, Inyo Co.

   Host Plants: Umbelliferae.
   Life Zones: Canadian, Hudsonian.

8. **Papilio indra** Reak.
   Reserve vii-18-'33.

   THE INDRA SWALLOWTAIL is an erratic flier, difficult of capture. A single male was taken by Mr. Arthur Carthew of the Yosemite Field School near the summit of Yosemite Falls, el. 6,525 ft. The plant upon which it undoubtedly feeds in the Yosemite region is *Sanicula nevadensis*, abundant on the
dry, eastern slopes in association with Juniper and Sedum. *Indra* was also seen at the summit of Research Ridge and again flying with *Parnassius smintheus behrii* on the west bank of Yosemite Creek.

Host Plants: Umbelliferae.
Life Zones: Upper Transition, Canadian, *Hudsonian*.

15. **Papilio rutulus** Luc.
   Camp 19 vi-26-'33. Pate vii-23-’34.

THE WESTERN TIGER SWALLOWTAIL is a species which transcends zonal limits in its adherence to the stream bank association. It occurs at El Portal on the Merced River, thence through the Yosemite Valley and along tributary streams well into Canadian Zone.

Host Plants: *Populus, Salix*, especially *laiolepis* and *lassandra*.
Life Zones: Upper Sonoran, Transition, lower Canadian.

16. **Papilio multicaudata** Kirby (*= daunus* Bdv.)

Two specimens of the TWO-TAILED SWALLOWTAIL are in the collection of the Yosemite Museum, unfortunately without accompanying data. They are presumed to be the insects of which B. A. Thaxter* and Edna Banta, Field School members, wrote in 1930, “Among the Swallowtails found here we took the *Papilio daunus*, the largest western species, a bright yellow butterfly with black markings and two tails on each hind wing.” Their brief report, “Some Butterflies and Moths of the Yosemite Valley Region” is on file in the Yosemite Museum. *P. multicaudata* is of the Great Basin fauna and, although many plants of its choice grow west of the Sierran divide, it has not become established.

Host Plants: *Umbellularia, Fragaria, Fraxinus* (El Portal).
Life Zones: Upper Sonoran, Transition.

17. **Papilio eurymedon** Luc.
   Ledge vii-9-’33. Pate vii-23-’34.

THE PALE SWALLOWTAIL is more frequently encountered on dry hillsides than the nearly related and equally abundant *P. rutulus*. While the food plant adheres strictly to the lower zones, the strong wings of the butterfly carry it to the tops of the highest peaks.

Host Plants: *Rhamnus californica* (Upper Sonoran) var. *rubra* (Transition).
Life Zones: Upper Sonoran, Transition, straying higher.

*A communication from Mr. Thaxter confirms this opinion.*
25c. **Parnassius clodius baldur** Edw.

Eagle Pk. vii-1-'33. Glacier vii-9-'33.
Dana viii-8-'33. Slide vii-29-'34.

THE BALDUR PARNASSIAN flies to the very rim of the precipitous walls of Yosemite Valley. In the Research Reserve it was particularly abundant, over 50 specimens being netted in four days. A few are without the black-margined secondaries and suggest the parent stock, *clodius* Mén. Flying over thickets of Chinquapin and Ocean Spray (*Holodiscus discolor dumosa*), they pause to sip nectar from yellow *Senecio*. While the fir belt generally defines their habitat, they occasionally stray higher among Lodgepole Pine and Mountain Hemlock.

Host Plants: *Sedum, Vaccinium?*

Life Zones: (Upper Transition), Canadian, Lower Hudsonian.

26d. **Parnassius smintheus behrii** Edw.

Reserve vii-14-'33. Dana viii-8-'33.

BEHR’S PARNASSIAN, although well established on the desert slopes of the Sierra Nevada, may be considered within the Yosemite an invader from another fauna. That this invasion has reached a point as far west of Tioga Pass as Yosemite Creek is worthy of note, and is because of the favorable approach afforded by the persistence of the *Juniperus-Sedum* association on the arid eastern exposures of many ridges west of the Sierran divide. The larva and pupa of this race have already been described from a specimen secured by the writer and Mr. Godwin in the Rock Creek Lakes region.¹⁰

Host Plants: *Sedum obtusatum.*

Life Zones: Canadian, Hudsonian.

27. **Neophasia menapia** (F. & F.)

Little Yosemite viii-3-'33. Pate vii-23-'34.

THE PINE WHITE reaches the peak of its flight in August. Although not abundant in Yosemite in 1933, the writer saw them by hundreds in 1928 along the Big Oak Flat road. The larvae have been known to defoliate the pine trees over large areas and so are of special interest to the student of forest entomology. *Menapia* is a high flier, seldom descending from the tree tops to permit capture.

Host Plants: *Pinus ponderosa, P. contorta murrayana.*

Life Zones: Transition, Canadian.

33. *Pieris sisymbrii* Bdv.

    THE CALIFORNIA WHITE flies over much the same territory as *Parnassius clodius baldur*, with which it may be easily confused when on the wing and at a little distance. A spring brood may occur at lower elevations. The food plant grows abundantly in meadows of the Research Reserve.
    
    Host Plants: Cruciferae, especially *Sisymbrium*.
    Life Zones: Canadian.

    El Portal vi-28-'33.

    THE COMMON WHITE.
    Host Plants: Cruciferae, especially *Brassica*.
    Life Zones: Upper Sonoran, Transition.

    Yosemite 1926.

    HARRIS’ WHITE is, according to Dr. Comstock, “a rare, high altitude race that is occasionally encountered in the central Sierras.” While none were found in the course of our survey, two specimens of a *napi* form probably referable to the above are in the collection in the Yosemite Museum. It is possible that *P. napi venosa* also occurs in the foothills adjacent to the San Joaquin Valley in the springtime.
    
    Host Plants: Cruciferae.
    Life Zones: Undetermined.

38. *Pieris rapae* L.
    Pate vii-23-'34.

    THE CABBAGE WHITE.
    Host Plants: Cruciferae.
    Life Zones: Upper Sonoran, Transition.


    THE DAINTY YELLOW is likely to be encountered in the most unexpected places and at any time of year, even towards timber line in mid-winter! We have records of *iole* flying below sea level on the Colorado Desert and at 9,000 feet on Mt. San Jacinto in the same months, March and November. There are no set rules of behavior for this butterfly, which has followed the Filaree into many an improbable situation.
    
    Host Plants: *Erodium cicutarium*, *Helenium bigelovii*.
    Life Zones: Upper Sonoran, Transition, and higher.
40a. **Euchloe creusa hyantis (Edw.)**

Eagle Pk. vii-1-'33.
Reserve vii-16-'33.

Glacier vii-9-'33.
Ostrander vii-4-'34.

EDWARD’S MARBLE and the following *coloradensis* are difficult to separate. The former shows heavy green marbling on the under side of the secondaries against a dead white background. The latter has less green and it is of a decidedly yellowish cast against a pearly white ground color. As a matter of fact, the green of both species is only an effect produced by yellow scales laid over black, as examination with a hand lens will demonstrate. Eagle Pk. and Glacier Pt. specimens are typical; a few of the Reserve specimens show mixed characters.

Host Plants: *Arabis, Streptanthus tortuosus?*

Life Zones: (Upper Transition), Canadian, *Hudsonian*.

41a. **Euchloe ausonides coloradensis (Hy. Edw.)**

Reserve vii-16, 17-'33.

THE COLORADO MARBLE is the common *Euchloe* of the Research Reserve, about four specimens being taken to every one of *hyantis*. Like *Parnassius behrii* it is of the Great Basin fauna. In company with *hyantis* it flies to the mountain tops and the collector who stations himself in such a location may be certain of a goodly series. *Coloradensis* neither descends to lower elevations nor flies further westward, as does the foregoing species.

Host Plants: Cruciferae, especially *Arabis*.

Life Zones: Canadian, *Hudsonian*.

43. **Anthocharis lanceolata Bdv.**

Eagle Pk. vii-1-'33.

Ledge vii-9-'33.

BOISDUVAL’S MARBLE is an early flier, as our dozen specimens from these two localities were badly worn. Yosemite specimens are almost gray enough beneath to match race *australis* Grin. They seek the vertical walls of the Yosemite Valley and choose *Arabis* upon which to deposit the eggs.

Host Plants: Cruciferae, especially *Arabis*.

Life Zones: Upper Sonoran, Transition.

47b. **Anthocharis sara julia Edw.**

Eagle Pk. vii-1-'33.
Reserve vii-16, 17-'33.

THE JULIA ORANGE-TIP neither flies to the mountain tops with the Euchloes nor up the steep cliffsides with *A. lanceolata*, preferring instead the sequestered trailside vistas of mod-
erate elevation. All females taken were yellowed, so much so that the name stella Edw. might be applied.

Host Plants: Cruciferae, especially the Mustards.
Life Zones: Upper Transition, Canadian.

56. Zerene eurydice (Bdv.)
Yosemite vi-’26.

THE CALIFORNIA DOG-FACE or FLYING PANSY as it is sometimes called has been selected by the entomologists of the state as their official emblem. The male bears the figure of a dog’s head in irridescent gold and violet against a jet black background of the forewing. The female is pure sulphur yellow. Evidently eurydice is a vagabond in the Yosemite, for Hall does not record the food plant, false indigo or lead bush, as occurring in the park. It is abundant in the foothills of Southern California.

Host Plants: Amorpha californica.
Life Zones: Upper Sonoran, lowerTransition.

61. Eurymus eurytheme (Bdv.)
Ledge vii-9-’33. Reserve vii-16-’33.
Camp 9 vii-23-’33 (f. amphiidusa (Bdv.).)

THE CLOUDED SULPHUR is partial to grassy meadows and to cultivated areas. It grades imperceptibly into the summer form, amphiidusa (Bdv.), larger and more orange. For the indigenous Astragalus it soon substitutes introduced alfalfa as a food plant.

Host Plants: Leguminosae, particularly Astragalus.
Life Zones: Upper Sonoran, Transition, Canadian.

63b. Eurymus occidentalis chrysomelas (H. Edw.)
Yosemite vi-’26. Dr. E. O. Essig, collector.

THE GOLDEN SULPHUR is the largest member of its genus occurring in California. It is an early flier and is considered a rarity.

Host Plants: Fabaceae?
Life Zones: Upper Sonoran, Transition.

72. Eurymus behrii (Edw.)
Florence viii-5-’33. Kuna viii-7-’33.
Kerrick vii-27-’34. Snow Lake vii-29-’34.

BEHR’S SULPHUR is the only greenish sulphur butterfly of the Sierra Nevada. Until the opening of the Tioga Road in 1915 it was considered a great rarity because of the extreme
inaccessibility of its habitat, the Tuolumne Meadows. John Batiste Lembert, who homesteaded the Soda Springs quarter section in 1885, found that there was a demand for this butterfly and for a dozen years supplied them in quantity to universities and museums. The secret of their haunts he shared only with the Indians, who in turn refused to divulge it to outsiders.

We now know that behrii has as its metropolis the Tuolumne Meadows, that smaller colonies are present in adjacent alpine meadows, and that it has been taken to the South at Rock Creek and Mineral King. Form  Canescent Const., although relegated to synonymy by Barnes and Benjamin, is a valid albinic  and may be recognized on the wing as well as in the collectors' cabinet.

Host Plants: Gentiana newberryi, Vaccinium caspitosum.

85. Danaus menippe (Hbn.) = Anosia plexippus (L.)
Camp 9 vii-23-'33.

THE MONARCH is common in Yosemite Valley. Various species of Milkweed (Asclepias) grow along the Merced River at Old Village, at Mirror Lake, on the Eagle Peak Trail, and at the fork of the road to the giant yellow pine. The striped larvae are easily discernable, but the waxy green chrysalids are discovered only upon diligent search.

Host Plants: Asclepias speciosa, cordifolia, mexicana.
Life Zones: Upper Sonoran, Transition.

102. Coenonympha californica West. & Hew.
El Portal vi-28-'33. Pate vii-23-'34 (galactinus)

THE CALIFORNIA RINGLET and its summer form  galactinus (Bdv.) are reliable indicators of Upper Sonoran Zone. Weak fliers, keeping close to the grasses upon which the larvae feed, they are taken with a sweeping motion of the net. The beginner in butterfly collecting might readily pass them up as “millers,” so much do they resemble certain small geometrid moths when on the wing.

Host Plants: Grasses.
Life Zone: Upper Sonoran.

116. Cercyonis silvestris (Edw.)
El Portal vi-28-'33. Pate vii-23-'34.
Benson vii-24-'34.

THE SYLVAN SATYR, like the California Ringlet, is a creature of the Elfin Forest which covers the foothills. Unlike
most butterflies, it prefers to alight in the shade and seeks to lure the pursuer ever deeper into the undergrowth. Its favorite haunts are about the roots of Manzanita, Scrub Oak, and Mountain Mahogany (*Cercocarpus parvifolius*).

**Host Plants:** Grasses.

**Life Zones:** Upper Sonoran, (Transition).

120b. *Oeneis chryxus ivallda* (Mead)

Florence viii-5-'33.
Dana viii-8-'33.
Lyell viii-6-'33.
Slide viii-1-'34.

**THE IVALLDA ARCTIC** inhabits the bleak, wind swept crags of the Arctic-Alpine Zone. Its flight begins where the last Mountain Hemlock stands at timber line and extends to the dizzy heights of Mt. Lyell. Mr. Edmund Godwin reports "many seen at 12,200 ft. on Matterhorn." Against a background of bare granite its course is difficult enough to follow; but when an Arctic alights upon a boulder, it becomes just one more patch of lichen. The females wander down into the pine forests of Hudsonian Zone to deposit their eggs.

**Host Plants:** Grasses.

**Life Zones:** (Upper Hudsonian), Arctic-Alpine.

155. *Argynnis leto* Behr

Camp 9 vii-23-'33 to viii-2-'33.

**THE LETO FRITILLARY** is the handsomest butterfly of Yosemite and the most certain to attract the attention of the tourist. From the thistles at Mirror Lake they may be easily traced to their breeding ground, the sequestered meadow near Camp 9. The velvet-brown females deposit their eggs among the dried grasses, always in the vicinity of violets, while the ruddy males hover above them. *Leto* is one of two Californian members of the genus which exhibit the phenomenon of sexual dimorphism, the other being *A. apacheana* Skin, of the Owens Valley.

**Host Plants:** *Viola*.

**Life Zones:** Lower Transition.

166. *Argynnis zerene* Bdv.

Wawona vii-20-'33.

**THE ZERENE FRITILLARY** was not encountered in Yosemite Valley. It is common along the highway from Chinquapin to Wawona and on to the Mariposa Grove of Big Trees. Every patch of thistle will bear investigation, for this fritillary is highly susceptible to their lure. A second choice for nectar is *Monardella*, a mint.

**Host Plants:** Violets.

**Life Zones:** Transition.
167. Argynnis hydaspe Bdv.
   Camp 19 vii-5-'33, Ledge vii-9-'33.
   Glen Aulin vii-10-'33, Pate vii-23-'34.

   THE HYDASPE FRITILLARY first appears in Yosemite Valley about the 4th of July, flying rapidly across the valley floor but pausing over the Monardella of the talus slides.
   Host Plants: Violets.
   Life Zones: Transition, lower Canadian.

169. Argynnis irene Bdv.
   Coldwater viii-3-'34, Tenaya vii-4-'34.

   THE IRENE FRITILLARY of Yosemite, determined by Dr. J. McDunnough, is a dark race, some specimens of which are strongly suggestive of hydaspe. Irene, however, is taken at elevations of 8,500 and 9,000 feet in Hudsonian Zone, hydaspe keeping well within Transition Zone. It will be seen that there is an entire zone, Canadian, without a representative of this aggregation, except as hydaspe strays within its lower borders.
   Host Plants: Presumably Violets.
   Life Zones: Hudsonian.

182. Argynnis montivaga Behr
   Eagle Pk. vii-l-'33, Reserve vii-16-'33.
   Dana vii-16-'33, Pate vii-23-'34.

   THE MOUNTAIN VAGABOND is a well-chosen name for this wanderer. Specimens are of a uniform small size, none suggestive of race malcolmi Comst. of the Mammoth Lakes region. A slight thickening of the veins of the primaries is characteristic, according to Dr. McDunnough, to whom specimens were referred. On the west slope of Mt. Dana they fairly swarmed in the late afternoon sunshine and could be swept into the net by dozens.
   Host Plants: Viola.
   Life Zones: Canadian, Hudsonian.

183. Argynnis mormonia Bdv.
   Dana viii-8-'33, Coldwater viii-3-'34.

   THE MORMON FRITILLARY occurs typically in the Monache Meadows of Tulare Co. Those of Yosemite have the embarrassing (to the “splitter”) tendency of approaching the foregoing species so closely in pattern as to suggest a link between them. Further north mormonia drops out in favor of montivaga.
   Host Plants: Violets.
   Life Zones: Canadian, Hudsonian.
199. **Brenthis epithore** (Edw.)

Ledge vii-9-'33.

**THE WESTERN MEADOW FRITILLARY** favors small, open glades beneath the fir trees, *Abies concolor* and *magnifica*. Along Yosemite Creek it is particularly abundant in mid-July.

Host Plants: Violets.
Life Zones: Upper Transition, Canadian.

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204. **Euphydryas chalcedona** (Dbldy. & Hew.)


**THE CHALCEDON CHECKER-SPOT** ranges throughout the foothills of the entire state. In the Yosemite region it may be taken abundantly along the Coulterville Road. *Chalcedona* feeds on a variety of plants from the blue Penstemon, *P. spectabilis*, to poison oak, *Rhus trilobata*. The Glacier Point record may be accounted for by the circumstance that a considerable area, originally Transition, or even Canadian Zone, has been recently burned over. The first replacement of chaparral has brought with it typical Upper Sonoran butterflies.

Host Plants: *Mimulus*, *Scrophularia*, *Penstemon*.
Life Zones: Upper Sonoran.

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211. **Euphydryas nubigena** (Behr)

Lyell viii-6-'33. Dana viii-8-'33.

**THE CLOUD-BORN CHECKER-SPOT** occurs at high elevations in company with *Oenice iwallda* and *Melitaea malcolmii*. First encountered on the loose rock slides of the north slope of Mt. Maclure near Vogelsang Lake, it continued to fly above timber line to a glacial tarn known locally as Bert Lake, at about the 12,000 foot level. During the ascent of the last thousand feet of Mt. Lyell, el. 13,000, none were observed.

Host Plants: Undetermined.
Life Zones: Hudsonian, Arctic-Alpine.

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215. **Euphydryas sierra** (Wright)

Eagle Pk, vii-1-'33. Reserve vii-14-'33.

**THE SIERRA CHECKER-SPOT** is a butterfly of medium elevations, preferring the wooded glades of upper Transition and Canadian Zone to the chaparral-clothed hillsides of *E. chalcedona* or the bleak mountain tops of *E. nubigena*. Thus, whether the collector chooses El Portal on the one hand or Mt. Lyell on the other, or any place between, he will find a representative of this widely distributed genus, each adhering closely to its zonal limitation.

Host Plants: *Montia?*
Life Zones: Upper Transition, Canadian.
226. Melitœa malcolmi Comst.
   Lyell viii-6-'33. Dana viii-8-'33.

MALCOLM’S CHECKER-SPOT was described from the only known colony at Red Lake, el. 11,000, above the Mammoth Lakes Basin, where it flies on a precipitous talus slide. The Yosemite records and one of the writer for a like elevation above Sonora Pass are therefore considerable extensions of range. It is probable that malcolmi flies the length of the Sierra at suitable elevations.

Host Plants: Unknown.
Life Zones: Upper Hudsonian, Arctic-Alpine.

230. Melitœa palla Bdv.
   Eagle Pk. vii-1-'33. Ledge vii-9-'33.

THE NORTHERN CHECKER-SPOT enjoys a wide range throughout the Sierra Nevada and Cascade chain as well as the Rockies. The darkening characteristic of race whitneyi Behr apparently does not extend much further north than the Huntington Lake region, as it was not observed in Yosemite specimens. Palla flies with the following species, hoffmanni, but descends to lower elevations, as the Ledge and Glacier records show.

Host Plants: Castilleja.
Life Zones: Upper Transition. Canadian.

230-1. Melitœa hoffmanni Behr
   Reserve vii-14 to 18-'33. Pate vii-23-'34.
   Benson vii-24-'34.

HOFFMANN’S CHECKER-SPOT was the most abundant butterfly of the Research Reserve, nearly 200 being netted in four days. They fairly swarmed over the Monardella, the nectar of which appeared to intoxicate and render them oblivious to the collector’s presence. They had not begun to mate.

Host Plants: Chrysopsis brewerii?
Life Zones: Canadian.

236. Melitœa leanira F. & F.
   Ledge vii-9-'33.

A single specimen of THE LEANIRA CHECKER-SPOT netted half way up the ledge trail appeared to be a straggler from the lower elevations, where it properly belongs.

Host Plants: Cordylanthus tenuis, Bird’s Beak.
Life Zones: Upper Sonoran, (Transition).
253. **Phyciodes campestris** (Behr)  
Museum vii-5-'33. Benson vii-26-'34.

THE FIELD CRESCENT is found about moist places at lower elevations, as on the floor of Yosemite Valley. Higher up it grades imperceptibly into the following (?) species.

Host Plants: *Aster*.
Life Zones: Upper Sonoran, Transition.

255. **Phyciodes montana** (Behr)  
Reserve vii-16-'33. Dana viii-8-'33.
Benson vii-24-'34. Coldwater viii-3-'34.

THE MOUNTAIN CRESCENT appears to be but a race of the foregoing species found at higher elevations and to the north. The tawny ground color has all but obliterated the sub-marginal row of spots on the secondaries.

Host Plants: *Aster, Chrysopsis*?
Life Zones: Canadian, lower Hudsonian.

258. **Phyciodes mylitta** (Edw.)  
Museum vii-5-'33. Benson vii-24-'34.

THE MYLITTA CRESCENT frequents the streamside and is often taken in company with the following species, *Polygonia satyrus*.

Host Plants: *Carduus*.
Life Zones: Transition.

274. **Polygonia satyrus** (Edw.)  
Museum vii-5-'33.

THE SATYR flies about the trunks of Alder, Willow, and Cottonwood, on the mottled bark of which it is quite indistinguishable.

Host Plants: *Urtica*.
Life Zones: Upper Sonoran, Transition.

275a. **Polygonia faunus rusticus** (Edw.)  

THE RUSTIC ANGLE-WING occurs sparingly throughout the Sierra, principally north of Yosemite. It is darker than typical *faunus*, which reaches the Pacific Northwest.

Host Plants: *Rhododendron occidentale*.
Life Zones: Undetermined by us; host plant strictly Transition.
277. *Polygonia zephyrus* (Edw.)
Reserve vii-14-'33.

THE ZEPHYR replaces the Satyr (*P. satyrus*) as the common Angle-Wing of Canadian Zone. Its pale gray underside will serve as a distinguishing feature. Several were taken along Yosemite Creek in mid-July.

Host Plants: *Rhododendron, Ribes.*
Life Zones: Upper Transition, Canadian.

Camp vii-24-'33 to vii-5-'33. Ledge vii-9-'33.

THE CALIFORNIA TORTOISE-SHELL appears in great numbers every few years throughout the Sierra. Mr. C. B. Williams, in his monograph *The Migration of Butterflies*, mentions observations of Edwards and Behr before 1900 in the Mill Valley section, where a fall southern movement as well as a spring northerly advance was noted. The June flights observed by the writer in General Grant National Park in 1922, in the San Bernardino Mtns, in 1931, and in Yosemite in 1933 have all been in a northerly or northwesterly direction, roughly paralleling the axis of the Sierra. Mr. C. A. Harwell, park naturalist, reports a return flight on October 4, 1933 in which myriads of the insects passed through the highest mountain passes, all headed south. This observation is remarkable in view of the lateness of the year and the extreme altitude, for Mr. Harwell was on a glacier-measuring survey at the time.

The duration of the spring flight is but a few days. It begins at 5 a.m. and lasts until after sundown. At times the greatest density of the insects appears to be a hundred feet or more in height, well over the treetops; again they come so close to the ground that they may be knocked down with a hat. A few weeks later the *Ceanothus* is matted with webs of the larvae, which are gregarious. Complete defoliation results over large areas.

Host Plants: *Ceanothus*, particularly Snow Brush.
Life Zones: Apparently unrestricted, although *Ceanothus* is not found above Canadian.

284. *Hamadryas milberti* (Godt.)
Lyell viii-6-'33.

MILBERT’S TORTOISE-SHELL was taken at the very summit of Mt. Lyell, el. 13,090 ft., and the highest point in Yosemite. The nearest *Urtica* was many thousand feet below. Form *subpallida* (Ckll.) flies with normal individuals, although not commonly. The summits of Olancha Pk. and Mt. San Gorgonio in Southern California have also yielded *milberti* in numbers.

Host Plants: *Urtica*.
Life Zones: Transition, Canadian, straying higher.
285. **Hamadryas antiopa (L.)**

THE MOURNING CLOAK.

Host Plants: *Salix, Populus*.

Life Zones: Transition, Canadian.

286. **Cynthia atalanta (L.)**


THE ALDERMAN or THE RED ADMIRAL.

Host Plants: *Urtica*.

Life Zones: Upper Sonoran, Transition.

287. **Cynthia virginiensis (Dru.)**

Reserve vii-14 to 18-’33.

THE VIRGINIA LADY.

Host Plants: *Gnaphalium, Antennaria*.

Life Zones: Upper Sonoran, Transition, Canadian.

288. **Cynthia cardui (L.)**

Reserve vii-14 to 18-’33.

THE PAINTED LADY.

Host Plants: *Carduus, Urtica, Malva*.

Life Zones: Upper Sonoran, Transition, Canadian.

289. **Cynthia carye (Hbn.)**

Reserve vii-14 to 18-’33.

THE WEST COAST LADY.

Host Plants: *Urtica, Malva*.

Life Zones: Upper Sonoran, Transition, Canadian.

290. **Junonia ccena Hbn.**

Ledge vii-9-’33. Reserve vii-14 to 18-’33.

THE BUCKEYE.

Host Plants: *Mimulus, Sedum*.

Life Zones: Upper Sonoran, Transition, (lower Canadian).

310. **Basilarchia lorquini (Bdv.)**

Yosemite Valley vii-’33. Pate vii-23-’34.

LORQUIN’S ADMIRAL seldom strays far from the willows of the stream bed; in fact, it adheres to the riparian association throughout three life zones. On the wing it is sometimes confused with the following species, but the manner of flight is quite different.

Host Plants: *Salix, Populus, Prunus*.

Life Zones: Upper Sonoran, Transition, Canadian.
313a. Heterochroa bredowii californica Bull.
   Museum vii-5-'33. Glacier vii-9-'33.
   Meadow, Camp 9 vii-23-'33.

   THE CALIFORNIA SISTER vies with the Leto Fritillary as being the insect most likely to attract the attention of the park visitor. It flies with the foregoing species, which it superficially resembles, but from which it may be told on the wing by the habit of alternating a few rapid beats with a glide in which the wings are held slightly below the horizontal level. Unlike the Admiral, the Sister forsakes the stream for the hot canyon walls and the Golden Cup Oak association.

   Host Plants: Quercus chrysolepis.
   Life Zones: Upper Sonoran, Transition.

324a. Apodemia mormo virgulti (Behr)
   Little Yosemite viii-3-'33. Pate vii-23-'34.

   BEHR'S METAL-MARK occurs in abundance in the chaparral of Upper Sonoran Zone in the spring months and again in the fall. The Little Yosemite record, high Transition, is unexpected.

   Host Plants: Eriogonum.
   Life Zones: Upper Sonoran, (Transition).

338. Habrodais grunus (Bdv.)
   Columbia Pt. vii-14-'33. Pohono vii-23-'33.
   Benson vii-24-'34.

   The crepuscular habits of BOISDUVAL'S HAIR-STREAK have long been known. The insect continues to fly about the live oaks after the last rays of sun have left the canyon walls. A party of the Yosemite Field School, on the way to the Research Reserve, discovered grunus flying at Columbia Pt. before 5 A.M. in semi-darkness. They had not been disturbed.

   Host Plants: Quercus chrysolepis.
   Life Zones: Transition.

339. Atlides halesus (Cram.)
   Museum viii-5-'34.

   THE GREAT BLUE HAIR-STREAK is our only representative of a large group of tropical butterflies displaying a metallic blue of dazzling luster on the superior wing surface. The specimen recorded was captured by a small boy who willingly parted with his treasure that the museum collection might be enriched. Halesus is rarely encountered north of Tehachapi.

   Host Plants: Mistletoe.
   Life Zones: Upper Sonoran, (Transition).
357. STRYMON MELINUS Hbn.
Museum vii-8-'33.

THE COMMON HAIR-STREAK flies in the Museum garden.

Host Plants: *Malva*.
Life Zones: Upper Sonoran, (Transition).

365. STRYMON CALIFORNIC A (Edw.)
Museum vii-5-'33. Pate vii-23-'34.

THE CALIFORNIA HAIR-STREAK visits the nature garden behind the Yosemite Museum. It is partial to the flowers of Pink Pussy Paws (*Spraguea umbellata*), from which it may be picked with fingers or forceps. The Yerba Santa also proves attractive.

Host Plants: *Quercus*.
Life Zones: Upper Sonoran, (lower Transition).

367. STRYMON SYLVINUS (Bdv.)
Museum vii-8-'33.

THE SYLVAN HAIR-STREAK is generally found about the willows of the stream bed, rather than in forest glades, as its name might suggest.

Host Plants: *Salix*.
Life Zones: Upper Sonoran, (lower Transition).

373a. STRYMON AURETORUM SPADIX (Hy. Edw.)
El Portal vi-28-'33.

THE NUT-BROWN HAIR-STREAK was taken with several *S. sepium*, and it was not until they were spread that the difference was noted. It was then thought to be the Golden Hair-Streak, *S. auretorum* (Bdv.), of such rarity that no specimen could be found for illustration in Dr. Comstock's "Butterflies of California" and it was necessary to reproduce Oberthur's figure of the type. After consulting Barnes and McDunnough, *Contributions*, III, 2, 1916-17, pp. 104-05, it appears that the type locality of *auretorum* was north of an imaginary line drawn between San Francisco and Virginia City, Nevada, it being a specimen of Lorquin's collecting. Since Yosemite is decidedly south of this line, our specimen becomes race *spadix*. In marking it is intermediate; the ochraceous scales typical of *auretorum* are wanting, but the fine lines are more distinct than *spadix* from San Bernardino Co.

Host Plants: *Quercus*.
Life Zones: Upper Sonoran.
375. STRYMON SÆPIUM (Bdv.)
    El Portal vii-28-'33. Pate vii-23-'34.
    THE HEDGE-ROW HAIR-STREAK was abundant in the late afternoon on the blossoms of the Buckeye (Æsculus californica). In company with sæpium were E. chalcedona and S. auretorum spadix, a typical Upper Sonoran association.
    Host Plants: Ceanothus cuneatus.
    Life Zones: Upper Sonoran, (lower Transition).

379. MITOURA NELSONI (Bdv.)
    Museum vii-5-'33. Reserve vii-14 to 18-'33.
    NELSON'S HAIR-STREAK is even more abundant in the nature garden behind the museum than is Strymon californica. Both swarm over the pink clusters of Spraguea and may be nipped off with forceps.
    Host Plants: Libocedrus decurrens.
    Life Zones: Transition, Canadian.

385. INCISALIA IROIDES (Bdv.).
    Ledge vii-9-33.
    THE WESTERN ELFIN is one of the first butterflies to emerge in the spring. March finds it on the wing in the foothills of the San Joaquin basin, February in Southern California. It is a very plain, brown elfin.
    Host Plants: Dodder, Eriogonum. Sedum has been erroneously listed.
    Life Zones: Upper Sonoran, (lower Transition).

392. INCISALIA ERYPHON (Bdv.)
    Reserve vii-9 to 14-'34.
    THE WESTERN BANDED ELFIN clings quite constantly to Canadian Zone, occasionally straying into Hudsonian. Never common, its capture is cause for comment. In the San Bernardino Mtns. the writer has observed that eryphon always flies in the vicinity of Gooseberry. The same probably holds true in Yosemite.
    Host Plants: Unknown; Ribes association noted.
    Life Zones: Canadian, (lower Hudsonian).

394a. CALLOPHRYS DUMETORUM PERPLEXA B. & Benj.
    Reserve vii-16-'33.
    A single, battered example of THE PERPLEXING HAIR-STREAK was taken on the summit of Research Ridge, three zones removed from its normal habitat.
    Host Plants: Syrmatium glabrum, Hosackia, Eriogonum.
    Life Zones: Upper Sonoran, (Hudsonian).
402. Tharsalea arota (Bdv.)

Museum vii-8-’33. Pate vii-23-’34.

THE AROTA COPPER was taken by Edmund Godwin on laurel (Umbellularia californica) at an elevation of 5,000 feet. When compared with virginiensis (Edw.) from the type locality, Virginia City, and with specimens of a local race from near Lebec, which are as nearly typical of arota as anything available, the Yosemite specimen proves to be much nearer arota. No tendency towards darkening, as in race nublia Comst., is manifest.

Host Plants: Ribes.
Life Zones: Transition. Upper Sonoran?

408. Lycaena editha (Mead)
Kuna vii-7-’33. Dana viii-8-’33.
Kerrick vii-27-’34. Snow Lake vii-29-’34.

EDITH’S COPPER is a creature of the higher elevations of the eastern portion of the park, where it flies in company with mariposa, cupreus, and heteronea. The Yosemite region is particularly rich in members of the genus Lycaena, seven of the fifteen North American species occurring within the park boundaries. The presence of an eighth, L. rubidus, is strongly suspected.

Host Plants: Potentilla, Horkellia.
Life Zones: Hudsonian.

410. Lycaena mariposa (Reak.)
Kuna viii-7-’33. Slide Creek vii-29-’34.

REAKIRT’S COPPER was encountered while crossing the valley of the Lyell Fork of the Tuolumne River, el. 10,600, preliminary to an ascent of Kuna Crest. It frequents small meadows of the southern exposure as far as timber line, but does not fly above.

Host Plants: Polygonum?
Life Zones: Hudsonian.

411. Lycaena nivalis (Bdv.)
Kuna vii-7-’33. Benson vii-24-’34.
Kerrick vii-27-’34.

For a number of years the small colony of the NIVALIS COPPER at Glacier Point supplied the world with this rarity. The five localities above indicate that nivalis flies generally throughout the park at elevations of 7,000 feet and above.

Host Plants: Unknown. Ribes always present.
Life Zones: Canadian, Hudsonian.
412. Lycêna helloides (Bdv.)
   El Portal vi-28-'33.

   THE PURPLISH COPPER is a dweller of the lowlands.
   Host Plants: Rumex, Oxytheca, Gayophytum.
   Life Zones: Upper Sonoran, lower Transition.

415. Lycêna hypophlæas (Bdv.)
   Lyell vii-6-'33.

   THE AMERICAN COPPER is very common east of the Rockies, where it flies at moderate elevations. Its capture on the north face of Mt. Maclure at about 12,000 feet is therefore remarkable. Hypophlaeas was netted beside a tiny glacial tarn known locally as Bert Lake, where it flies with E. nubigena and M. malcolmi. Its small size, subdued brassy color, and bluish spots above the orange submarginal band of the secondaries suggest race feildenæ M'Lachlan. (Journal Linnean Society-Zoology, XIV, 1878, p. 111.) Since feildenæ is a truly Arctic butterfly from lat. 81°45' N., it is logical that the Yosemite race, from so great an elevation, should be considered its southern representative, rather than a western offshoot of typical hypophlaeas which would be expected to fly at sea level in this latitude. The life zone principles support this theory.

   Hypophlaeas is now recorded for the first time in California.
   Host Plants: Rumex.
   Life Zones: Arctic-Alpine.

416. Lycêna cupreus (Edw.)
   Kuna vii-7-'33, Dana vii-7-'33.
   Snow Lake vii-29-'34.

   THE LUSTROUS COPPER is the most intense bit of color on the wing in Yosemite. Its fiery dress enlivens the mountain meadows.
   Host Plants: Unknown.
   Life Zones: Hudsonian.

419. Lycêna heteronea Bdv.
   Ledge vii-9-'33, Reserve vii-14-'33.

   THE VARIED BLUE occupies the altitudes between those chosen by L. helloides on the one hand and those preferred by such high fliers as hypophlaeas and cupreus on the other. Wherever a spring gushes from a mountainside and a lush growth of lupine, larkspur, and columbine occurs, conditions are ideal for heteronea.
   Host Plants: Eriogonum.
   Life Zones: Upper Transition, Canadian.
432a. *Plebejus melissa lotis* (Lint.)
   
   Reserve vii-16-'33. Benson vii-24-'34.

   THE LOTIS BLUE is distinguished from the following species by the wider marginal fringe of white and by the orange of the submarginal spots on the under side appearing on the primaries as well as on the secondaries. A series of the two shows a constant difference in the shade of blue, that of *lotis* being the brighter, while *anna* tends towards purplish gray.

   Host Plants: *Astragalus, Lotus*.
   
   Life Zones: Transition, Canadian.

433. *Plebejus anna* (Edw.)
   Dana viii-8-'33, Kerrick vii-27-'34.
   Coldwater viii-3-'34, Tenaya viii-4-'34.

   THE ANNA BLUE occurs at higher elevations than *P. lotis*. While both fly in Canadian Zone, the latter drops out in Hudsonian.

   Host Plants: Undetermined.
   
   Life Zones: Canadian, Hudsonian.

434b. *Plebejus aquilo podarce* (F. & F.)
   Eagle Pk. vii-1-'33, Reserve vii-18-'33.
   Kuna vii-7-'33, Kerrick vii-27-'34.

   THE GRAY BLUE is perhaps the most characteristic butterfly of the alpine meadow. It is always found in association with the Shooting Star (*Dodecatheon alpinum*). As soon as the sun leaves the mountain valleys, *podarce* settles in great numbers upon the grasses and sedges and may be picked by hand or forceps. The species is recognized by a cross on the forewing.

   Host Plant: Unknown.
   
   Life Zones: Upper Canadian, Hudsonian.

435. *Plebejus saepiolus* (Bdv.)
   Glacier vii-9-'33, Reserve vii-17-'33.
   Florence vii-5-'33, Pate vii-23-'34

   THE GREENISH BLUE flies with the foregoing species, *podarce*, in equal abundance. *Saepiolus*, however, descends to lower elevations, as at Glacier Point. As with *podarce*, only the male wears the color indicated by the common name, the female being drab brown.

   Host Plants: Alpine clovers.
   
   Life Zones: Canadian, Hudsonian.
438. Plebejus icarioides (Bdv.)
    Glacier vii-9-'33.

    BOISDUVAL'S BLUE is a widely distributed species, having been divided by several authors into seven geographical races. The Yosemite form suggests race evius (Bdv.) in which the blue of the female is invaded from the margins by a pale orange. This insect, because of its size and markings, may be confused with L. heteronea when on the wing.

    Host Plants: Lupinus.
    Life Zones: Transition, Canadian.

441a. Plebejus shasta comstocki Fox
        Reserve vii-16-'33.  Kuna viii-7-'33.
        Kerrick vii-27-'34.  Slide Creek vii-29-'34.

    At least one butterfly bears the name of Yosemite, for Dr. Comstock in "Butterflies of California" christens P. comstocki THE YOSEMITE BLUE. While a few were encountered in the weak Hudsonian of the Reserve, the metropolis for the species appears to be above timber line, where they fly over dwarf lupine and yellow buckwheat, Eriogonum incanum.

    Host Plants: Unknown.
    Life Zones: Hudsonian, Arctic-Alpine.

442. Plebejus acmon (West. & Hew.)
        Coldwater viii-3-'34.  Kerrick vii-27-'34.

    THE ACMON BLUE flies at moderate elevations, usually being replaced around the 7,000 foot level by the following (?) species.

    Host Plants: Astragalus, Hosackia, Eriogonum, Lotus.
    Life Zones: Upper Sonoran, Transition, lower Canadian.

443. Plebejus lupini (Bdv.)
        Eagle Pk. vii-1-'33.

    THE LUPINE BLUE may be distinguished from acmon by the purplish luster of both sexes. While Barnes and Benjamin in their Check List give it the status of a species, there are many who believe it to be but a race of acmon.

    Host Plants: Presumably as acmon.
    Life Zones: Canadian.
448. Philotes battoides (Behr)
Reserve vii-15, 16-'33. Slide Creek vii-29-'34.

THE SQUARE-SPOTTED BLUE of Yosemite, when compared with typical battoides from Mineral King, Tulare Co., and paratypes of race oregonensis B. & McD., appears to be intermediate between the two, as would be expected from their geographical location. Battoides flies at the top of Research Ridge, keeping well within the few acres marked by the presence of a few Hudsonian elements. Whether to list it as an indicator of this zone was questionable until Mr. Godwin reported a colony at 10,000 feet in Slide Canyon. The Square Spot flies over Eriogonum incanum and Astragalus bolanderi, a yellow buckwheat and a straggly legume.

Host Plants: Unknown, probably one of the former.
Life Zones: Hudsonian.

450. Philotes enoptes (Bdv.)
Ledge vii-9-'33. Reserve vii-16-'33.

THE DOTTED BLUE, as taken on the Ledge Trail, is typical. Two specimens taken on Research Ridge show mixed battoides and enoptes characters, but are easily separated from battoides.

Host Plants: Eriogonum.
Life Zones: Upper Transition, Canadian.

455. Peledrotes piasus (Bdv.)
Eagle Pk. vii-1-'33. Reserve vii-9 to 14-'34.

THE ARROWHEAD BLUE is apparently not common in the park, the above records being of a single specimen each.

Host Plants: Lupinus.
Life Zones: Upper Transition, Canadian.

Eagle Pk. vii-1-'33. Reserve vii-9 to 14-'34.

THE EYED BLUE was found just above Yosemite Falls, flying with Parnassius baldur over Lupine. Its pattern conforms neither to that of race behrii (Edw.) of the Bay Region, nor to australis Grin. of Southern California, being intermediate.

Host Plants: Lotus, Lupinus, Astragalus.
Life Zones: Upper Transition, Canadian.
458d. *Lycœnopsis pseudargiolus echo* (Edw.)
   El Portal vi-28-'33, Glacier vii-9-'33.
   Reserve vii-14 to 18-'33.

   THE ECHO BLUE has a wide vertical range, occurring through three life zones. It is the western representative of a highly polymorphic species, but manifests none of the inconsistencies of the eastern stem.

   Host Plants: *Cornus, Ceanothus, Hosackia.*
   Life Zones: Upper Sonoran, Transition, Canadian.

467. *Epargyreus tityrus* (Fabr.)
   Coulterville Rd. vi-'26.

   THE SILVER SPOT SKIPPER.
   Host Plants: Legumes.
   Life Zones: Upper Sonoran.

489. *Thorybes nevada* Scud.
   Reserve vii-16-'33.

   THE NEVADA DUSKY WING belongs to the Great Basin fauna and is therefore a creature of the territory east of the Sierran Crest. As long as conditions are favorable *nevada* may be expected to invade park territory via the Tioga Pass and extend its range fanwise throughout the Yosemite. According to Mr. E. L. Bell, who determined the specimen, the size and number of the hyaline spots is variable and there is little if any necessity for keeping Skinner's name *amilea* for the individuals with the larger spots. The type locality of *amilea* was Yosemite, California, an addition made by Skinner himself (Trans. Amer. Ent. Soc., XXXVII, p. 182, 1911) to the original designation, Fort Klamath, Oregon.

   Host Plants: Unknown.
   Life Zones: Canadian. Comstock records Hudsonian and Arctic-Alpine.

498. *Urbanus ruralis* (Bdv.)
   Reserve vii-15-'33.

   THE TWO-BANDED SKIPPER was taken in a grassy meadow flying about *Horkellia.* The single specimen was lighter than the usual run of the species.

   Host Plants: *Potentilla, Sidalcea.*
   Life Zones: Canadian.
503. Urbanus tessellata occidentalis (Skin.)

THE WESTERN CHECKERED SKIPPER.
Host Plants: Malva, Sidalcea.
Life Zones: Upper Sonoran.

528a. Erynnis persius afranius (Lint.)
Reserve vii-15-‘33.

THE AFRANIUS DUSKY WING.
Host Plants: Salix, Populus.
Life Zones: Transition, Canadian.

532. Erynnis propertius (Scud. & Burg.)
Ledge vii-9-‘33. Reserve vii-16-‘33.

THE PROPERTIUS DUSKY WING may be distinguished from E. juvenalis (Fabr.), under which name several specimens in the Yosemite Museum had been erroneously masquerading for years, by the fact that the white of the wings is produced by hairs in the former, by scales in the latter. A hand lens quickly settles this point, which cannot be learned from a colored picture. We have found no juvenalis in the park, although it ranges widely throughout the state.

Host Plants: Unknown.
Life Zones: Transition, Canadian.

539. Erynnis funeralis (Scud. & Burg.)

THE FUNEREAL DUSKY WING.
Host Plants: Nemophila, Hosackia.
Life Zones: Upper Sonoran.

568a. Hesperia comma colorado (Scud.)?
Eagle Pk. vii-1-‘33. Reserve vii-16-‘33.

THE COLORADO SKIPPER, so determined by Mr. E. L. Bell, is new to California lepidopterists as a member of the butterfly fauna of our state. In the comma group there is a great discrepancy in the width of the silver band on the under side of the secondaries, as our Yosemite specimens show. Females are particularly difficult to classify. For these reasons Mr. Bell follows his determination with a question mark.

Host Plants: Unknown.
Life Zones: Canadian.
569. Hesperia juba (Scud.)
Yosemite vi-'26.

THE JUBA SKIPPER, determined by Mr. E. L. Bell.
Host Plants: Unknown.
Life Zones: Not ascertained by us.

583. Ochloides sylvanoides (Bdv.)
Yosemite Valley vii-'33. Pate vii-23-'34.

THE WOODLAND SKIPPER was encountered “in sage on open granite slopes,” according to Edmund Godwin.
Host Plants: Unknown.
Life Zones: Upper Sonoran.

592. Polites sonora (Scud.)
Ledge vii-9-'33. Reserve vii-17-'33.

THE SONORA SKIPPER is the most abundant Hesperid of medium elevations. It occurs on the coastal as well as on the desert slopes, and meadows are its habitat.
Host Plants: Unknown.
Life Zones: Canadian.

596a. Polites sabuleti tecumseh (Grin.)
Reserve vii-17-'33. Kuna viii-7-'33.
Kerrick vii-27-'34. Snow Lake vii-29-'34.

THE TECUMSEH SKIPPER, named for an Indian chief-tain, is the smallest of the Yosemite Hesperids and occurs most abundantly on the high, barren slopes facing the desert, to which fauna it truly belongs.
Host Plants: Trifolium.
Life Zones: Canadian, Hudsonian.

LIST OF BUTTERFLIES BY LIFE ZONES

As a summary of the foregoing data, an attempt is herewith made to list the species according to the life zones in which they normally fly in the Yosemite. Hence the writer has disregarded the few existing lists of similar nature as they are based upon observations made in faunas remote from the territory in question by observers who, through a different understanding of the relative importance of indicators, might reasonably arrive at different zonal analyses. These lists will form the more interesting basis for comparison because they represent conclusions independently reached. For the sake of completeness all species, even cosmopolites, are included. The method of listing makes it un-
necessary for any name to appear twice. In the few cases in
which the data is manifestly insufficient to warrant the placing
of the insect with any degree of accuracy, the name is inserted
in parentheses under the zone in which it was captured, although
future investigation may show that it belongs on the unrestricted
list. Species frequently encountered in a zone other than that
to which they are restricted by host plant, association, or other
factor, are followed by the initial letter of the second zone
parenthesized. Such is the case with a number of Upper So-
noran fliers, particularly the *Theclinae*.

### ZONAL DISTRIBUTION OF BUTTERFLIES

<table>
<thead>
<tr>
<th>Unrestricted in Flight</th>
<th>Restricted in Flight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In Every Zone</strong></td>
<td><strong>Upper Sonoran</strong></td>
</tr>
<tr>
<td>N. iole</td>
<td>Coe. california</td>
</tr>
<tr>
<td>Ham. californica</td>
<td>C. silvestris</td>
</tr>
<tr>
<td>H. milberti</td>
<td>E. chalcedona</td>
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<tr>
<td>H. antiopa</td>
<td>M. leanira</td>
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<tr>
<td>C. cardui</td>
<td>A. m. virgulti</td>
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<tr>
<td>C. carye</td>
<td>A. halesus (T)</td>
</tr>
<tr>
<td><strong>U. S.-Trans.-Can.</strong></td>
<td>S. californica (T)</td>
</tr>
<tr>
<td>P. rutulus</td>
<td>S. sylvinus (T)</td>
</tr>
<tr>
<td>P. eurymedon</td>
<td>S. a. spadix</td>
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<tr>
<td>E. eurytheme</td>
<td>I. iroides (T)</td>
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<tr>
<td>C. virginiensis</td>
<td>C. d. perplexa</td>
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<tr>
<td>B. lorquini</td>
<td>E. tityrus</td>
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<tr>
<td>P. acmon</td>
<td>U. t. occidentalis</td>
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<tr>
<td>L. p. echo</td>
<td>E. funeralis</td>
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<tr>
<td><strong>U. S.-Trans.</strong></td>
<td>O. sylvanoides</td>
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<tr>
<td>P. multicaudata</td>
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<tr>
<td>P. protodice</td>
<td>Transition</td>
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<tr>
<td>P. rapac</td>
<td>A. leto</td>
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<tr>
<td>A. lanceolata</td>
<td>A. zerene</td>
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<tr>
<td>(E. o. chryssolemas)</td>
<td>A. hydaspe (C)</td>
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<tr>
<td>Z. eurydice</td>
<td>P. mylitta</td>
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<tr>
<td>D. menippe</td>
<td>P. i. rusticus?</td>
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<tr>
<td>P. campestris</td>
<td>H. grunus</td>
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<tr>
<td>P. satyrus</td>
<td>(T. arota)</td>
</tr>
<tr>
<td>C. atalanta</td>
<td>(G. l. australis)</td>
</tr>
<tr>
<td>J. coea (C)</td>
<td><strong>Canadian</strong></td>
</tr>
<tr>
<td>Het. b. californica</td>
<td>P. sisymbrii</td>
</tr>
<tr>
<td>S. melinus</td>
<td>E. c. hyantis</td>
</tr>
<tr>
<td>L. helioides</td>
<td>E. a. coloradensis</td>
</tr>
<tr>
<td><strong>Trans.-Can.</strong></td>
<td>A. s. julia</td>
</tr>
<tr>
<td>P. indra (H)</td>
<td>B. epithore (T)</td>
</tr>
<tr>
<td>N. menapia</td>
<td>E. sierra (T)</td>
</tr>
</tbody>
</table>

73
Unrestricted in Flight

Trans.-Can.—Cont.

M. palla
P. zephyrus
M. nelsoni
L. heteronea
P. m. lotis
P. icarioides
P. enoptes
E. p. afranius
E. propertius

Can.-Hud.

P. zelicaon
P. c. baldur
P. s. behrii
A. montivaga (T)
A. mormonia
P. montana
L. nivalis
P. anna
P. a. podarce
P. saepiolus
H. c. colorado
P. s. tecumseh

Restricted in Flight

Canadian—Cont.

M. hoffmanni
I. eryphron
P. lupini
(P. piasus)
(U. ruralis)
T. nevada
H. juba
P. sonora

Hudsonian

E. behrii
A. irene
L. editha
L. mariposa
L. cupreus
P. s. comstocki
P. battoides

Arctic-Alpine

O. ivallda
E. nubigena (H)
M. malcolmi
(L. hypophlaeas)
P. s. comstocki

ADDITIONS TO YOSEMITE MUSEUM COLLECTION

As a result of the survey the following 33 species were added to the collection of the Yosemite Museum, giving it a complete representation of the butterfly fauna of the park:

P. s. behrii
P. sisymbrii
E. a. coloradensis
A. lanceolata
A. s. stella
E. behrii
O. c. ivallda
A. irene
A. mormonia
A. montivaga
E. nubigena
M. palla
M. malcolmi
A. m. virgulti
A. halesus
S. a. spadix
I. eryphron
C. d. perplexa
L. editha
L. mariposa
L. nivalis
L. heteronea
P. a. podarce
P. saepiolus
P. s. comstocki
P. lupini
P. battoides
P. enoptes
P. piasus
G. l. australis
U. ruralis
H. c. colorado
E. p. afranius
From these lists it will be seen that, of the 100 species flying in Yosemite National Park, 50 are either restricted to a single life zone or have been reported from but one. Of the remaining 50, 35 fly in two zones, 7 in three, and 6 in more than three (2 undetermined), although it is doubtful if they breed in more than three. The accumulation of other distributional records will doubtless prove that a number of species as yet known from but a single zone habitually occur in two or more, and that many listed as flying in two zones are in reality vagrants in the second, their host plant being restricted to one or the other. It is suggested that the Yosemite Museum be made a clearing house for such information, that we may eventually know which butterflies best fulfill the requirements of insect indicators:

(1) Reasonably restricted in flight to a single life zone.

(2) Reasonably restricted by host plant, association, or other ecologic factor, to a single life zone.

(3) Of sufficient abundance to be of practical value.

(4) Preferably distinguishable to the practised eye when on the wing.
EARLY STAGES OF PAPILIO POLYDAMAS
LUCAYUS R. & J.

By John A. Comstock and Florence Moore Grimshawe

Dr. Marston Bates has called attention to the fact that our Florida race of Papilio polydamus is lucayus R. & J.¹

The species has been exceedingly scarce in the region of Miami until 1933. In the thirteen-year period prior to that not a single specimen had been recorded, and it was considered as practically extinct. It reappeared, however, in May of 1933, and since that date has been rather abundant in the vicinity of Biscayne Bay.

The life history of this butterfly has not been published in detail, in any work that is readily accessible to North American lepidopterists. Henry Edwards² gives eight references between the years 1836 and 1881, three of which are in German publications, and one in French. Probably the most useful notes published in that period were those of Gundlach.³

Holland gives no reference to the transformations other than those which apply to the Aristolochia group as a whole.

Seitz, in his Macrolepidoptera of the World alludes to them in the following brief paragraph.

"The larva varies from brown-yellow to dark black-brown; the tubercles are long, in dark specimens red. The pupa is strongly curved, and has three long, compressed humps on the abdomen; the thoracic horn is long."

Dewitz published figures in 1878,⁴ but these are not accessible to the average student.

It is therefore felt that the following notes on the life history of this butterfly, together with the illustrations, will have some interest and value to the workers of this generation.

The species probably breeds in a state of nature on Aristolochia pentandra (Jacq.) which is found in the hammocks of southern Florida. A. macrophylla sipho (L'Her.) is another native that helps to support it. Experimental breeding can best be carried on with the introduced African species, Aristolochia grandiflora gigas (Lindl.) or the native A. macrophylla sipho. It will, however, take readily to A. ringens, and probably many others.

² Described Transformations of North American Lepidoptera.
³ Entomol. Cubana, p. 121.
⁴ Wiegemann Archiv. Naturgesch, p. 2, fig. 1.
The eggs are deposited on the vines, tendrils and leaf stems, but not on the leaves of the foodplant. They are laid in clusters of from ten to fourteen, and hatch in from four to six days. The average time of hatching at a uniform temperature of 80°F is five days.

Egg. About 1.25 mm. tall by 1.1 mm. in circumference. Spherical, the base slightly flattened. The surface of the egg is smooth, and of a light yellow color, but this is nearly obscured by a partial covering of a bright yellow or orange substance which has the appearance of being an exudate. This has a fatty or resinous appearance, and seems to be laid on the surface in irregular longitudinal lines or bands. These bands have numerous globules or droplets adhering to their surfaces, which bear a resemblance to oily pearls. These features are brought out in our illustration on Plate 3.

PLATE 3
Egg of Papilio polydamas lucayus
magnified x 22.
Drawing by J. A. Comstock

The young larvae are gregarious in their earlier phases, but separate as they mature.

Larva, first instar.

Head larger than body; glistening jet black, covered sparsely with short black vibrissae. Mouth parts black, except the basal joint of the antennae, and the labrum, which are gray-white.

The body ground color is a soiled gray-yellow. On the first cervical segment there is a prominent black scutellum, from which arises a number of single black hairs. Anterior to this is the orifice of the eversible glands. This orifice is white.

The body is covered with the usual number of rows of black fleshy papillae characteristic of the polydamas—philenor group. Each papillus bears a single black bristle.

Legs black, as are also the prolegs and anal prolegs.

There is a black plate on the anal extremity, on which are superimposed a number of black papillae bearing hairs.

The first instar is illustrated on Plate 4.
PLATE 4
Larva of *Papilio polydamas lucayus*.
first instar, highly magnified.
Drawing by J. A. Comstock

In the earlier instars the larvae moult on an average every four days. The intermediate instars were not recorded in detail, but the mature larva may be described as follows:

**Mature larva.** Length 1½ to 1¾ inches. Color of body a velvety black, with a dark reddish purple on the segmental junctures. We have seen very few of the “brown-yellow” phases mentioned by Seitz.

Head, black, covered with short black pile.

Two prominent fleshy horns extend from the first segment laterally, and recurve slightly anteriorly. These are black at their tips, and reddish-orange at their bases. A fleshy collar connects over the neck, by means of which the base of each horn is united. This is of the same reddish orange shade as the base of the horns.

On each side of the mid-dorsal area there is a prominent row of fleshy orange papillae, one to each segment, and eleven in the row on each side. Each papillus is tipped with black and bears microscopic vibrissae.

A row of similar papillae occurs laterally, with one papillus each on the 2nd, 3rd, 4th, and 5th segment, a larger one on the 10th, and a short one on the 11th. These are orange, but are shaded heavily at their tips with black.
A single orange tubercle occurs at the base of each proleg, the orange color of which is sometimes obscured with black. Prolegs, shiny black, and thickly covered with short black hairs. The caudal segment bears similar hairs.

Spiracles black. Ocelli, jet black. See Plate 5.

PLATE 5
Mature larva of *Papilio polydamas lucayus*, enlarged x 2.

Drawing by J. A. Comstock

Pupa. Length 32 mm. Greatest width, 14.5 mm. There are two color phases in the pupa, as with many of the Genus Papilio. One is a uniform gray-brown. The other, which we will describe, is green.

Body color, dark olive-green, with a saddle of light yellow-green over the recurved dorsal portion. Antennal sheaths a lighter green than the ground on which they rest. There is a prominent lateral flaring ridge at the edge of the wing cases which is sometimes margined with light blue, and the tips of all the prominent tubercles and protrusions are sometimes laved with the same blue shade. A prominent ridge connecting the two roots of the antennae also bears the same blue edging. The characteristic shape of this pupa, with its prominent dorsal horn, and rounded humps on the dorso-abdominal portion is clearly brought out in our illustration, Plate 6.

The average length of time in pupa is 18 days. Cold weather will naturally retard the time of emergence.
The larval span, from the time of hatching until the formation of the chrysalis, runs from 19 to 24 days. At a regulated temperature of 78° it averages 24 days, while a rise of 8 points, or, in other words, a uniform temperature of 86 will shorten the larval span to 19 days. This should make possible a number of broods during the year, under favorable weather conditions.

PLATE 6
Pupa of *Papilio polydamas lucayus*, lateral aspect, slightly enlarged.

From painting by John A. Comstock
NOTES ON THE EARLY STAGES OF TWO BUTTERFLIES AND ONE MOTH

By John A. Comstock and Charles M. Dammers

Habrodais grunus Bdv.

Repeated efforts have been made to obtain eggs of this species by confining females, but without avail. The larval food-plant was first recorded by Dyar¹ in 1892 and a complete description of the mature larva and pupa was later published by the same author.²

![PLATE 7](image_url)

Mature larva and pupa of Habrodais grunus.
A. Larva, lateral aspect, enlarged x 4.
B. Pupa, lateral aspect, enlarged x 4.
C. Cervical shield of larva highly magnified.

Reproduced from painting by Charles M. Dammers

We can add a few minor details to that description, and, in addition, show illustrations of the mature larva, Plate 7, fig. A, and the pupa, fig. B of the same plate.

Mature Larva. Length, 16-17 mm.

Body, slug shaped, and somewhat more flattened than with others of the group. Color, pale bluish-green, heavily sprinkled with yellowish-brown punctae, from each of which arises a single silvery-white hair; those on the infrastigmatal fold being longer and stouter than on other areas.

The subdorsal white (or lemon-white) line mentioned in Dyar’s description seems to be a constant feature, but the re-

Maining stigmatal and subventral lines are only occasionally present. A few examples show a suggestion of a mid-dorsal line. The infrastigmatal fold is edged with bluish-white.

Stigmata, soiled orange, with darker rims.

Legs, colorless, with pale brown tips. Prolegs, bluish-white, with pale brown hairs on the claspers.

Cervical shield unusually large, bluish-white, with a pale thin band down its center, and covered with minute brown punctae that are free of hairs. The shield is illustrated on Plate 7, fig. c.

Abdomen, greenish-white, covered with silvery-white hair.

Head, pale olive, mouth parts dark brown. Ocelli, soiled white on a black patch.

The distinguishing feature of this larva is the tuft of hairs on the sub-dorsal line at the rear of each segment, these being considerably longer than the remainder.

Pupa. Length, 11 mm.

Color, pale bluish-green. There is a narrow lemon-white band running subdorsally along the body.

The entire surface, except the abdomen, antennal sheaths and lower half of the wing cases, is liberally sprinkled with olive-brown punctae of varying sizes. The body, thorax and head are covered with minute short white hairs. These are so minute that they escaped the attention of Dr. Dyar.

Under the caudal segments, which recurve dorsally, is a rounded eminence of very pale blue-green, almost colorless. This is studded with minute orange points around its margin. Stigmata, soiled white.

Dyar records 15 days as the duration of the pupal stage.

Pupation occurs on the foodplant, suspended by the cremaster and a silk girdle.

Foodplant, Quercus chrysolepis Liebm.

The species is single brooded, and it is more than likely that the eggs are laid on the oak twigs, and remain over winter.

Plebejus icarioides evius Bdv.

This southern race of a very widely distributed western species has long been known to feed in the larval state on lupine. In view of its abundance, it seems strange that its life history should have remained for so long a time unrecorded.

Specimens were raised to maturity from eggs laid in captivity, the females having been secured on June 2, 1931, at Crystal Lake, San Gabriel Canyon, California. The eggs are deposited singly on the foodplant, and hatch in from five to eight days.
Egg. Echinoid, .6 mm. in diameter. Color, a delicate greenish white. The micropyle is very minute, and the surface of the egg is covered with projecting white papillae which, under high magnification, show globular or bulbous ends.

The bases of these papillae are connected by thin walls or partitions with neighboring papillae, which produces a fine reticulation over the surface of the egg. The cells which are defined by these partitions are irregularly triangular or quadrate. Plate 8 accurately pictures the upper surface of the egg. This specimen was laid in captivity on June 29, 1931, and hatched July 3.

PLATE 8
Egg of Plebejus icarioides evius
magnified x 40.
Photo by Menke, retouched by Comstock

Larva, first instar: body color, dark mauve, shading to green at the segmental joints, and covered with short stiff white hairs. Abdomen, green. Head, black.

In successive instars the color ranges from green with a trace of mauve, to an almost solid mauve. The mid-dorsal line is always distinctly mauve in all types. The body surface is covered with irregularly spaced dark mauve punctae from which arise very short silvery-white hairs.

An indistinct white diagonal bar crosses each segment laterally. The overlap, or infrastigmatal fold, is a soiled white with a mauve edging. Spiracles, soiled white. Abdomen, pale green, and covered with a white pile.

Legs, green, the terminal segments colorless.

Prolegs, pale green, with mauve claspers.

Head, glistening black.

Mature larva. Length, extended, 16 mm. Of the usual slug-shaped form. The color and markings are as above described except that the lateral surface shows three indistinct white diagonal bars across each segment. These are, however, obsolescent on the first segment, and become less clearly defined in the caudal area.
PLATE 9

Immature larva of *Plebejus icarioides evius*, lateral aspect, enlarged.
From painting by Charles M. Dammers

The larvae begin their feeding on the leaves, and as they mature, transfer to the stems and flowers. They feed for about a month and then go into hibernation until the following spring. Plate 9 shows the partly matured larva at the beginning of its hibernation. The mature larva is shown on Plate 10, fig. A.

Pupation takes place at the base of the foodplant, and the chrysalis is suspended by the usual silk button and girdle. Our specimens pupated in late May, and imagos began emerging on June 20, 1932.

**Pupa.** Length, 10 mm.

The form is accurately shown on Plate 10, fig. B. The wing cases, thorax and head are green with a pinkish shade anteriorly. The body is a chestnut red with a suggestion of green showing through it, and blotches of pale green on the surface, particularly of the abdominal area. Spiracles, white. Wing venation showing through the wing cases as an obscure greenish-white.

The head, thorax and body are sparingly covered with short chestnut-red hairs.

PLATE 10

A. Mature larva of *Plebejus icarioides evius*, lateral aspect, enlarged x 5.

B. Pupa of *P. icarioides evius*, lateral aspect, enlarged x 4¾.
Reproduced from painting by Charles M. Dammers
Adaina montana Wlsh.

On September 26, 1932, while collecting along the Colorado River near Blythe, Riverside County, California, the larvae of this species was taken on cockle burr (*Xanthium canadense* Mill.). These were bred to maturity and the first imago emerged October 11.

In feeding, the caterpillars consume the under surface of the leaf, leaving the shell and skeleton of the upper surface.

**Mature larva.** Length, extended, 12 mm. In form they are flattened dorso-ventrally, widest at about the fifth segment, and tapering caudally.

There is considerable variation in the body color, ranging from a pale green, through various shades of gray, to a pale chocolate.

The pale green type may be described as follows:

Along each side of the mid-dorsal area, a pair of raised brown punctae on each segment from each of which arises a single stiff white hair. These hairs are bent over at the tips.

Laterally in the region of the infrastigmatal fold occurs a row of tufts made up of long white hairs. These extend horizontally and arch slightly downward.

Immediately posterior to each one of these tufts there occurs a small fan of white hairs. The structural characteristics of the larva are clearly shown in Plate 11.

---

**PLATE 11**

Larva and pupa of *Adaina montana*.

a. Larva, lateral aspect, enlarged x 5.
b. Pupa, lateral aspect, enlarged x 7.
c. Front view of larva, enlarged.

Reproduced from painting by Charles M. Dammers
The body color is pale green. On the lateral surface there is a row of black dots, two to a segment.

The abdomen, legs, prolegs and anal prolegs are pale green.

The head is obscured by a long arching fringe of white hairs which arise from the first segment. It is a soiled yellow, except for the mouth parts and ocelli, which are brown.

In ejecting their droppings the larvae flip these off with a spring-like movement of sufficient force to cause the adherence of the frass to the sides of the breeding cage.

Pupation takes place on the food-plant, secured by a silken webbing.

**Pupa.** Length, 6 mm. The color is variable, ranging from pale green, through shades of red to a dark brown. The latter type will be described.

Body and thorax, dark brown. Wing cases, head and antennal sheaths pale green. A protruding brown papillus occurs on each side of the fourth segment. A number of longitudinal bands of dark brown occur on the body, disposed as shown on Plate 11, fig. b.

From the center of each segment, on both sides of the body, there arise four or five long curved stout white hairs. There are also six tufts of short white hairs to each segment. The placement of these is adequately shown in our illustration. The wing cases extend beyond the 11th segment, being free from the body beyond the 8th.

The ventral surface is comparatively flat, and appears superficially to be free of appendages. Magnification discloses a number of lines of very short white hairs, placed on, and running the length of the antennal sheaths, and on certain of the limb cases.

The antennal cases are extended to within 1.5 mm. from the caudal extremity. The eye sheaths are prominent and large, and are a light brown. The ventral surface of the chrysalis is shown on Plate 12.
Foodplant, as previously stated, *Xanthium canadense* Mill. We have also found the larvae of *Chlosyne crocale* (and its several related color phases) feeding on the same plant in the region of Blythe.

PLATE 12
Pupa of *Adaina montana*, ventral aspect, enlarged x 7.

Photo by Menke, retouched by Comstock
SALVADORA GRAHAMIAE VIRGULTEA, A NEW SUBSPECIES OF THE PATCH-NOSED SNAKE

By Chas. M. Bogert

Zoology Department, University of California at Los Angeles

INTRODUCTION

The Patch-nosed Snakes of the genus Salvadora first attracted my serious attention in 1928 when I collected a snake belonging to this genus on the Mojave Desert at Dove Springs, Kern County, California. This specimen was so strikingly different in coloration from individuals of the genus that I had previously collected in the Upper Sonoran Zone of the San Gabriel Mountains in Los Angeles County that the difference appeared worthy of note. Since 1928 several specimens, of both the desert and Upper Sonoran forms, were examined in the field, dead on the road or collected alive, and distinct differences between the two forms were observed to be consistent.

Klauber (1931) under the heading, Color Variation with Habitat, likewise noted these differences, stating:

“S. g. hexalepis: In this form there is a definite change from coast to desert, specimens from the latter area being considerably lighter. Not only are the colors lighter in the eastern individuals, both in ground color and brown longitudinal stripes, but the width of the light dorsal line is increased and the secondary lines on the sides are more pronounced, thus heightening the contrast by increasing the light and decreasing the dark areas. An occasional lighter specimen is found amongst the coastal individuals, but the average difference is extensive.”

When an investigation of the desert and coastal forms, both of which have heretofore been regarded as a single form, hexalepis, was undertaken, it was found that there existed considerable discrepancy in the range of Salvadora grahamiae hexalepis (Cope 1866) as given by recent authors. Thus it became apparent that a more complete understanding of the relationships existed between the eastern form, S. g. grahamiae, and the desert form, S. g. hexalepis, would have to be established before a fair comparison of the desert and coastal forms could be made. In order better to gain this understanding a study of the entire genus has been entered upon by the writer, and the results,

1 Klauber, 1931, p. 48.
2 See Stejneger and Barbour, 1933, p. 97; Klauber, 1931, p. 9; Blanchard, 1925, p. 32.
while not complete and while beyond the scope of the present paper, have established the status of *hexalepis* as a subspecies of *Salvadora grahamiae* B. & G. in which view I am in agreement with Blanchard ("25). 4

**Material Examined**

To date a total of 260 specimens belonging to the *grahamiae* group of the genus *Salvadora* has been examined, and three additional scale counts have been available. Of the total 263 specimens, 75 are from the coastal area of southern California and northern Lower California, 84 are typical desert specimens of *S. g. hexalepis* from southern Lower California, Tiburon Island, and the desert regions of California, Nevada, Utah, Arizona, and western Mexico. The remaining 101 specimens are *S. g. grahamiae* and intergrades between that form and *S. g. hexalepis*.

Examination of this material indicates sufficient differences in color, markings, and scutellation between the desert and coastal forms to warrant the formation of a new coastal subspecies for which I propose the name

**SALVADORA GRAHAMIAE VIRGULTEA** subsp. nov.

**CHAPARRAL PATCH-NOSED SNAKE**

**Type**—No. 12025 in the collection of the San Diego Society of Natural History. Collected at Deerhorn Flat, San Diego County, California, June 29, 1929, by Mr. F. E. Walker.

**Diagnosis**—A subspecies of *Salvadora grahamiae*, differing from the typical form in having the posterior pair of chin-shields separated by two or more small scales, in possessing a divided loreal, a proportionately broader frontal, a wider rostral, its edges more detached and in having a greater average number of ventral scales. From *S. g. hexalepis*, to which it is more closely allied, it differs in having a narrower dorsal stripe paralleled on each side by a single brown band, five to five and a half scales wide, which may be indistinctly broken up, posteriorly only, into two bands. Also it differs from *hexalepis*, in having a lower average ventral scale count and in usually having the sixth upper labial only in contact with the eye.

3 Stejneger, 1902, p. 155, with material available at that time, found no evidence of intergradation, consequently adopting a binomial appellation for the two forms, *grahamiae* and *hexalepis*. I find evidence of intergradation in the material recently examined, and therefore re-adopt the trinominal for both forms.

4 Blanchard, 1925, p. 32.

5 Having reference to habitat; a decided predilection for brush or chaparral is characteristic of this form.
PLATE 13
Chaparral Patch-nosed Snake, *Salvadora grahamiae virgultea*, collected near Sierra Madre, Los Angeles County, California

**Description of Type**—Young adult male. Head rounded on top, snout prominent, overhanging, and blunt. Rostral plate large, 3.2 mm. wide, recurved on top of snout, lateral edges free; bounded behind by first upper labial, prenasal and internasal plates. Internasals subtriangular, proportionately large, and widely separated to within .5 mm. of prefrontals by rostral. Prefrontals slightly larger than internasals, longitudinally narrow and transversely elongated, extending down on sides of head to a blunt point contacting postnasal and upper loreal. Frontal subpentagonal, 4.8 mm. long and 3.9 mm. wide; ratio of width to length .812. Parietals rather short, sides rounded. Prenasal subquadrangular, larger than postnasal which is subpentagonal. Nostril situated in anterior of postnasal. Loreal divided, the upper larger, subpentagonal; the lower about half as large, subpentagonal, more elongate, and situated above fourth and smallest upper labial. Preoculars two, the upper large and angular, produced to upper surface of head between prefrontal and supraocular; lower small, subhexagonal, situated on commissure between fourth and fifth labials. Postoculars two, each subquadangular, nearly equal in size. Temporals 2 + 3. Upper labials, nine, sixth only contacting eye, last four largest and nearly equal in size. Lower labials not conspicuous, ten in number, sixth largest, first pair meeting on normal suture. Posterior pair of chin-shields slightly larger than anterior pair, and separated by two small scales followed by three small scales.

Body subcylindrical, elongated. Tail subconical, tapering to a rather thin point. Length over all 580 mm. Length of tail 131 mm. Ratio of tail to total length .226. Scales elliptical, smooth except near base of tail where lateral scales are faintly carinate, disposed in seventeen rows. outer row somewhat broader, the rest slightly diminishing toward dorsal region. Ventrals 195, anal divided, caudals 95.

Surface of head “Olive-Brown.”6 A dorsal stripe of “Pale Olive-Buff” extends from neck to near end of tail, embracing anteriorly one and two half scales, and on the tail two half

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6 Quotation marks refer to color designations of Ridgway, 1912.
scales. On the neck it broadens and merges into darker surface of head. On each side of this stripe, a vitta, averaging “Chae-
tura Drab” to “Clove Brown,” runs parallel anteriorly em-
bracing five and one-half scales, and posteriorly indistinctly breaking up into two bands separated by a faint light stripe. Lower two rows of scales grayish, approaching the color of dorsal stripe. Belly uniformly “Cream Buff.”

Range—The chaparral-covered foothills of southwestern California and northwestern Lower California, from sea level to an elevation of approximately six thousand feet. Northward it is known to range to lower Sespe Canyon, Ventura County and Prairie Fork of the San Gabriel River, Los Angeles County; eastward it ranges to San Bernardino, San Bernardino County, Banning, and Vanderventer Flat east of Lake Hemet, Riverside County, Santa Ysabel and Campo, San Diego County; southward it ranges at least as far as Ensenada, Lower California. The most westerly record is Sespe Canyon, Ventura County, Cali-
ifornia, although it is known to occur as far west as the coast in San Diego County, while the Ensenada specimen is from the coast of northern Lower California.

PLATE 14
Desert Patch-nosed Snake, Salvadora grahamiae hexalepis,
collected near Red Rock Canyon, Kern County, California

General Description and Remarks—The following data are summarized from scale counts, measurements, and notes on 60 specimens. In some cases the condition of individual speci-
mens owing to the hazards of collection and preservation was such that complete description of all characters could not be de-
termined with safety. One specimen consisted of a head only.

Size, medium; does not seem to attain the length of other forms of Salvadora. Scale rows 17. Scales all smooth except near anal region where lateral scales are slightly carinate. Ven-
trals; Max. 199, min. 187, av. 193.7 (58 specimens). No sexual dimorphism in this character was indicated, the average for 15 males and 15 females being the same. Anal divided (100 per cent). Caudals; males, max. 97, min. 90, av. 94.2 (8 specimens); females, max. 95, min. 80, av. 84.1 (9 specimens). Upper labials usually 9.95 (83.3 per cent), occasionally 9.8 (11.7 per cent), rarely 9.7, 9.6, or 7.6 (1.6 per cent of each). Lower labials usually 10-10 (61.7 per cent), occasionally 11-11 or 10-11 (16.7 per cent of each), sometimes 10-9 (3.3 per cent), rarely 10-8 (1.6 per cent).

The rostral is especially well developed in this subspecies, lateral edges free, and recurved on top of snout, extending approximately two-thirds of the width of the internasals to a point on the suture separating these. Besides the internasals it contacts the anterior nasal and the first labial plates. Plates on top of the head are a pair of internasals, a pair of prefrontals, a frontal, a supraocular of each side, and a pair of rather short, rounded parietals. The frontal is exceptionally broad, the average ratio of greatest width to greatest length .755 (30 specimens). Anterior and posterior nasals distinct. Normally there are two loreals (73.3 per cent), occasionally three (15 per cent) or 3-2 (5 per cent), or 2-1 (6.7 per cent). No specimen examined has a single loreal on both sides of the head. Preoculars 2, rarely 3. Postoculars 2, occasionally 3. Temporals 2 + 2, 2 + 3, or rarely 2 + 4. The eye is normally in contact with the sixth upper labial only (73.3 per cent), sometimes in contact with the fifth and sixth (11.7 per cent), or rarely with the fifth only, the fourth only, or prevented from contact by the presence of suboculars (less than 5 per cent of each). The posterior pair of chin-shields is separated by either two or three small scales followed by either three or four small scales.

The average ratio of tail to total length is .227. The largest specimen examined measured 866 mm.

The most conspicuous feature of the pattern is the light dorsal stripe, two and one-half, or less commonly three scales wide on the body, tapering to two half scales in width on the tail. This stripe varies in coloration, in some specimens being yellowish while in others it is grayish. The broad band, five or five and a half scales wide which parallels this dorsal stripe on either side is usually brownish, varying from "Fuscous Black" to "Olive Brown." Individual specimens selected at random were "Mummy Brown," "Clove Brown," and "Deep Sepia." The belly is uniformly yellowish varying from "Naples Yellow" to "Cream Buff." The first two rows of scales on each side are slightly darker than the belly, this color extending anteriorly to the upper lips, while the upper surface of the head is brown.

1 Two figures indicate the condition on each side of the head per specimen. This method is adopted as one presenting a truer picture of the manner and frequency of occurrence of variations.
without markings. Young are approximately the same as the adults in color and markings. The specimen pictured in Van Denburgh ('22)\(^*\) belongs to this subspecies.

\(^*\) Van Denburgh, pl. 71, opp. p. 696.

### Comparison of Hexalepis and Virgultea

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**TABLE No. 1**

* Standard error of the difference .6813.
** Prevented from contact by the presence of suboculars.

### Acknowledgments

As previously stated, data beyond the scope of the present paper has been assembled, and this, it is hoped, will form the basis for a report which may appear later. Many persons and institutions have lent valuable preserved material without which
this investigation could not have been accomplished. I am especially indebted to the following: Dr. A. Wetmore, Dr. L. Stejneger, Dr. Doris M. Cochran of the United States National Museum; Mr. L. M. Klauber of the San Diego Society of Natural History; Mr. J. R. Slevin of the California Academy of Science; Dr. Joseph Grinnell and Dr. Jean Linsdale of the Museum of Vertebrate Zoology, University of California; Dr. G. K. Noble of the American Museum of Natural History; Mr. K. P. Schmidt and Mr. A. C. Simms of the Field Museum of Natural History; Mrs. H. T. Gaige of the University of Michigan; Dr. Thomas Barbour and Mr. A. Loveridge of the Museum of Comparative Zoology, Harvard University; Mr. M. G. Netting of the Carnegie Museum; Mr. H. R. Hill of the Los Angeles Museum; Mr. E. D. McKee, Park Naturalist, Grand Canyon National Park; Mr. R. P. Hays of Pasadena Junior College; Mr. Berry Campbell of Monrovia, California; Mr. Wallace Wood of Oakland, California.

To Mr. L. M. Klauber I am indebted, not only for the loan of specimens in his own collection and that of the San Diego Society of Natural History, but also for a large number of scale counts, valuable suggestions and advice.

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Literature Cited


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Los Angeles Museum, Exposition Park, Los Angeles, Cal.
FAUNA OF THE CAMBRIAN CADIZ FORMATION, MARBLE MOUNTAINS, CALIFORNIA

By John F. Mason

Introduction

This report is based upon a study of the Middle Cambrian fauna of the Cadiz formation in the Marble Mountains, San Bernardino County, California. The presence of this fauna at an apparently new locality was first noted by Dr. John H. Bradley, Jr., in the course of reconnaissance work in 1932. An extensive collection was made in the spring of 1934 by Dr. Bradley and the author. Laboratory and library facilities for the preparation of the specimens secured were provided by the Los Angeles Museum, to which thanks are due. The author wishes to express his appreciation of the loan of several Walcott publications by Prof. A. J. Tieje, of the direction of the work by Dr. Bradley, and of valuable suggestions by Prof. B. F. Howell.

Previous Work

The reports of Darton,1 Cavins,2 and Clark3 first indicated the presence of fossiliferous Middle Cambrian rocks in the Marble Mountains. Clark's material was restudied and redescribed by Resser.4 Subsequent collections by Hazzard,5 reported upon by Crickmay, slightly increased the faunal list. The knowledge of the Middle Cambrian in the Marble Mountains has recently been summarized in a paper by Hazzard and the author.6

---

Location and Stratigraphic Position

The new locality is at the south-eastern extremity of the Marble Mountains, two and three-quarter miles east-north-east of Cadiz, a station on the Santa Fé Railroad 100 miles east of Barstow. It is situated on two small saddles at the crest of a projecting fault block. The stratigraphy of the formation has been fully dealt with in the reports of Hazzard and Hazzard and Mason. As established in the latter, the Cadiz formation consists of the upper 375 feet of the quartzite and shale unit originally noted as containing both Lower and Middle Cambrian fossils. The lower 100 feet of the unit as originally described is not included within the Cadiz formation as it is known to contain Mesonacidae. The exact contact between the Lower and Middle Cambrian beds has not been determined, but it is placed provisionally, at a buff, oolitic limestone and limy, glauconitic sandstone horizon about 100 feet above the top of the Lower Cambrian algal limestone. The fossils of the present report came from a thin-bedded limestone which weathered into small buff-colored blocks and plates, and from an underlying green shale. The thin-bedded limestone is immediately overlain by the heavy, dark gray limestone of the Bonanza King formation (Middle Cambrian). The green shale is probably not more than 50 feet lower in the formation.

Fauna

The fossils collected from this new locality are as follows:

Chancelloria eros Walcott,
Hyolites princeps Billings
H. sp. indet.
Iphidella pannula (White)
Westonia ella (Hall and Whitfield)
Billingsella highlandensis (Walcott)
Acrocephalites ? trifossatus sp. nov.
Alokistocare linnarssoni (Walcott)
Amecephalus piochensis (Walcott)
A. strangulatus sp. nov.
Anomocarella ? spatha sp. nov.
Anoria lodensis (Clark)
Bathyuriscus howelli (Walcott)
B. maximus sp. nov.
Corynexochus ? sp.
Dolichometopus productus (Hall and Whitfield)
Pagetia clytia ? Walcott
Zacanthoides typicalis (Walcott)
Dorypyge quadriceps (Hall and Whitfield)

7 J. C. Hazzard: op. cit., p. 64.
8 J. C. Hazzard and J. F. Mason: loc. cit.
In addition the following species have been reported from the Cadiz formation in the Marble Mountains by Crickmay:9

Acrocephalites sp. indet.
Bathyuriscus belesis Walcott
Dolichometopus productus (Hall and Whitfield), var.
D. lodensis (Clark.
"Ptychoparia" sp. indet.

There are at least twenty species in the fauna of the Cadiz formation as known from the vicinity of the type locality, comprising more than thirteen trilobites (four of them new), three brachiopods, two molluscs, and one siliceous sponge.

**Correlation**

The most closely related fauna is that of the Chisholm shale, described from the vicinity of Pioche, Nevada.10 More recently Pack11 has reported upon that fauna, describing several new species. The faunas of the two formations have at least eight species in common. Burling12 correlated the Chisholm shale with the Spence shale of Utah and Idaho and the Stephen formation of British Columbia. All are of lower Middle Cambrian age.

---

9 J. C. Hazzard: op. cit., pp. 74-75.
DESCRIPTIONS OF SPECIES

Phylum Porifera
Genus Chancelloria Walcott
Chancelloria eros Walcott
Plate 15, fig. 1

Chancelloria eros Walcott, 1920, Smithsonian Misc. Coll., vol. 67, no. 6, p. 329, pl. 86, figs. 2, 2a-c; pl. 88, figs. 1, 1a-f.

Several detached spicules are referred to this species. They agree well with the type-description, save for their larger size. They are all five (?) or six-rayed, and one specimen shows a great development of two rays on opposite sides of the central disk, the other four being reduced. The same specimen has the surface of the central disk produced upward, to form a short, stubby vertical ray. The spicules are broken, so that the following measurements can not give an accurate idea of the proportions.

Measurements

<table>
<thead>
<tr>
<th>Greatest extension of rays</th>
<th>14. mm.</th>
<th>5.8 mm.</th>
<th>8. mm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of longest ray</td>
<td>6.7</td>
<td>4.</td>
<td>3.7</td>
</tr>
<tr>
<td>Greatest diameter of ray</td>
<td>1.1</td>
<td>.9</td>
<td>1.1</td>
</tr>
<tr>
<td>Diameter of central disk</td>
<td>1.6</td>
<td>1.1</td>
<td>...</td>
</tr>
</tbody>
</table>

Horizon and Locality: Burgess shale member and Ogygopsis zone of the Stephen formation, near Field, British Columbia; Cadiz formation, Marble Mountains, California.

Phylum Mollusca
Class Gastropoda
Order Opisthobranchia Milne Edwards
Suborder Pteropoda Cuvier
Family Hyolithidae Nicholson
Genus Hyolithes Eichwald
Hyolithes princeps Billings


This species is represented in the Cadiz fauna by a great many specimens, which weather out of the limestone. On none are the surface markings discernible. The length varies from 1 to 3 inches.

Horizon and Locality: Bic conglomerate, Province of Quebec, Canada; Silver Peak, Nevada; Cadiz formation, Marble Mountains, California.
Hyolithes sp. indet.

Among the numerous specimens of pteropods that weather out of the limestones of the Cadiz formation, the shorter are referred to an undetermined species, smaller than *Hyolithes princeps*. The most common pteropod reported from the Nevada area is *H. billingsi* Walcott, but that species is smaller than any of the Cadiz specimens.

Horizon and Locality: Cadiz formation, Marble Mountains, California.

---

Phylum Brachiopoda
Order Atremata Beecher
Super-family Rustellacea Walcott
Family Paterinidae Schuchert
Genus Iphidella Walcott
Iphidella panulla (White)


See complete bibliography in this reference, p. 361.

A few broken shells are referred to this species, identified by means of the distinctive surface markings. Nothing can be added to the knowledge of the species from the present material.

Horizon and Locality (in addition to those occurrences enumerated in Walcott, 1912, *op. cit.*, pp. 363-364): Cadiz formation, Marble Mountains, California.

---

Superfamily Obolacea Schuchert
Family Obolidae King
Subfamily Obolinae Dall
Genus Westonia Walcott
Westonia ella (Hall and Whitfield)


The present specimens possess no features not as yet described.

Horizon and Locality (in addition to those occurrences enumerated in Walcott, 1912, *op. cit.*, pp. 457-458): Cadiz formation, Marble Mountains, California.
Order Protremata Beecher
Superfamily Orthacea Walcott and Schuchert
Family Billingsellidae Schuchert
Subfamily Billingsellinae Walcott
Genus Billingsella Hall and Clarke
Billingsella highlandensis (Walcott)


The present specimen is a cast of the interior of a dorsal valve, similar to that figured by Walcott (1912, op. cit., pl. 87, fig. 4c). It adds nothing to the knowledge of this species, save increasing the geographic distribution.

Horizon and Locality: Pioche shale, Pioche, Nevada; idem. Highland Range, Nevada; Cadiz formation, Marble Mountains, California.

Phylum Arthropoda
Subphylum Branchiata
Class Crustacea
Subclass Trilobita Walch
Order Opisthoparia Beecher
Family Conocoryphidae Angelin
Genus Acrocephalites Wallerius
Acrocephalites ? trifossatus sp. nov.*
Plate 15, figs. 2, 3

Six cranidia from this collection are referred to this species. The glabella is pyramidal, though truncated at a height equal to the width of its base by the flat frontal limb which meets the glabella abruptly. The dorsal furrows are rounded and fairly well impressed. The occipital furrow is strong, and slightly sinuous, bending forward as it crosses the axis. Three pairs of strong glabellar furrows are present, nearly equidistant and decreasing in strength anteriorly. The first pair is at right angles to the axis; the two posterior pairs are slightly inclined. The neck ring may have had a median spine; there is a hole at that point on one specimen. The frontal limb is narrow and concave, not separated from the upturned rim. There is an obscure boss on one specimen. The rim is not thickened, but the recurvature is undiminished from suture to suture.

* This is probably not a true Acrocephalites, and is thought to be a member of a new genus ancestral to that form.
The fixed cheeks are bulbous, nearly as high as the glabella; they extend a little farther forward than that portion, and descend in an even curve to the frontal limb, being separated from the rim by a rounded groove. From the rounded anterior angles of the glabella strong palpebral ridges spring out. These curve gently back to a point at which they are even with the posterior glabellar furrows. The eyes are a distance from the glabella equal to the anterior breadth of that body. The facial sutures diverge slightly as they come back from the rim to meet the palpebral ridges even with the first glabellar furrows, where the ridges are trending strongly backward. The sutures skirt the ridges for a short distance, and then diverge rapidly. The postero-lateral limbs are narrowly triangular, with thickened trailing edges and rounded grooves just in front. The surface is strongly tuberculate.

**Measurements**

<table>
<thead>
<tr>
<th></th>
<th>Length of cranidium (to neck furrow)</th>
<th>Length of glabella (to neck furrow)</th>
<th>Width of glabella anteriorly</th>
<th>Width of glabella posteriorly</th>
<th>Length of postero-lateral limb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.5 mm.</td>
<td>5.</td>
<td>3.5</td>
<td>5.2</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>8.7 mm.</td>
<td>6.</td>
<td>3.7</td>
<td>6.2</td>
<td>5.</td>
</tr>
<tr>
<td></td>
<td>4. mm.</td>
<td>3.</td>
<td>1.8</td>
<td>3.2</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>4.8 mm.</td>
<td>3.6</td>
<td>2.5</td>
<td>3.8</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>7. mm.</td>
<td>5.</td>
<td>3</td>
<td>5.3</td>
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</table>

This species is characterized by its strong curving palpebral ridges, truncato-pyramidal glabella, upturned frontal rim, and tuberculate surface. The tuberculate surface and general features of the glabella cause the tentative reference to the genus *Acrocephalites* Wallerius. But that genus has no palpebral ridges. From *Alokistocare* Lorenz the present species differs in the surface markings, strong glabellar furrows, and short, upturned frontal rim. This species falls between these two genera, though it is probably generically related to several species referred to them. *Acrocephalites haynesi* Walcott is similar, but differs in having a strong median spine on the neck ring, rather obscure palpebral ridges, short postero-lateral limbs, a strong rounded frontal limb, and the surface coarsely granulated. *Alokistocare? labrosum* Walcott differs in the strong rounded frontal rim, pitted surface, and triangular neck ring. *Acrocephalites insignis* Walcott is smaller and has a wider neck ring, shallow glabellar furrows, and granulose surface.

Horizon and Locality: Cadiz formation, Marble Mountains, California.
Genus Alokistocare Lorenz
Alokistocare linnarssoni (Walcott)
Plate 15, fig. 4

_Ptychoparia ? linnarssoni_ Walcott, 1884, _U. S. Geol. Surv., Mon._ 8, p. 47, pl. 9, figs. 18, 18a.

_Alokistocare linnarssoni_ Walcott, 1916, _Smithsonian Misc. Coll._, vol. 64, no. 3, p. 185, pl. 25, figs. 7, 7a.

This species is represented in the present collection by the cranidium of a single large specimen. The glabella is pyramidal in shape, but truncated at a height apparently equal to the width of the base by a straight anterior margin. Laterally and at the front the glabella is set off from the rest of the cranidium by deep furrows. No glabellar furrows are visible, and the posterior extremity is broken off. The frontal limb is broad, terminating in a shallow groove which bends forward where it passes the glabella. The enlargement of the frontal limb thus afforded is occupied by a large low boss. The frontal rim is narrower than the frontal limb, gently upturned, and not thickened.

Rising from the limb in even slopes, the fixed cheeks are higher than the glabella. Due to the imperfect condition of the surface, the palpebral ridges are not apparent. The facial suture, except for its gently rounded anterior extension on the rim, is broken away. The surface is covered by heavy but rather obscure tubercles and by irregular depressed lines covering the boss and fixed cheeks. The weathered surface of the type specimen is said to be either minutely pitted or punctate. The present specimen is impunctate but it agrees in other points very well. It may be noted that there is a tendency for the frontal limb to break off at the bottom of the frontal groove, leaving the boss projecting forward. A specimen which has suffered such damage is shown by Walcott (1916, fig. 7a). The present specimen shows a crack at this point, though the rim is still attached.

**Measurements**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of cranidum</td>
<td>8.0 mm</td>
</tr>
<tr>
<td>Length of glabella</td>
<td>4.0</td>
</tr>
<tr>
<td>Width of glabella anteriorly</td>
<td>2.5</td>
</tr>
<tr>
<td>Width of glabella posteriorly</td>
<td>3.5</td>
</tr>
<tr>
<td>Width of frontal limb</td>
<td>2.0</td>
</tr>
<tr>
<td>Width of frontal rim</td>
<td>1.5</td>
</tr>
</tbody>
</table>

This specimen falls into the genus _Alokistocare_ Lorenz by reason of the boss extending forward onto the frontal rim. The tuberculate surface, however, is an indication that revision of _Alokistocare_ and _Acrocephalites_ Wallerius is necessary. In general, the surface of the former is said by Walcott to be punctate, and that of the latter to be tuberculate. The present material.
is not sufficient to warrant a new generic assignment of this species.* The species showing the greatest similarity to *Aloktocare linnarssonti* is *A. ? prospectense* (Walcott). The latter differs in having a shorter cranidium and the palpebral ridges situated farther back. From *A. subcoronatum* (Hall and Whittfield) the present species may be distinguished by its greater length and a more distinct boss on the frontal limb. *A. althea* Walcott has a long cranidium, but the frontal limb is proportionately shorter and the boss is not so large.

Horizon and locality: Secret Canyon shale, Eureka, Nevada; Orr formation, Fish Spring Range and Fish Creek Range, Tooele County, Utah; Cadiz formation, Marble Mountains, California.

---

Family Olenidae Burmeister
Genus Amecephalus Walcott
Amecephalus piochensis (Walcott)
Plate 15, figs. 5, 6, 7


*Amecephalus piochensis* Walcott, 1924, *Smithsonian Misc. Coll.*, vol. 75, p. 54, pl. 9, fig. 1; Walcott, 1925, *idem*, vol. 75, p. 66, pl. 15, fig. 8.


This species is represented in the collection from this new locality by numerous cranidia and by one hypostoma. The surface of the cranidium is smooth, except for the insoculating lines on the frontal limb. The hypostoma is quadrate, with broad short anterior auriculate projections. Its body is a raised circular area, and a semicircular bulbous posterior extension is separated from it by a furrow. A little in front of the point at which the furrow crosses the axis the edges of the hypostoma are brought to very small points. The length is over 6.5 mm., and the width at the “points” just mentioned is 5.4 mm.

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* See note at the end of this paper.
As Reed has shown\textsuperscript{13} the value of the characteristics by which Lorenz split up the group of species referred to \textit{ Ptychoparia sensu lato} is open to question. Inasmuch as Walcott preferred to include \textit{Liostracus piochensis} Lorenz in the synonomy of the species selected as the genotype of \textit{Amecephalus}, his usage is followed here.

Walcott's description of the genus \textit{Amecephalus} states that there are “three sets of glabellar furrows,” but his illustrations and line drawing show four\textsuperscript{*} Those specimens of the present collection which display the details of the glabella have four pairs of furrows. The presence and size of the boss on the frontal limb are quite variable. It occasionally extends forward onto the frontal rim. If, as Walcott suggests, the genus \textit{Acrocephalites} is related to \textit{Amecephalus}, this characteristic may be of considerable significance. Indeed, the similarity of \textit{Amecephalus piochensis} (Walcott), \textit{Acrocephalites americanus} Walcott, and \textit{Alokistocare subcoronatum} (Hall and Whitfield) leads one to suspect that these species are congeneric, though the first and last mentioned are genotypes. The principal difference between them is in the character of the surface markings. Other than irregular inosculating lines, the surface of \textit{Amecephalus} is smooth. The surface of \textit{Acrocephalites americanus} has similar lines, and is covered by scattered tubercles. \textit{Alokistocare subcoronatum} is marked by similar lines, and Walcott remarked that the surface was possibly pitted or punctate.

Horizon and Locality: Chisholm formation, Pioche, Nevada; idem, Highland Range, Nevada; Spence shale, House Range, Utah; idem, Wasatch Canyon, Utah; Cadiz formation, Marble Mountains, California.

\textbf{Amecephalus strangulatus, sp. nov.}

Plate 15, figs. 8, 9

Cranidium subquadrate; glabella pyramidal, though truncated at its anterior end by a rather straight transverse line. The dorsal furrows are shallow but distinct and are continuous around the forward end of the glabella. There is an occipital furrow, slightly impressed as it crosses the axis, deeper at the sides. The neck ring is of moderate width, with a low median node. The glabella has four short lateral furrows, slightly oblique and bending back as they approach the median line. This results in a keel.


\textsuperscript{*} The rear furrow of these four may not be a true glabellar furrow.
The fixed cheeks are equal in width to the anterior width of the glabella, not elevated greatly, and highest opposite the anterior end of the glabella. The palpebral ridges spring backward from a point just back of the anterior angles of the glabella. They are quite prominent and pursue an arcuate course to within a short distance of the posterior edge of the cranidium. Frontal limb broad and marked in front of the glabella by a prominent elongate boss which extends forward onto the upturned frontal rim. Laterally the frontal limb is concave. The facial sutures cut directly backward from the frontal rim, though curving slightly as they pass the ocular lobes, and then turn sharply outward to form narrow postero-lateral limbs. These are about twice the width of the fixed cheeks in length, and marked by deep furrows a little back of the occipital furrow. The surface is finely tuberculate. Fine inosculating lines cover the frontal limb and the border in front of the palpebral lobes. A single specimen has a smooth surface, but shows the other features of the species.

Measurements

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of cranidium</td>
<td>7.8 mm.</td>
</tr>
<tr>
<td>Length of glabella</td>
<td>4.6</td>
</tr>
<tr>
<td>Width of glabella anteriorly</td>
<td>2.5</td>
</tr>
<tr>
<td>Width of glabella posteriorly</td>
<td>3.8</td>
</tr>
<tr>
<td>Width between extremities of postero-lateral limbs</td>
<td>...</td>
</tr>
<tr>
<td>Horizon and Locality: Cadiz formation, Marble Mountains, California</td>
<td></td>
</tr>
</tbody>
</table>

This species differs from *Amecephalus piochensis* Walcott, the only other described member of the genus, in having a distinct neck ring, a median occipital node, and a tuberculate surface.

Family *Dikelocephalidae* Miller
Genus *Anomocarella* Walcott
*Anomocarella? spatha sp. nov.*

This species is represented in the present collection by seven cranidia. Cranidium semi-circular in outline; glabella subrectangular to subtriangular, two-thirds the length of the cranidium, the anterior corners rounded so that the anterior end is arcuate. A sinuous, shallow furrow sets off an occipital ring, broad and with no apparent node. Glabellar furrows three in number, very weak, visible only as lateral pits. The glabella, the highest part of the cephalon, is bordered by distinct dorsal furrows, which lessen in depth as they curve around the anterior end.
The frontal limb is a convex slope connecting the elevated cheek areas and not separated from them. It is equal in width to the frontal rim. The rim is a somewhat flattened margin of the elevated glabella, cheeks, and limb, which descend in an even curve to the rim. The depressed line separating the limb and cheeks from the rim is bent backwards as it passes the glabella, forming an obtuse angle at that point. The fixed cheeks are as wide as the anterior width of the glabella, and nearly as high. The palpebral ridges are visible on but one specimen, curving back from near the front of the glabella. The outline of the cheeks is not apparent, for the specimens are broken. The surface is covered by small but distinct tubercles.

**Measurements**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Specimen 1</th>
<th>Specimen 2</th>
<th>Specimen 3</th>
<th>Specimen 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of cranidium</td>
<td>8. mm</td>
<td>... mm</td>
<td>5.2 mm</td>
<td>... mm</td>
</tr>
<tr>
<td>Length of glabella</td>
<td>5.2</td>
<td>7.</td>
<td>3.8</td>
<td>...</td>
</tr>
<tr>
<td>Width of glabella anteriorly</td>
<td>3.2</td>
<td>4.3</td>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>Width of glabella posteriorly</td>
<td>4.3</td>
<td>5.8</td>
<td>2.7</td>
<td>2.8</td>
</tr>
<tr>
<td>Width of frontal limb</td>
<td>1.5</td>
<td>...</td>
<td>.8</td>
<td>...</td>
</tr>
<tr>
<td>Width of frontal rim</td>
<td>1.5</td>
<td>...</td>
<td>.6</td>
<td>...</td>
</tr>
<tr>
<td>Width of occipital ring</td>
<td>...</td>
<td>1.</td>
<td>.5</td>
<td>...</td>
</tr>
</tbody>
</table>

*Anomocarella* is characterized by the absence of glabellar furrows, and by a relatively narrow, flattened frontal rim. The sides of the glabella are parallel, or but slightly converging forward (as in the genotype, *A. chinensis* Walcott). The palpebral ridges of the species assigned to this genus are in general not distinct. The present species varies from the preceding in the three pairs of glabellar furrows (faint, to be sure) and in the more pyramidal glabella. It may be compared with species of the genus *Ctenocephalus*, from which it differs in the angulation of the frontal furrow and narrower fixed cheeks. From *Armonia* it is distinguished by the relatively wider frontal limb and border. The present cranidia are similar in outline to *Crepticephalus Augusta* Walcott (U. S. Geol. Surv., Bull. 30, 1886, p. 208), but differ in having a flat frontal border instead of the thickened frontal rim of the Nevada form.
Family Corynexochidae Angelin
Genus Anoria Walcott
Anoria lodensis (Clark)
Plate 15, figs. 11, 12


This species is represented in the present collection by one incomplete crushed carapace, an hypostoma, and a single thoracic segment. General form ovate; cephalon, thorax, and pygidium of nearly equal length. The glabella is elongate, expanding forward, the fore part quite bulbous. The dorsal furrows are but slightly defined behind, and deepen near their anterior end. No glabellar furrows are visible. From the posterior side of the glabellar bulb the palpebral ridges curve widely backwards to meet the small ocular lobes, which are situated far back and inclined forward and outward. The eye lobe is about half the width of the glabella distant from that part. The glabella appears to be terminal, with no frontal limb or rim, but the preservation of this area is not good. The facial sutures curve evenly around the fore part of the glabella and meet the palpebral ridges two millimeters from their origins. Their posterior extension is obscure. The fixed and free cheeks are equal in width when measured at an angle of 45° to the axis, but the free cheek widens backwards. Both the fixed and free cheeks are two-thirds the width of the glabella at its narrowest point. The margins of the free cheek are prolonged at the postero-lateral angles into sturdy sharp spines.

The thorax is composed of seven segments. The pleurae bend backwards and terminate in distinctly pointed spines. The pleural groove is broad and distinct, and slightly oblique, but it disappears before the terminal spine is reached. The fifth segment is prolonged into a sharp spine, longer than the genal spine and extending back of the forward edge of the pygidium. It is inclined outward so as not to overlap that portion of the carapace. The axial lobes of the thoracic segments have low median spines. The pygidium is broad and elliptical in outline. Neither pleural furrows or border are visible.

The associated hypostoma is roughly triangular. The central area rises gently from the margins. The posterior end is marked by a transverse furrow, back of which is a rather bulbous ridge.
Measurements

Length of carapace ........................................... 43. mm.
Length of glabella ............................................ 14.
Width of glabella anteriorly ................................. 9.
Width of glabella posteriorly ................................. 7.
Length of palpebral ridges ................................... 6.
Distance to eye from posterior margin of cephalon ....... 1.5
Width between genal spines .................................. 29.
Length of thorax ............................................... 15.
Width between spines of the fifth pleurae .................. 29.5
Length of pygidium ............................................ 13.5
Width of pygidium ............................................. 25.
Length of hypostoma .......................................... 5.2
Width of hypostoma anteriorly ................................. 4.
Length of posterior segment ................................ 1.

The original description merely states that *Bathyuriscus howelli lodensis* has eight thoracic segments and an elongate fifth segment. The subsequent reference by Resser was based on the holotype. The present topotype differs in having seven segments in the thorax. It is possible that the thickened anterior edge of the pygidium of the holotype was mistaken for an eighth segment. Otherwise, the agreement is close. Walcott described the closely allied species *Anoria tontoensis* from the Grand Canyon. The large curved palpebral ridges preclude the assignment of the present specimen to that species, the only one heretofore placed in *Anoria*. The genus is characterized by the lack of any frontal limb or rim on the cephalon. The remainder of the carapace is similar to the thorax and pygidium of *Dolichometopus*. The primitive character of the genus is apparent in the elongate pleural segments present in the species assigned to it, *A tontoensis* Walcott and *A. lodensis* (Clark).

Horizon and Locality: Cadiz formation, Marble Mountains, California.

Genus Bathyuriscus Meek
Bathyuriscus howelli Walcott

Plate 15, fig. 13


This species is represented in the present collection by a number of cranidia. The expansion of the glabella forward is not so great as in the type specimen. The third pair of glabellar furrows is not visible on any of these specimens, and the second is nearly obsolete. The occipital furrow and first glabellar furrow are deeply indented and nearly equal in strength, save that the glabellar furrow does not cross the axis. The palpebral ridges in the present specimens are like those of the holotype, but on one immature specimen they are very close to the glabella, greatly cutting down the area of the fixed cheeks.

**Measurements**

<table>
<thead>
<tr>
<th></th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of glabella</td>
<td>5.5</td>
</tr>
<tr>
<td>Width of glabella</td>
<td>5.5</td>
</tr>
<tr>
<td>Width of glabella</td>
<td>3.8</td>
</tr>
<tr>
<td>Width of glabella</td>
<td>4.8</td>
</tr>
<tr>
<td>Width of occipital ring</td>
<td>1.2</td>
</tr>
<tr>
<td>Length of palpebral ridge</td>
<td>3.4</td>
</tr>
<tr>
<td>Width of fixed cheek</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Horizon and Locality: Spence shale, Wasatch Canyon, Utah; Chisholm shale, Pioche, Nevada; idem, Highland Range, Nevada; Cadiz formation, Marble Mountains, California.

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*Bathyuriscus maximus* sp. nov.

Plate 15, figs. 14, 15, 16


This species was incompletely described by Pack as *Bathyuriscus howelli*, emending Walcott's description of that species. Pack states that the specimens from Pioche showed an elongate glabella, expanding in front of the eyes. The glabella was marked by four pairs of furrows, the posterior pair inclined backwards,
the next directly transverse, and the anterior pairs inclined forward. A frontal margin well developed laterally formed auriculate corners. The length of his illustrated specimen was fifteen millimeters. The reference to Walcott's species was a "tentative assignment."

The present collection contains several cranidia, an hypostoma, and a number of pygidia. The glabella displays the characters pointed out by Pack, except for the auriculate corners. There is considerable longitudinal convexity in the present specimens. The hypostoma has the frontal margins broken away. Its body is a broadly convex round area. Back of this is a semicircular area, the outer edge of which is flattened. This area is set off from the body by a pair of sharp ridges extending inward and backwards from the margin but not meeting across the axis. These ridges are set in a broad shallow furrow extending around the posterior end of the body.

The pygidium is semicircular and elevated, but with a wide flattened border. The highly convex axial lobe tapers backward slightly through five segments and then disappears in a rounded terminal segment as it approaches the border. The pleural lobes are crossed by five narrow rounded furrows, each originating near the middle of an axial segment and extending outward to midway of the flattened border. The more posterior furrows are directed more definitely backward. The margin of the pygidium is even, save for a broad reentrant angle where it crosses the axial line on a few large specimens. The doublure is wider than the dorsal flattened area, and is marked by numerous fine lines more or less parallel to the margin and decreasing in frequency toward it.

**Measurements**

<table>
<thead>
<tr>
<th>Glabella</th>
<th>Length ...............</th>
<th>19. mm.</th>
<th>13. mm.</th>
<th>16.5 mm.</th>
<th>... mm.</th>
<th>14. mm.</th>
<th>13. mm.</th>
<th>16.5 mm.</th>
<th>... mm.</th>
<th>14. mm.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Width anteriorly ...</td>
<td>10.3</td>
<td>9.7</td>
<td>10.</td>
<td>...</td>
<td>9.</td>
<td>9.</td>
<td>9.</td>
<td>9.</td>
<td>9.</td>
</tr>
<tr>
<td></td>
<td>Width posteriorly ..</td>
<td>7.3</td>
<td>6.4</td>
<td>7.3</td>
<td>4.9</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Width of fixed cheek</td>
<td>3.4</td>
<td>3.4</td>
<td>4.3</td>
<td>2.7</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td>Hypostoma</td>
<td>Length ...............</td>
<td>7.6 mm.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Width ................</td>
<td>7.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Width at furrow ...</td>
<td>5.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pygidium</td>
<td>Length ................</td>
<td>7.7 mm.</td>
<td>19. mm.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Width ................</td>
<td>15.</td>
<td>30.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length of axial lobe</td>
<td>6.</td>
<td>15.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Median width of axial lobe</td>
<td>2.6</td>
<td>5.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This large species may be compared with *Bathyuriscus howelli*, from which it differs in size, in the forward expansion of the glabella and the additional fourth pair of glabellar furrows, and in the terminal indentation and the five segments of the pygidium.

**Horizon and Locality:** Cadiz formation, Marble Mountains, California; Chisholm shale, Pioche, Nevada; idem. Highland Range, Nevada.

---

**Genus Corynexochus** Angelin

*Corynexochus ?* sp.

Plate 15, fig. 17

A single hypostoma in the present collection is referred to the above genus. It is similar in shape to the hypostoma of *Corynexochus senectus* (Billings), but much too large to be referred to that species. It is possible that it belongs to one of the Corynexochidae described in this paper, but there is no species associated with this hypostoma to which it can with certainty be referred. The assignment is doubtful, then, owing to the absence of dorsal shield fragments.

**Measurements**

<table>
<thead>
<tr>
<th>Description</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>7.0 mm</td>
</tr>
<tr>
<td>Width at lateral projections</td>
<td>9.5</td>
</tr>
<tr>
<td>Width posteriorly</td>
<td>5.0</td>
</tr>
<tr>
<td>Width of axial lobe, inside furrow</td>
<td>3.8</td>
</tr>
<tr>
<td>Length of segment set off by furrow</td>
<td>1.1</td>
</tr>
</tbody>
</table>

**Horizon and Locality:** Cadiz formation, Marble Mountains, California.

---

**Genus Dolichometopus** Angelin

*Dolichometopus productus* (Hall and Whitfield)

*Ogygia producta* Hall and Whitfield. 1877, *U. S. Geol. Expl. 40th Parallel*, vol. 4, p. 244, pl. 2, figs. 31-34.

*Ogygia parabola* Hall and Whitfield, 1877, *idem*, vol. 4, p. 245, pl. 2, fig. 35.


*Dolichometopus productus* Walcott, 1916, *Smithsonian Misc. Coll.*, vol. 64, p. 369, pl. 53, figs. 2, 2a-e, 3, 3a-b, 4, 4a.
This common species is represented in the Marble Mountains fauna by numerous pygidia and a few cranidia. The glabellas of the present specimens are nearly rectangular, thus approaching the original types from the Oquirrh Range, Utah, more closely than the specimens from the Chisholm shale figured by Walcott. The palpebral ridges are farther back than in the types, and their position corresponds to that of the ridges on the Nevada specimens.

The pygidia have the usual shape for the species, with a wide brim and unsegmented axial lobe. On several specimens the lobe ends posteriorly in a rather sharp point intersecting the brim. In others it ends at the edge of the brim in a rounded terminal segment. A few specimens indicate the presence of five transverse furrows, the anterior furrow being the most prominent. One specimen displays three very faint furrows on the pleural lobes, inclined slightly backward, in addition to the deep furrow just back of the anterior edge.

Horizon and Locality: Ophir formation, Oquirrh Range; McDowell Mountains; Chisholm shale, House Range; Simpson Spring, Tooele County; Onaqui Mountains; Howell formation, House Range, all in Utah; Chisholm shale, Pioche, Nevada; Bright Angel shale, Grand Canyon, Arizona; Cadiz formation, Marble Mountains, California. Also in the Rome formation, Hawkins County, Tennessee; Bays Mountains, Knox County, Tennessee; Conasauga formation, Floyd County, Georgia.

Genus Pagetia Walcott
Pagetia clytia ? Walcott

Pagetia clytia Walcott, 1916, Smithsonian Misc. Coll., vol. 64, p. 408, pl. 67, figs. 2, 2a-e.

A single pygidium from the present collection is referred to this Spence shale species. It is semicircular, with a brim which merges into the thickened forward edge. The axial lobe is high, rounded, and cut by distinct furrows into five segments, the last being the longest. The tip is bluntly pointed, and does not intersect the rim. The pleural lobes are faintly marked by furrows trending outward and but slightly backward. The number of furrows can not be determined, but there are at least two. The pygidium measures 1.2 millimeters in length.

Though the agreement with the Idaho specimens is quite close, the present specimen is questionably assigned to this species. It is possible that it represents a youthful stage of any of several
of the Corynexochidae. But its small size, the constant width of the axial lobe, the five segments, all seem to indicate *Pagetia clytia*.

Horizon and Locality: Spence shale, Bear Lake County, Idaho; Cadiz formation, Marble Mountains, California.

Family *Oryctocephalidae* Beecher  
Genus *Zacanthoides* Walcott  
*Zacanthoides typicalis* (Walcott)


This species is represented in the author's collection by two cranidia and a pygidium. The glabella is long and narrow, tapering slightly forward, with at least three pairs of obscure oblique glabellar furrows, extending one-third the distance across the glabella. Fixed cheeks wide and semicircular, bounded by prominent palpebral ridges. The ocular lobe extends to the furrow of the postero-lateral limb, which is midway between the posterior glabellar furrow and the occipital furrow. Dorsal furrow nearly obsolete. Palpebral ridges meet the glabella in front of the third glabellar furrows, but far back of the anterior end of the glabella. Facial sutures converge rapidly from the frontal rim to the margin of the glabella, and then follow the curve of the palpebral ridges and lobes. The frontal limb is bent gently upward.

**Measurements**

<table>
<thead>
<tr>
<th>Description</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of glabella (to neck ring)</td>
<td>3.8 mm.</td>
</tr>
<tr>
<td></td>
<td>8.6 mm.</td>
</tr>
<tr>
<td>Width of glabella anteriorly</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>4.3</td>
</tr>
<tr>
<td>Width of glabella posteriorly</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>4.9</td>
</tr>
<tr>
<td>Maximum width between facial sutures</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>9.6</td>
</tr>
</tbody>
</table>

Horizon and Locality: Chisholm shale, Pioche, Nevada; idem, Highland Range, Nevada; Spence shale, House Range, Utah; Cadiz formation, Marble Mountains, California.
Genus Dorypyge Dames
Dorypyge quadriceps (Hall and Whitfield)

Plate 15, figs. 18-22


Dicellocephalus ? quadriceps Walcott, 1884, U. S. Geol. Surv., Mon. 8, p. 45, pl. 9, fig. 24.


This species is represented by numerous cranidia and pygidia and two hypostomas. The agreement with the following description (condensed) of Hall and Whitfield is fairly good:

Glabella and fixed cheeks quadrangular, with an arcuate front margin. Glabella elongate quadrangular, slightly expanded in front, somewhat inflated. Three pairs of very faint glabellar furrows. Occipital furrow distinct; neck ring strong. A prominent median spine on the posterior margin has a wide base and is directed upward and backward. Fixed cheeks of moderate size, strongly convex. Eye lobes small, situated behind the mid-section; ocular ridges distinct, inclined forward from eye to glabella. Facial sutures begin directly in front of the eye lobe and cut back in a straight line to the eye. Pygidium paraboloid, with twelve strong, but short, spines, the central four shortest. Axis narrow, highly convex with five rings. Lateral lobes broad, convex, marked by four ribs ending in spines.

The hypostomas in the present collection were found closely associated with parts of the dorsal shield of this species. The shape is subrectangular save for the antero-lateral projections. The anterior margin is evenly arcuate. The body is ovate, and moderately elevated. It is surrounded by a flat narrow rim, which is extended to form the narrowly triangular antero-lateral projections.

The size of the type specimens figured by Hall and Whitfield is less than the average size of the present specimens. But those authors note the occurrence of much larger forms, even larger than the present examples. The expansion forward, by which Walcott distinguished Olenoides from Dorypyge, is not a prominent feature. In the latter genus a pair of indentations
beside the forward end of the glabella causes a constriction of that body. This feature is seen on a few of the present specimens but is not at all usual. The other distinction between the two genera is the character of the pleural furrows of the pygidium. In these specimens the furrow is narrow and the intervening ridges broad, thus corresponding to the pygidial furrows of *Dorypyge*.

**Measurements**

<table>
<thead>
<tr>
<th>Cranidium</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>15.5 mm.</td>
<td>mm. 7. mm.</td>
</tr>
<tr>
<td>Width between eyes</td>
<td>17.5</td>
<td>9.</td>
</tr>
<tr>
<td>Width of glabella</td>
<td>8.3</td>
<td>4.</td>
</tr>
<tr>
<td>Width of neck ring</td>
<td>3.</td>
<td>1.2</td>
</tr>
<tr>
<td>Length of postero-lateral limb</td>
<td>8.</td>
<td>3.5</td>
</tr>
<tr>
<td>Width of postero-lateral limb</td>
<td>3.3</td>
<td>1.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypostoma</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>7. mm.</td>
<td>mm.</td>
</tr>
<tr>
<td>Width at anterior corners (broken)</td>
<td>7.</td>
<td>7.</td>
</tr>
<tr>
<td>Width of body</td>
<td>3.</td>
<td>3.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pygidium</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>11. mm.</td>
<td>mm. 7. mm.</td>
</tr>
<tr>
<td>Width anteriorly</td>
<td>16.5</td>
<td>11.</td>
</tr>
<tr>
<td>Width of axial lobe anteriorly</td>
<td>5.1</td>
<td>2.6</td>
</tr>
<tr>
<td>Width of axial lobe posteriorly</td>
<td>4.4</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Horizon and Locality: Ute formation, Blacksmith Fork, Utah; Eureka, Nevada; Liau-tung, Manchuria; Cadiz formation, Marble Mountains, California.

**Note**

In a paper by Dr. Resser,* published after the preparation of this paper in the spring of 1934, numerous genera and species are revised, *Alokistocare linnarssoni* (Walcott) is made the genotype of *Eldoradia* Resser, *Amecephalus piochensis* (Walcott) is removed to *Alokistocare* Lorenz, and *Amecephalus strangulatus* sp. nov. is included in Resser’s *Alokistocare piochensis*. Dr. Resser anticipated the writer in the publication of the opinion that “*Acrocephalites* americanus Walcott, “*Amecephalus* piochensis” (Walcott), and *Alokistocare subcoronatum* (Hall and Whitfield) are congeneric, *Anoria lodensis* (Clark) and *Dolichometopus productus* (Hall and Whitfield) are placed in *Glossopleura* Poulsen. *Bathyuriscus howelli* Walcott is put into *Clavaspidella* Poulsen, but Pack’s “*B. howelli*,” here referred to *B. maximus* sp. nov., is not mentioned.


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NOTES ON THE EARLY STAGES OF THREE BUTTERFLIES AND SIX MOTHS FROM CALIFORNIA

By John A. Comstock and Charles M. Dammers

STRYMON COLUMELLA Fabr.

We are indebted to Mr. C. Henne of South Pasadena for having secured the eggs of this species. While collecting at the California Lakes, Imperial County, November 25, 1934, he observed the female ovipositing on Sida hederacea Torr. An egg was secured, and the subsequent imprisonment of a gravid female with a spray of the foodplant resulted in two more. Eggs which were deposited November 25 hatched December 2 and 6.

Egg. Size .6 mm. in diameter x about .3 mm. high. Echinoid. Color, pea green, the micropyle slightly darker, and measuring about .012 mm. in diameter.

The surface is covered with a fine mesh of reticulated walls, enclosing cells of an irregular hexagonal form. These walls are low as compared with most Lycaenid eggs, and are of the same color as the body of the egg. Their junctures are only slightly thickened and protruded.

The micropylar cells are of the same size as those on the body of the egg, but their walls are narrower. See Plate 16.

![PLATE 16](image)

Egg of *Strymon columella* enlarged x 6.

Drawing by J. A. Comstock

The larvae were raised on common Malva, and fed mostly on the stems and unfolded young leaves.

Larva, first instar; length extended, 1.5 mm. Color, pale greenish white.

There are eight rows of long curved white hairs, one hair to a segment, as will be noted in Fig. A of Plate 17. These arise from pale brown punctae. Across the top of the first segment there is a large pale brown scutellum.
Legs and all prolegs, pale greenish white. Abdomen concolorous with body.

Head, very pale brown with a black spot on each side.

The molt occurred December 10. Period of the instar, six days.

Second instar. Length, extended, 2.5 mm. Slug shaped. Body ground color, translucent pale green, with a mid-dorsal and two lateral longitudinal bands of light maroon. The rows of long hairs are present as in the first instar.

The larva cast its skin December 16. Period of the instar, six days.

Third instar. Length, extended, 3 mm. Body ground color, pale pink. Two parallel dark maroon bands run mid-dorsally from the second to the tenth segments.

Laterally each segment is crossed diagonally by three pale carmine bars. This feature is clearly shown in Fig. B of Plate 17.

Abdomen, and all legs, pale greenish yellow.

The body is sparingly covered with long soiled white hairs having pale brown tips. These arise from black punctae.
The infra-stigmatal fold is pale pink. Spiracles not discernible, and therefore probably concolorous with body.

Abdomen clothed with short white hairs.
The last two segments are pale carmine.
Head as in previous instars.

A second larva was somewhat darker than the above described specimen.

The molt occurred December 26. Period of the instar, ten days.

Fourth instar. Length, extended, 5 mm.
Body color, dull apple green. There is a slightly darker green mid-dorsal narrow band.

Infra-stigmatal fold, light green. Abdomen, pale blue-green, covered with cream-white hairs.

Spiracles, soiled yellow, with brown rims. Legs, pale green, with cream points. Prolegs, pale green with cream claspers.

Cervical shield pink.
The body is covered with soiled white hairs arising from similarly colored punctae.

Head as in previous instars.
The skin was cast on January 11. Period of the instar, sixteen days.

Fifth, and final instar. Length, extended, 13 mm.
Body color, dark green, with a slightly darker mid-dorsal line.


Cervical shield, soiled white, with a maroon shading in its center, and bisected by a narrow soiled white band. On each side of this there is a brown dot. The surface of the cervical shield is sprinkled with minute brown specks, as will be noted in Fig. D of Plate 17.

Head, pale brown. Ocelli, black. Mouth parts, brown.
The body of the larva is covered with translucent hairs of a glistening chestnut shade, which arise from translucent white points. The mature larva is pictured on Plate 17, fig. C.

Pupation occurred February 24. Period of the instar, forty-four days. The pupa was formed on the floor of the breeding cage with no apparent attachment.

Pupa. Length, 9.5 mm.
The thorax and body are a pink-buff, heavily sprinkled with minute brown specks. An irregular mid-dorsal greenish band occurs on the abdomen which bifurcates and curves laterally
on the last three segments. This band is black at the point of contact with the thorax.

PLATE 18

Pupa of *Strymon columella*, dorsal and lateral aspects enlarged x 4.

Reproduced from painting by Comm. Charles M. Dammers

The segmental joint between the eighth and ninth segments is very clearly defined, and is black.

On the abdomen there are six lines of black dots, one to each segment. The pair nearest the mid dorsal line are composed of larger and more conspicuous spots, and each is surrounded by a number of black specks, as will be noted by reference to the illustration, Plate 18. The next lateral line is composed of very small ovoid dots. In the third and most lateral line the dots are round, and are intermediate in size between those of the first and second row.

Spiracles, pale buff.

The thorax is blotched with brown on its sides only. Wing cases, pale olive, and sparingly sprinkled with light olive-brown.

The thorax and body are covered with short buff hairs.

Our two imagos emerged on March 22 and 23, 1935. Both were males.

*Strymon columella* has been recorded from Riverside, Laguna Lakes, Orange County, San Diego, and Indian Wells, Riverside County. It is more common, though never abundant, at Blythe, and in the region of the California Lakes in the valley of the Colorado River.
THARSALEA HERMES Edw.

For several years past the writers have endeavored to secure larvae of this butterfly in the vicinity of San Diego, but without success. In June of 1932 Mr. Fred Thorne induced a female to lay in captivity, but the resultant eggs did not hatch.

In nature the eggs are laid on the stems of *Rhamnus crocea* Nutt. (Red Berry) and remain over the summer, fall and winter, giving forth larvae in the early spring.

On April 28, 1935 a single larva was beaten from *Rhamnus*, and raised to maturity, thus furnishing the material for this partial record of the metamorphosis.

Egg. Echinoid; covered with deep pits surrounded by high and somewhat irregular walls, rising to crests at their junctures. Micropyle deeply depressed. Color white. See Plate 19.

![Plate 19](image)

**PLATE 19**

Egg of *Tharsalea hermes*, greatly magnified.

Photo by Menke, retouched by Comstock

Mature larva. Length, extended, 13 mm.

Slug shaped, robust, with the usual small retractile head. The ground color of the body is apple green.

A mid-dorsal band of slightly darker green runs from the fourth to the eleventh segments. This is margined with yellowish green, and is shown on Plate 20, fig. D.

Laterally there are two rather indistinct longitudinal interrupted yellow bands on each side, and the infrastigmatal fold is edged with yellowish green.

Abdomen, pale green. Spiracles, dark brown.

Legs, pale green, almost colorless, with pale brown points.

Prolegs, pale green with brown hairs on the claspers.

The body is sparingly covered with silvery white dots which, under high magnification, are noted as pillar-shaped stout projections with rounded ends. One of these is illustrated on Plate 20, fig. C. There is also a complete body vestiture of minute short brown hairs which are not erect, and are only discernible with a strong lens. Those on the front of the first segment and on the caudal end are much longer.

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Head, soiled yellow; mouth parts, brown. Ocelli, white on a black field.

PLATE 20
Larva of *Tharsalea hermes*.

A. Mature larva, lateral view, enlarged x 4.  
B. Minute processes on head, thorax and body of chrysalis, highly magnified.  
C. Minute processes on body of larva, highly magnified.  
D. Two segments of larva, dorsal view, enlarged x 4.  
E. Cervical shield of larva, highly magnified.

Reproduced from painting by Comm. Charles M. Dammers

The cervical shield is quite distinctive. It is shaped like a double barbed spear point. The basal color is brown, bisected by a bluish white bar across the center.

There are three rows of large stout papillae running transversely across it, each of which bears a single brown spiculiferous hair. The number and arrangement of these is shown on Plate 20, fig. E.

Pupation took place on the foodplant May 13, 1935. The chrysalis was secured to a silken pad and held by a delicate girdle. The pupa is illustrated on Plate 21.

Pupa. Length, 11 mm.

Stout, with heavily arched abdomen.

Color, grass green. A narrow mid-dorsal yellow stripe extends from the fifth to ninth segments.
Subdorsally, a second yellow band runs longitudinally over the thorax and abdomen, and bends abruptly at each segmental juncture, edging the same for some distance laterally. Each abdominal segment is also crossed laterally by three diagonal yellow bars.

Spiracles, soiled orange.

The entire surface is sparingly covered with olive brown spots of various sizes.

Mid-dorsally on the fourth segment there is a black triangle. On the ninth to caudal segments in the mid-dorsal line a black quadrate spot on each segment, those caudally placed shading off to brown.

The head, thorax and body are sparingly covered with minute silvery white processes, which, under magnification, show as trumpet-shaped projections. (See Plate 20, fig. B.)

The head, and prothorax superior to it are of a lighter shade than the remainder of the chrysalis.

The single imago emerged June 4, 1935, a female.

We are unable to state the range of variation, if any, in the larva and pupa.

This butterfly is, as above indicated, single brooded. It is never a common insect, and with the spread of settlement in the San Diego area is threatened with extinction in California. Fortunately a colony has been reported at Ensenada, Baja California, and it may occur at numerous points along the west coast of that Mexican state.
Glaucopsyche lygdamus australis Grin.

The egg of this species was previously described and illustrated in 1929.*

Numerous ova were collected on March 25, 1931, at Riverside, California. They were laid singly on the tender leaf tips of *Lotus scoparius* Nutt (Deerweed). A number of these were raised to maturity and the following brief notes on the metamorphosis secured.

Mature larva. Length, extended, 13 mm.

Slug shaped. Ground color of body a vivid green, covered with a silver-white pile.

There is a broad mid-dorsal band of dark magenta, shading

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**PLATE 22**

Larva and pupa of *Glaucopsyche lygdamus australis*.
Upper figure, mature larva, lateral aspect, enlarged x 5.
Middle figure, mature larva, dorsal aspect, enlarged x 5.
Lower figure, pupa, lateral aspect, enlarged x 5.

Reproduced from painting by Comm. Charles M. Dammers

to scarlet at its edges. This begins at the front of the second segment and extends to the tail. It is broad at its beginning and gradually narrows to the tenth—then expands toward the caudal termination.

On either side of this band there is a row of yellow triangles, with light mauve centers—one such triangle on a side to each segment. This feature is well defined in the illustration of the dorsal aspect of the larva on Plate 22.

The infra-stigmatal fold is lemon yellow, shading to a pale mauve on its upper edge, and to a dark magenta inferiorly.

The first segment is pale lavender. Abdomen, vivid green. Spiracles white. Legs, colorless. Prolegs and anal prolegs, green, with colorless claspers.

The head is a shiny black, and is retractable, as with most Lycaenid larvae.

Pupation occurred on the foodplant, the chrysalis being secured by a silk button, and a delicate girdle.

Pupa. Length, 9.5 mm.

Color, pale brown, profusely speckled with black dots arranged in groups. The wing cases, thorax and head are of a slightly lighter shade than the remainder of the body.

A few short white hairs occur on the head, and posterior portions of the abdomen. The pupa is illustrated on Plate 22.

Imagos emerged in late May of 1931.

This species is never abundant, but may be found over a wide area of the lowlands and foothills of southern California, wherever the foodplant occurs.

Erinnyis obscura Fabr.

This sphinx moth is taken only occasionally in southern California, but is comparatively common in portions of Mexico and Central America. It is possible that the early stages have been dealt with in some work on tropical lepidoptera, but we can find no reference to the metamorphosis in available North American literature.

During August and September of 1929 and 1930 larvae were collected at Riverside, and also in Chino Canyon, Riverside Co.,
Calif. Since that time no others have been observed although frequent search was made.

The foodplant is Philibertia heterophylla, a climbing milkweed. Attempts were made to transfer the larvae to other milkweeds without success.

PLATE 23

Mature larva of Erinnyis obscura, green form, on a branch of Philibertia heterophylla, slightly enlarged.
Reproduced from painting by Comm. Charles M. Dammers

In the first instar the larva is yellow-green, with a mauve shading along the mid-dorsal line. The caudal horn is brownish black, and is exceptionally long up to and including the second instar, after which it is replaced by a button.

Mature larva. Length, extended, 51 mm.

There are two color forms; a green, and a mottled brown. In some examples a green shade will persist through the first three instars, and then be replaced by brown.

Green form. Body, pale green, liberally sprinkled with white dots. A narrow dorso-lateral white line extends from the fore part of the face to the caudal button. The latter is orange.


Brown form. Ground color, pale brown, speckled and blotched with black. There is a narrow black mid-dorsal line running longitudinally on the first three segments; also there occurs a prominent lateral line running longitudinally which is
formed of conjoined crescentic areas of black mottling, the arches of the crescents pointing upward and the tips conjoined. This feature is clearly shown on Plate 24.


Head, pale brown, mottled with black.

PLATE 24
Larva and pupa of Erinnyis obscura.
Upper figure, mature larva, brown form, slightly enlarged.
Lower figure, pupa, lateral aspect, enlarged x 1½.
Reproduced from painting by Comm. Charles M. Dammers

In all instars the larvae are remarkably adapted to their environment by their protective coloration. In the mature phase they resemble the seed pods of the plant.

Pupation takes place on top of the soil in a light silk nest formed among leaves that have been drawn together.

Pupa, length, 32 mm. Color, bright chestnut, with lighter bands across the body and light lines on the wing cases, as indicated in Plate 24, lower figure.

Imagos emerged from September to November.
Kodiosoma fulva Stretch.

The genus *Kodiosoma* is represented in the Barnes and Benjamin List* by *K. fulva*, with three named color forms, and *K. otero* Barnes. We have bred numerous examples from various groups of larvae, and find that all of the several color phases including the supposed separate species, *otero*, may result. The black phase (*nigra* Stretch) seems to be the least common.

The description which follows will therefore apply to all of the species and varieties now listed.

The first lot of larvae were collected in the Gavilan Hills, Riverside Co., Calif., on March 5, 1933. They had evidently hibernated as larvae, and were feeding on a minute plant, *Uropappus linearifolius* Nutt.

They took readily to *Lactuca* (Wild Lettuce) and were raised to maturity on it. Obviously this introduced group of plants is not their original food source.

Imagos emerged in April of the same year.

In March, 1934, the species was mated in captivity, and produced fertile eggs. The larvae from these, and also subsequent broods went into hibernation in their third instar, and began feeding again in the early spring. It was thus possible to record its metamorphosis.

Egg. Hemispherical or ovoid—slightly flattened on two sides; colorless, or with an evanescent pearly lustre. The measurements were not recorded, nor the time in ovum.

Mature larva. The largest example measured 25 mm. in length. There was however great disparity in size between several mature examples.

Body color varying from a pale olive-brown to an almost solid black.

The body surface is thickly covered with numerous tufts of hair, arising from large rugose nodules. There are ten of these nodules and tufts to each segment, with an additional pair of small ones placed mid-dorsally on the third to eleventh segments.

The upper pair of large tufts, and the smaller mid-dorsal ones are composed of brownish black hairs. The next lateral pairs contain only pale brown hairs. The three lower lateral pairs are made up of grayish white hairs.

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From the center of the upper pair of large tufts, and the next pair below them, there arises from the fourth to the caudal segments a single long white hair. Thus there are two rows of these hairs, longitudinally placed, on each side of the mid-dorsal area. This feature is well defined in the accompanying illustration of the larva, Plate 25.

Abdomen, concolorous with body. Spiracles indistinguishable. Legs, black. Prolegs, brownish black, with yellow claspers.

Head, glistening black, with a sparse covering of colorless hairs.

PLATE 25
Larva and pupa of Kodiosoma fulva.
Upper figure, mature larva, lateral aspect, enlarged x 2¼.
Lower figure, pupa, lateral aspect, enlarged approximately x 2.

Reproduced from painting by Comm. Charles M. Dammers

Pupation takes place at the base of the foodplant. In some cases a very fragile silk cocoon is spun, while in others this is lacking. Specimens collected on March 5, 1933, began to form pupae on March 19 of the same year.

Pupa. Length of the largest example, 14 mm. Color, uniform dark chestnut. The texture is shiny. Wing cases proportionately very small and closely appressed.

Abdomen heavily arched and thick. Caudal end rounded.

A view of the lateral aspect of this pupa is shown on Plate 25, lower figure.

Imagos began emerging from the above lot on April 2, 1933.

This species is seldom taken on the wing, and we have seen no record of its capture at light. It is best secured by rearing the larva.
Euchaetias zella Dyar.

While collecting in Mason Valley, San Diego Co., Calif., on September 30, 1931, a large number of larvae of this species were taken on Philibertia heterophylla Jepson. Efforts were made to substitute other and more easily procurable milkweeds, but these were consistently refused, and the brood was reared to maturity on Philibertia.

Mature larva. Length, extended, 25 mm. The body ground color varies from blue-black to dark gray.

In the mid-dorsal line there occur eight double tufts of long black hairs, extending from the fourth to the eleventh segments. The hairs of the tuft on the fourth segment are longer than the others. At the base of these on each side is a small tuft of stiff white hairs.

There are five longitudinal rows of tufts of mixed black and white stiff hairs on each side of the larva, their bases being staggered across the segment. The lowermost row on either side, however, contains only white hairs, and these are soft and drooping.

All of the tufts above described arise from raised black papillae.

There is a broad broken lemon-white mid-dorsal longitudinal band, and a second longitudinal band of orange runs in line with the second row of tufts. Lemon-white triangular patches occur subdorsally, and also in line with the overlap, as may be noted by reference to the lateral aspect of larva illustrated on Plate 26. A dorsal view of the mature larva is also shown on Plate 28.

PLATE 26
Larva and pupa of Euchaetias zella.
Upper figure, mature larva, lateral aspect (gray form), enlarged x 2½.
Lower figure, pupa, lateral aspect, enlarged x 3.
Reproduced from painting by Comm. Charles M. Dammers

A few very long white hairs arise from the top of the first four, and also the tail segments.
Abdomen, reddish black. Spiracles, black. Legs, black. Prolegs and anal prolegs carmine. Head, brown; mouth parts black. The head is partially obscured by long gray hairs that arch forward from the first segment.

A second group of larvae of this species was collected August 28, 1934, at Palm Springs, Riverside Co., Calif., feeding on the same foodplant. They were about half grown and showed no change in that instar, from that of the mature phase. However, they were all of the blue-black type, and differed from those previously described in that the abdomen was lemon-white, the spiracles a soiled yellow, and the prolegs a soiled orange with colorless claspers. A painting was made of this color variation, which is reproduced in halftone on Plate 27.

![Plate 27](image)

**PLATE 27**

Larva of *Euchætias zeila*.

Upper figure, mature larva (blue-black form), lateral aspect, enlarged x 2½.

Lower figure, typical segment of mature larva, dorsal aspect.

Reproduced from painting by Comm. Charles M. Dammers

Pupa. Length, 12.5 mm. Color, a uniform rich chestnut. Thickest through the fourth or fifth abdominal segment. There are no appendages or vibrissae observable with a low-powered hand lens. The shape of this chrysalis is shown on Plate 26, lower figure.

Pupation takes place in a dense oval cocoon, into which the larval hairs are incorporated. The cocoon is figured on Plate 29.

Imagos from the first lot of caterpillars began their emergence on October 25, 1931, and specimens continued to hatch for some time thereafter.

A third location in which larva have been collected is in Chino Canyon, Riverside County.

The species is parasitized by *Erematylus* sp. near *arctiae* (Ashm).
PLATE 28
Larva of Euchaetias zella, last instar, dorsal aspect, enlarged x 3.
Photo by Menke, retouched by Comstock

PLATE 29
Cocoon of Euchaetias zella, enlarged.
Photo by Menke
Ectypia clio Packard.

The larva and cocoon of this species was very briefly commented upon by Dr. H. Behr in Papilio, Vol. 2, p. 187, 1882. The foodplant which he listed was *Apocynum androsaemifolium* L. Our own notes, and a new foodplant, give some additional information on the life history of this handsome moth.

Egg: dome shaped, the surface smooth. White. Laid in line along one of the tendrils of *Philibertia hirtella* Parish.

Larva, first instar. Length, extended, 3 mm. Body color, brown. The hair tufts of the mature larva are represented by single long brown hairs. Legs and prolegs, brown. Head dark brown.

Second instar. Length 6 mm. Body ground color light brown. The tufts are now composed of three or four single brown hairs in the upper three rows, and white hairs in the lower two rows.

Mature larva, extended length, 30 mm. Body color, pale gray. There are ten tufts of hairs to each segment, with an additional tuft above each proleg. The uppermost pair of tufts is anterior to the next lower, and the remaining tufts on the segment are staggered in relation to each other. The two upper pairs are composed of short dark brown stiff erect hairs and long soft curled bronze hairs.

The next two lower pairs are composed of dark brown stiff hairs. The lowermost pair, and those above the prolegs, are made up of stiff dun colored hairs. The characteristic arrangement and inclination of these tufts is best given in our illustration of the dorsal aspect of the mature larva on Plate 30.

PLATE 30
Mature larva of *Ectypia clio*, dorsal aspect, enlarged x 2.
Photo by Menke, retouched by Comstock
Spiracles, dark brown. Abdomen, pale gray. Legs, gray with brown points. Prolegs and anal prolegs, light gray with yellow claspers.

Head, dark brown. Mouth parts, light brown.

The larvae are nocturnal, and spend the daylight hours concealed at the base of the foodplant.

Pupation took place in a light silk cocoon, into which the larval hairs were incorporated.

Pupa. Length, 17 mm. This measurement is probably sub-normal, as the resulting imago was deformed.

Shape, robust, the caudal and cephalic ends well rounded. The pupa is shown in dorsal aspect on Plate 31. Color, uniform rich chestnut, darkening slightly at the caudal end.

PLATE 31
Pupa of Ectypia elio, dorsal aspect, enlarged x 2.
Photo by Menke, retouched by Comstock

The eggs, from which the above single example was reared were collected at Blythe, Riverside County, on July 27, 1931. Pupation began on September 3, but the one example that was raised to maturity did not pupate until December 15. This emerged on March 9, 1932.

Although the eggs were hatched in a breeding cage and the larvae carefully guarded, all were parasitized by a Tachinid except the one example. It has been suggested that the eggs of the parasite were introduced on the foodplant.

A pair of imagos in copula were taken at Lee Lake, Riverside County, August 16, 1928. A second pair was secured at Snow Creek, Riverside County, on April 24, 1932.

From the female of the last recorded pair, placed in captivity, a group of eggs was secured.

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Bagisara buxea Grote.

While on a collecting trip in the Colorado River basin at Blythe, in the fall of 1934, a number of larvae were secured on a species of *Sphaeralcea*. They were successfully raised to maturity, the first imago emerging May 13, 1935.

This proved to be *Bagisara bucea*, the metamorphosis of which is unrecorded. The following notes, though somewhat fragmentary, will help in the solution of the problem.

![Mature larva of Bagisara bucea.](Image)

PLATE 32
Mature larva of *Bagisara bucea*, lateral aspect, enlarged x 2 1/4.

Photo by Menke, retouched by Comstock

Mature larva. Length, approximately 30 mm. Subcylindrical, the abdomen slightly flattened. Ground color of body, green, with a mottled whitish green pattern as shown in the illustration, Plates 32, and 33, fig. A.

The lighter spots on the dorsum tend to arrange themselves in irregular V shaped lines.

Numerous long pale brown hairs are scattered over the body. Each of these arises from a whitish papillus.

![Mature larva of Bagisara bucea.](Image)

PLATE 33
Mature larva of *Bagisara bucea*.
A. Lateral aspect.  B. Two segments of larva, dorsal aspect.
Figures enlarged x 2.
Reproduced from painting by Comm. Charles M. Dammers
There is a prominent white or soiled white stigmatal line. Abdomen, concolorous with body, and irregularly mottled or dashed with whitish spots.

Spiracles, yellow. Legs and prolegs concolorous with body.

Head: Ground color the same as on the body, and the lighter mottling similar, but with the admixture of a few small dots interspersed with the white mottled areas. Ocelli green, tipped with black. There is a sparse covering of short light hairs over the head.

The larva is colored in close simulation to its foodplant.

Pupation occurs under the ground, in a stout oval chamber or cocoon. The larva remains in this without changing its skin until the following May. One example was still a larva on May 20, while another cocoon gave forth an imago on that date.

Pupa. Length, 11 mm. The imago from this specimen was considerably dwarfed, and the measurement is therefore less than normal. A second example measured 13 mm.

Color, yellow brown, the caudal end darker, as are also the eye cases.

The surface texture is smooth. Eye cases prominent.

There are no vibrissae or protuberances except for the two small cremasteric hooks. Spiracles, dark brown.

Plate 34 shows three aspects of the pupa.

![Plate 34](Image)

**PLATE 34**

Pupa of *Bagisara buxea*, enlarged x 4.

A. Ventral aspect. B. Lateral aspect. C. Dorsal aspect.

Photo by Menke, retouched by Comstock
Jocara trabalis Grt.

Collectors working in the Sonoran zone of southern California have frequently observed certain bushes of Eriogonum fasciculatum Benth. (False Buckwheat) which appear partly stripped of leaves, and full of dark befouled webbings. The latter represent the runways of larvae of a common Pyralid moth, Jocara trabalis. Not only may these larvae be pulled from the webbing, but occasionally one may find a visitor therein who has taken no part in the construction of the retreat, but welcomes it as a safe place of concealment. This visitor is the larva of Apodemia virgulti. The metamorphosis of the latter species has been described* but we can find no record of any description of the larva and pupa of Jocara trabalis, hence the following brief notes.

Mature larva. Length, extended, 27 mm.

Form, subcylindrical, somewhat flattened on the abdominal surface. The body color is a uniform dark mahogany, although occasional examples are of a lighter shade.

A few specimens show a pale mid-dorsal line, poorly defined, but the majority lack this feature.

A longitudinal double line of long white hairs occurs dorso-laterally, arising from raised papillae. This line contains two hairs and papillae to each segment, except for the first, which bears none, and the second and third which carry only one each. A third line of papillae and hairs occurs below the infrastigmatal fold. These features are clearly shown in Plate 35.

PLATE 35
Mature larva and pupa of Jocara trabalis shown in lateral aspect, enlarged x 2½.
Reproduced from painting by Comm. Charles M. Dammers

On the first three segments there is a light chestnut band on each side of the mid-dorsal area. This feature is brought out in our Plate 36 which shows the dorsal aspect of the head and first three segments. There is a chitinous scutellum on the

Head and first four body segments of larva of *Jocara trabalis*, shown in dorsal aspect, enlarged approximately x 8.

Reproduced from painting by Comm. Charles M. Dammers

dorsal aspect of the first segment. Abdomen, concolorous with body. Spiracles, orange. Legs, concolorous with body, as are also the prolegs. The claspers are carmine.

The tail segments bear a sparse covering of white hairs.

Head, dark brown, with a light chestnut band on the cheeks which is continuous with the band on first segment. There is a sparse covering of short white hairs.

Pupa. Length, 13 mm. Color, a uniform chestnut. The mid-dorsal area of thorax and abdomen is slightly rugose. A painting of the lateral aspect of the pupa is reproduced in black-and-white on Plate 35. This is slightly diagrammatic, as may be seen by reference to the actual photograph of the pupa on Plate 37.

Pupation occurs on the foodplant in a thickly woven dark silk cocoon.
PLATE 37

Pupa of *Jocara trabalis*, enlarged x 4.

Photo by Menke, retouched by Comstock

MISCELLANEOUS NOTES ON WESTERN LEPIDOPTERA

By JOHN A. COMSTOCK

The Lorquin Entomological Club has on its membership a number of keen observers and ardent collectors who have done much to enlarge our knowledge of the range and habits of Southern California butterflies.

During the first week of September, 1934, one of these enthusiasts, Mr. C. N. Rudkin, was motoring through the Ibanpah Mountains. He noticed a number of Papilios congregated at a moist spot in the road. Reporting this at one of the Club meetings resulted in the capture of a long series by several members, including the writer. Mr. Rudkin pointed out to us at the time that certain points of difference seemed to exist be-
tween Holland’s figure of the type of *Papilio brucei* and our Ibanpah Mountains examples. Later, specimens were sent to Dr. McDunnough by Commander C. M. Dammers, of Riverside, which drew forth significant comments, as follows:

“*Brucei* — was originally described from Glenwood Springs, Colorado, and is the dimorphic form of what I suppose will have to be called *hollandii*, if we are going to split the Colorado race from the race of the southwestern region.

“If this is done your so-called *brucei* would really need a name, as it is not exactly the same as the few specimens I have before me from Glenwood Springs. You might call the matter to Dr. Comstock’s attention and let him work it out, if he so desires.”

Acting on this very generous suggestion of Dr. McDunnough’s, I have made careful comparisons with such material as is in our collections, of the plate of the so-called “type” in Holland’s book,1 and of the original description of *brucei* as given by W. H. Edwards.2

I am led to the conclusion that our California examples belong to a distinct race, and therefore propose the name *rudkini* in recognition of our fellow club member’s discovery and observations.

*Papilio bairdii* form *rudkini*, f. nov.

Expanse (of the holotype, which is about of average size) 25½ inches. Holotype ♂. Ibanpah Mts., Calif., September 9, 1934.

Primaries; upper side. Fringes black at the ends of the nervules, yellow between; a submarginal row of eight ovate spots; internal to this a broad black area occasionally flecked through its center with a few yellow scales.

In the inner half of the limbal area there is a broad band of irregularly quadrate yellow spots beginning with a small very irregular one close to the apex, followed below by progressively larger and longer spots. The lateral edges of these spots are more consistently curved outwardly rather than straight, as in the Colorado form, or slightly concave as in the true *oregonia*.

The basal area is very slightly powdered with yellow scales on a rich black background. There is a crescentic yellow spot at the apex of the cell, and an irregularly subquadrate one about 3 mm. internal to it. The latter is exceedingly variable in size.

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Secondaries: A submarginal row of lunate spots, consider-
ably smaller on the average than with the Colorado form. The
wide limbal black band has only a sparse sprinkling of blue
scales through its center. The orange spot at the anal angle
is round, and black pupiled. The discal yellow band is heavily
dentate on its outer margin. The basal black area measures
about 2.75 mm, in width.

On the under side, the primaries have the row of sub-
marginal oval spots reproduced with very little enlargement, and
no tendency to confluenence or the production of a band as in
oregonia.

The two discal yellow spots are present, but there is no
other area of yellow scaling within the disc.

The secondaries show a rather constant suffusion of the
submarginal yellow crescents with orange scales, particularly on
those that are close to the costal margin. There is also a rich
suffusion of orange along the outer margin of the wide discal
yellow area.

The body is black on the dorsum. There is a wide yellow
area on the lateral surface of the abdomen, below which is a
narrow black band. Internal to this is a narrow yellow area,
and on the venter a wide black band, sometimes containing a
few yellow scales in its center. There is, however, considerable
variation in the placement and extent of these yellow and black
areas.

Allotype ♀. Ibanpah Mts., Calif., September 9, 1934. Diff-
ers from the male principally in its slightly larger size and in
the greater extent of the blue suffusion and spots on the sec-
donaries.

Paratypes. Nos, 1 to 30 taken in the Ibanpah Mts., from
September 9, 1934 to July 1, 1935.

Holotype and allotype in the collection of the Los Angeles
Museum. Paratypes will be distributed to the United States
National Museum, the Canadian National Museum at Ottawa,
the California Academy of Sciences at San Francisco, and the
British Museum.

This species flies in association with typical bairdii, and
interbreeds with it. However, the proportion of bairdii to
rudkini is about fifty of the latter to one of the former. We
have collected and reared over four hundred examples from
larvae. The two forms cannot be separated in the larval state.
Edwards notes that in Colorado, the light and dark forms are
about equally represented. Furthermore the Colorado foodplant is
Artemisia, whereas on the Mojave Desert, and in the desert
ranges of California, it is Thamnosa montana Torr. and Frem.
(Turpentine Broom). Commander Dammers has complete notes
on the metamorphosis of rudkini, which will later appear in
this Bulletin. Mr. C. Henne was the first to report the foodplant.

We take this opportunity of expressing our appreciation
for the generous aid in this matter extended by Dr. J. McDun-
nough. Were it not for his helpful coöperation, our western students of the lepidoptera, far removed as they are from large libraries and collections, would not be able to solve many problems.

**Euphydryas magdalena B. & Mc. D.**

One of the most distinctive of the Euphydryads of eastern Arizona is the small dark species of the White Mountain area named *magdalena*. This butterfly occurs at high elevations and is on the wing in late July, August, and possibly early September. We first observed it in Hannigan’s Meadows in 1930, and on July 27 of that year secured a few eggs from a captive female which we were unable to bring through.

In June of this year, while collecting in the alpine meadows on the Springerville-McNary road, five larvae were taken. Two of these were carried to the pupal stage, and one gave forth an imago on July 16. The larvae were all found on grass into which they had probably crawled to pupate or molt.

The two examples that were successfully reared to chrysalis fed on the common lowland species of *Plantago*. Probably some dwarf alpine species of this genus supports them on their native heath.

Egg. .5 mm, broad x .6 mm, high. Color, bright yellow. The form is of the usual type for the genus, and is illustrated on Plate 38. The upper half bears about fourteen longitudinal ridges, between which are numerous secondary striae running at right angles to the main ridges. The lower half of the egg is irregularly pitted.

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**PLATE 38**

Egg of *Euphydryas magdalena*, enlarged x 45.

Drawing by J. A. Comstock

Mature larva. Length, 18 mm. Ground color, ivory, mottled with black.

The characteristic number of branching spines are present, the color of these being black. Those of the mid-dorsal row arise from orange-yellow papillae. Between each papillus runs a narrow black line.

The next dorso-lateral row of spines arise from a black mottled area, which gives the larva an appearance of having a prominent dorso-lateral black band.
The spines of the next lateral row have narrow orange-yellow circlets at their bases, as have also the spines of the fourth (infra-stigmatal) row.

Stigmata, black. There is a mottled black area between each breathing hole which gives the appearance of a stigmatal line. Legs, black. Prolegs and anal proleg, straw.

Head, black, thickly covered with short black hair.

The first example pupated June 18, and subsequently died. A second specimen pupated July 6, and the imago emerged July 16. The mature larva, dorsal view, is shown on Plate 39.

PLATE 39
Mature larva of *Euphydryas magdalena*, dorsal aspect, enlarged x 3½.
Photo by Menke, retouched by Comstock

Pupa. Length, 10 mm. Ground color, lustrous white, heavily marked with black dots and dashes, as shown in the illustration. Plate 40.

All of the nodules representing vestiges of the larval spines are a deep orange.
Antennal sheaths heavily checkered with black squares, separated by narrow white segmental lines.

Ocellar ribbon, black—the remainder of the eye white, slightly tinged with orange at the corners.

There is a slight shading of orange-brown on the shoulder and across the center of the wing cases. Spiracles black.

Cremaster, brown at the end—soiled ivory at the base.

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PLATE 40

Pupa of Euphydryas magdalena, enlarged x 3.

Photo by Menke, retouched by Comstock

CALEPHELIS NEMESIS ETC.

Southern California collectors have labored under some confusion with regard to the correct names for the various species of Calephelis occurring within our borders, owing to our inability to make comparison with the types and with compared-type material.

A series of specimens, submitted by Commander Dammers to Dr. Foster H. Benjamin and by him given genitalic study, has brought out the following points:

The small form, with dark bands across the center of the wings which we have hitherto been designating as nemesis, proves to be the true australis.

A somewhat similar form, taken at Blythe, in which the dark bands are slightly less pronounced, and the primaries in the male less pointed at the aspices, is the true nemesis.

The large light form which lacks the dark band across the
wings has heretofore gone by the name of *australis*, and is so designated on Plate 47, Figs. 16 and 17, "Butterflies of California."

This will probably have to be called *Calephelis wrighti* Holland.

The latter species was described from specimens illustrated by W. G. Wright, on Plate XXVII, Figs. 303 and 303c of "Butterflies of the West Coast," under the name of *C. nemesis*. We can match this figure with faded males taken at Palm Springs. Wright's specimens were accredited to Mendocino County, but we are of the opinion that they were actually taken in the Coachella Valley.

Wright was a commercial collector, and it is known that he frequently mislabeled his specimens in order to keep others from visiting his favorite collecting grounds and spoiling his market.

Commander Dammers and the author described the early stages of what we have been calling *Calephelis nemesis*, in the Bulletin Southern California Academy of Sciences, Vol. XXXI, p. 12. This will have to be changed to *C. australis*.

The prior description by the author, of the metamorphosis of the so-called *C. australis* (Bull. So. Calif. Ac. Sci., Vol. XXVII, p. 80), will apply to *Calephelis wrighti*.

We are indebted to Dr. Benjamin for another important correction to our list of California butterflies.

The small species of *Thorybes* occurring in Southern California which we illustrated as *T. mexicana* in "Butterflies of California" on Plate 58, Figs. 1 and 2, proves to be merely a dwarf western race of *Thorybes pylades* Scud. Dr. Benjamin makes this determination on the basis of genitalic studies made from material submitted by Commander Dammers.

In correspondence with Dr. Bell, and from an analysis of original descriptions of *T. mexicana* H. S., and *T. diversus* Bell we were inclined to place our Southern California examples under the latter name, and so stated in Bull. So. Calif. Acad. of Sciences, Vol. XXXIII, p. 33.

Our description of the metamorphosis, as published in Bull. So. Calif. Acad. of Sciences, Vol. XXXII, p. 110, will therefore have to apply to *T. pylades*.

It may be noted however that California examples, in spite of the similarity of genitalia, show a tendency toward a reduction of the size of spots in the lower half of the primaries, and a somewhat more rounded secondary, when compared with examples from the eastern seacoast.
Platyprepia guttata f. ochracea Stretch.

This form occurs in the coastal regions near Santa Barbara, feeding on Lupines. Examples were sent us by Mr. and Mrs. Carl W. Kirkwood of Santa Barbara, from one of which the accompanying illustration was made. A brief note concerning the larva was published by Packard in the Hayden Survey, and Stretch has given a description of the larva and cocoon, and reproduced a very poor figure of the caterpillar on Plate 10, Fig. 1, of that work. Since the last quoted book is not accessible to the average entomologist, it is felt that a brief description of the larva, and a reproduction from an actual photograph, will serve a useful purpose. See Plate 41.

PLATE 41

Mature larva of Platyprepia guttata, enlarged.
Photo by Menke

Mature larva: body black, the first three segments clothed with dense rust-red hairs; the remaining segments with very long silky white hairs, mingled with black along the sides, and a few rusty hairs on the anal segments.

3 Hayden's Survey of the Territories, 1873, p. 559.
4 Zygaenidae and Bombycidae of N. Am., p. 71, 1873.
Apantesis nevadensis f. geneura Strecker.

Larva of this species were secured by Mr. M. L. Walton of Glendale, Calif., feeding on Purshia, Artemisia, and a low yellow flowering unidentified plant. Numerous examples were collected at an elevation of 9,100 feet on the summit of the Inyo Mts., on May 10, 1930.

The mature larva is black on the body and head, and is thickly covered with stiff single hairs arising from warty nodules. These hairs are black in the area above the stigmata, while inferior to this area they are russet brown.

The illustration of the larva, Plate 42, shows the placement of the nodules and arrangement of the hairs.

PLATE 42
Mature larva of Apantesis nevadensis geneura, dorsal view, enlarged.

Photo by Menke
Pupa. Dark brown, or blackish brown, covered with a light bloom or powdery substance which easily rubs off. The antennal cases are robust, and widely separated through the mid-thoracic region, which helps to produce the maximum width of the chrysalis through this area. There are a number of minute vibrissae protruding from the anterior portions of the head, and four short stout cremasteric hooks at the caudal end. The pupa is illustrated on Plate 43,

PLATE 43
Pupa of *Apantesis nevadensis geneura*, enlarged.
A. Dorsal aspect. B. Lateral aspect. C. Ventral aspect.
Photo by Menke, retouched by Comstock.

The dates of pupation and emergence of those examples which came to maturity were as follows:

<table>
<thead>
<tr>
<th>Pupated</th>
<th>Emerged</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 10</td>
<td>June 30</td>
</tr>
<tr>
<td>&quot; 11...</td>
<td>&quot; July 9</td>
</tr>
<tr>
<td>&quot; 19...</td>
<td>&quot; 12</td>
</tr>
<tr>
<td>&quot; 21...</td>
<td>&quot; 15</td>
</tr>
</tbody>
</table>

While collecting larvae it was observed that when the bush on which they were feeding was touched they would invariably drop and secrete themselves under leaves, or in holes in the ground.

**Eutrepsia cephisaria** Grote.

During the first part of August, 1930, while collecting on the Greer Road in the White Mountains of Arizona, a long series of a black day-flying moth was secured. This was at first thought to be *Melanchroia chephise* Cr., as examples in the Los Angeles Museum collected were so labeled. A comparison of these with examples from Florida convinced us that the Arizona specimens were not *M. chephise* Cr, as the latter species shows a large white patch on the apex of primaries, and the
thorax is distinctly orange. In the Arizona specimens there is a white fringe on the primaries, but no expansion of this into a white spot on the apex. Furthermore the thorax is black, and there are scarlet scales on the collar and lappets, and a patch of pink-scarlet at the base of each wing on the under side, in the Arizona species.

Examples were submitted to Dr. Benjamin of the Department of Agriculture at Washington, and he has kindly determined the Arizona species as *Eutrepsia cephisaria* Grote. I quote from his letter as follows:

"The name *cephisaria* Grote is available for it" (the Arizona species). "This name is not a synonym of *inconstans* Geyer, and the latter name should be stricken from our lists.

"The generic name *Eutrepsia* H. S., type *inconstans* Geyer is available for use over the name *Oenotrus*, although the latter is in almost universal use in collections dealing with tropical species."

*Eutrepsia cephisaria* Grote deposits its eggs on the edge of the under surface of the leaves of *Monarda fistula* L. They are usually laid singly, but occasionally two or three are deposited together.

The egg is a flattened oval, measuring .75 mm. in length by .50 mm. in width and is about .40 mm. thick. In color it is pearly or cream white. The texture of the surface is apparently smooth, but careful examination discloses a fine reticulation in the form of regularly placed hexagons outlined in very low relief.

Plate 44 illustrates the egg.

Our limited facilities in camp made it impossible to record the larva.

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PLATE 44

Egg of *Eutrepsia cephisaria*, magnified x 42.
Upper figure, top view. Lower figure, side view.

Drawing by J. A. Comstock
Itame colata Grt.

Along the eastern base of the Sierras, and extending south through the Tejon Pass, the San Gabriel Mts., west of Phelan, and in the San Bernardino Mts., bordering the Mojave Desert, there occurs a belt of Purshia glandulosa, growing in association with juniper and yucca.

On the Purshia, in proper season, are to be found a number of different larvae, all of which are protectively colored, and hence difficult to see. They may however be beaten to the ground and collected thus in abundance.

From this bush we have bred Callipsyche behrii, recorded some time ago,* and more recently we reared a number of examples of Itame colata Grt. As the metamorphosis of the latter species has not been recorded we append the following brief notes:

Mature larva; body ground color, green. There is a dark green mid-dorsal band, more or less broken in character, and edged outwardly with a narrow white crenulated line. Lateral to this is a green area extending down to the spiracles, but more or less bisected by a broken line or series of dashes some of which are yellow—others white.

Below each spiracle (sometimes partially surrounding it) is a sub-triangular dash of white, tipped with yellow at its posterior end. Below this and extending on to the abdomen is the usual mottled green body color, partially interrupted in the mid-abdominal area by a series of broken and irregular whitish or yellow lines.

Each segment bears a number of single black hairs arising from raised black-tipped papillae.

Spiracles, orange brown, with brownish black rims.

True legs, yellowish, with brown terminal hooks. Proleg green. Anal proleg green, with a white dash across its center.

The head is a mottled green, with short sparsely placed black hairs. Ocelli colorless, the upper two with black tips. Mouth parts tinged with brown.

This larva is of the measuring worm, or looper type, as will be noted from the accompanying illustration, Plate 45.

PLATE 45

Mature larva of Itame colata, lateral aspect, enlarged.

Photo by Menke, retouched by Comstock

Pupa. Length, 9.5 mm. Greatest width 2.6 mm.

The thorax, wing cases, and anterior two-thirds of venter are a greenish brown. Abdomen and head, yellow-brown.

The abdominal surface is heavily pitted; wing cases, thorax and head areas smooth and shiny.

Cremasteric button, brownish black, heavily rugose, with two cremasteric hooks the ends of which are bifurcated.

Meso-thoracic spiracle, blackish brown, slightly protruded, and with a row of minute vibrissae along the anterior margin.

There is a single long colorless hair placed anterior to the first four spiracles on each side, each one arising from a minute papillus. A few scant hairs of similar character arise from various parts of the thoracic and abdominal surfaces. Otherwise the pupa is free of appendages.

Spiracles, concolorous with body, the rims slightly darker. The shape and texture of this chrysalis is adequately pictured in Plate 46.

Pupation occurred on the floor of the breeding cage.

Our examples were secured from two separate locations, namely: Mt. Pinus road about one and one-half miles from Lebec, Calif; and one mile south of Phelan, Mojave Desert.
A FIRST DYNASTY LETTER FROM BABYLON

By Carl Sumner Knopf, M. A., B. D., Ph.D., F. P. G. S.

(Professor of Semitic Archeology and History, University of Southern California)

Recently there was handed to the writer by Mrs. C. Q. Stanton of Los Angeles a cuneiform tablet of unbaked clay, 2¼ x 1½ x 7/8 inches, containing seventeen lines of text. There was no seal impression or evidence of envelope. The tablet was procured from a Bagdad dealer as "an old Babylonian bill." A glance revealed the characteristic cuneiform of the first dynasty of Babylon. Three words corrected the "bill" idea—ana, "unto"; qibima, "speak"; and umma, "thus"; these being the usual terms of the opening phrases of a Babylonian letter.

Tablets of this period, about 2000 B.C., often called the classical age of Babylonian history, are frequently unbaked and poorly preserved. They were but temporary, serving their purpose when the message was received, then thrown away. In some cases tablets are found which were apparently first drafts, filed away for reference after the final corrected draft was made and sent.1 Once in a while a letter will contain the words tuppi kil, i.e. "preserve my letter."

Like many other letters of this period, the document under discussion is undated. When the name of the ruler is mentioned and the year noted, dating becomes a fairly simple task, limited chiefly by lack of data permitting fixation of the date in exact terms of our present calendar. As time goes on and more documents are deciphered, more kings listed, and more details of chronology worked out, it will be possible to be more accurate in dealing with such documents as actually mention king and year. In some cases, certain family names may be identified with a particular span of years, and tablets bearing those names can thus be reasonably dated even when lacking specific date formulae. It seems reasonable to assume that the letter under discussion comes from a time between 2000 B.C. and 1900 B.C.

1 An interesting case of this kind was published by the writer in the Academy Bulletin in 1933, XXXII, Pt. 2, p. 72 ff.
Like modern letters, those of ancient times present problems for any reader far removed from the persons and their affairs. Words, clear in themselves, carry subtle meanings between correspondents. Unfinished sentences, quite intelligible to the recipient, baffle the modern decipherer. However, the gist of these first dynasty letters can usually be determined.

The letter opens as might be expected, with the word *ana*, "unto." Then follows the name of the recipient, Ilu-pisha. The next line contains the one word, *qibima*, an imperative form of *qebû*, "speak," with the emphatic particle *ma*. Then follows the usual term *umma*, from *amû* which also means "speak" but here used idiomatically, "thus," or "as follows." After this comes the name of the writer, Daganbanima, and the formal introduc-

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2 In translating, the customary symbolism is used, e.g. *m* signifying "man" or "male" indicates the vertical wedge which scribes often placed as a determinative before proper names. If read at all by the Babylonians, it was probably *amêlu*. The *d* is for old Sumerian *DINGIR*, "god," and indicates that the following sign is a deity name. Often *m* and *d* might appear together, since a man’s name could begin with a deity name. *Is* is for *išu* (Sumerian *GIš*) indicating that the following object was of wood or fiber.
tion is completed by calling upon the gods Shamash and Marduk to grant good health, using a precative particle lu or li, "may," prefixed to the verb balātu, "live," with the second person singular suffix, ka, added, hence "may . . . keep you in health." (See plate.)

_Tup-pi_, 1. 5 and 7, is the word _tuppu_, "tablet" with the first person pronominal suffix, _i_, "my" — "my tablet."

_Uṣ-ta-bi-la-ak-kum_, 1. 6, is built up from the verb _abalu_, "bring." When the Babylonian wished to indicate causation, he inserted a sibilant, _s_, and the form could be made reflexive by the further insertion of _ta_. This is called an īstafel stem. The _k_ immediately suggests a second person pronominal suffix, in this case _ku_ with the emphatic _m_ added. The initial _u_ indicates the first person, so the complete verbal complex is translated "I have caused . . . to bring to you."3

_Kima_, 1. 7, may have been derived from the old Sumerian _KIM_, "go." It is easy to see how this suggested immediacy hence came to signify "as soon as," "when," and other related meanings. _Ta-am-na-ru_ is from the verb _amaru_, "see," with the second person pronominal prefix, _ta_. This form would usually appear as _tammar_, but in this case the final _u_ is added for emphasis, or in construction in a _kima_ clause.

_Da-am-qu-tim_, 1. 9, is derived from a root meaning "clear," "clean," "friendly," hence "good."

Line 10 is badly broken. Enough is left however to suggest the oblique wedges followed by a horizontal wedge, cut by three verticals, which is the ideogram for _gaššu_, a "pole," or _rikku_, some kind of tree or plant. The form of the sign is more like what would be expected in an Assyrian text, though Fossey's listing of some 38,000 signs and variants shows how extensive variation might be. Following the sign are the possible remnants of another, probably some modifier, but too broken to make it safe to hazard a guess.4

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3 One would expect the present tense here, for Ilīshukal had not yet gone. He could hardly take the tablet before it was written! The scribe should have written _uṣ-ta-baši_, _ba_ instead of _bi_, making it a present tense, "I am sending" or "I will send." Either this is an error in tense or the preterit should in such a case as this be read "I am about to send."

4 If by any chance it should be the _UR_ sign, such meanings as _sādu_, "red," or _balitu_, "rich," "fertile," would fit the context with _rikku_, i.e. some red or fruit bearing plant. Cf. Barton, G. A., _Origin and Development of Babylonian Writing_, p. 257, No. 516.
Šu-bi-la, line 11, is an imperative form of the verb abalu, "carry" or "bring." The š denotes the causative, thus giving what is called a šafel imperative form, "cause to bring" hence "send."

Abu-ut-ka, 1. 13, is from abu, "father," plus utu, denoting an abstraction,\(^3\) plus ka, the second person pronominal suffix; —"your fatherhood." Lu-mu-ur is from amaru, "see," with the precative particle lu, "let," prefixed.—"let . . . behold."

Tu-ša-bi-la-am-ma, 1. 15, is from abalu (cf. line 11) but a preterit instead of imperative. Tu is second person; ša, the causative or šafel form; while the suffixed ma in this case, instead of being translated by "and" or considered merely an un-translatable emphatic particle, has a conjunctive force, "but." Such long word complexes are quite characteristic of Babylonian, and of the preceding Sumerian. The second sign in line 15, ša, varies a bit from the conventional form as found in letters of Hammurabi, in that the two horizontal wedges are in that position rather than written at an oblique angle.

Ma-am-ma-an, 1. 16, means "anything" or "someone." U-ul, 1. 17, is a negative particle. The two together mean "nobody," "nothing." The final word, idinam, is from nadanu, "give." Verbs with initial n are irregular and n disappears in certain forms, as in this case. Context of the tablet seems to demand that the translation be "delivered." the whole phrase reading "he delivered nothing."

To summarize, this letter was written by Dagan-banima to Ilupisha, to be delivered by Ilishukal. In it, two nets and a pole or plant of some kind are ordered. It would seem that they had been requested before, but Ilishukal on his last trip did not bring them; at least he delivered nothing, hence this letter urging immediate compliance with the writer's request.

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\(^3\) See Pinches, T. G., Outline of Assyrian Grammar, p. 5. Note how Babylonian and English use a similar vocalic sound to denote abstraction, ut/d and hood ("ud), the same sound with a rough breathing and hardened dental.
UNTIL 4


TRANSLATION

1 Unto Ilupisha speak. Thus (says) Daganbanima: May Shamash and Marduk preserve you in health. Just now I have caused Ilishukal to bring my tablet to you. When you have seen it, send me 2 good hunting nets and a pole (or . . . plant). In this may I behold your fatherhood. You have sent Ilishukal, but he delivered nothing.
0. a-na Ilu-pi-sa
qi - bi - ma
um-ma Da-gan-ba-ni-ma
je-ta - bi - u - ma
Da-gan-ba-ni-ma

5 a-nu-um-ma tup-pt Ilt. šu-uk - ka - al
mIš-ta - bi - la - ak - rum

Lo.8. 2 ša-ad - di
da - am - qu-tim

10 šu-bi - la
ša-ad - di
ša-ad - di
l - na an-ni - tim
abi - ut - ka Ilt. Ilt.
šu-uk - ka - al

15 tu - ša - bi - la - am - ma
ša-ad - di
ša-ad - di

PLATE 48
IN MEMORIAM

DR. BERNHARD R. BAUMGARDT

In the passing of Dr. Bernhard R. Baumgardt, who died at his home in Los Angeles, June 19, 1935, the Southern California Academy of Sciences deplores the loss of one of its oldest, one of its staunchest supporters, and its most eminent member and Fellow. Dr. Baumgardt was a natural student, explorer, investigator, recorder and expounder in many fields. He died quietly in his sleep at the age of seventy-three. In the nearly sixty years of his active life he had demonstrated as an able seaman before the mast, a competent navigator, a weather observer for the government, a master printer, a mathematician, an astronomer, a connoisseur in music, art, literature, a linguist of rare attainments and a lecturer of marked popularity.

Dr. Baumgardt was born in Liverpool, England, in 1862, his father Swedish and his mother Anglo-French. The family removed to Sweden a few years later, and the lad grew up and received his education in that country. Specializing in mathematics and astronomy, he attended Strengnas College, and graduated at a comparatively early age.

An uncle in command of a sailing ship inspired the young man to go to sea after his graduation, and for four years he lived the life of a sailor, first on his uncle's ship, then on others, until he had gained experience of the seven seas. His life as a sailor was crowded with hardship and adventure. And, with his dominant spirit, he was first to respond in time of stress, and ready to court danger. There is a tradition in the family of an occasion when, in a violent storm, he was aloft at night attempting to reef a frozen sail with stiff lashings, when a sudden flap of the canvas knocked him from the yardarm. In the desperation of his fall he grasped the rigging and saved himself from a tragic end. Then he climbed back to the spar and finished his task. On another occasion, in company with a shipmate, a German of middle age, he was out on the bowsprit for a furling when his companion shouted "Look out, Beany!" Baumgardt had just time to wrap his legs and arms about his perch when the ship's prow plunged beneath an advancing wave. When it emerged the shipmate was not there. And in such a storm rescue was out of the question. But that sort of thing was a matter of course with the crews on sailing ships. One trip, which brought him around the Horn and up the Pacific coast, was made under an old Dutch captain who had the habit of hurling his wooden shoe at a sailor who had displeased him.

After four years of such a life, and not feeling the urge for advancing to the command, young Baumgardt left the ship at
Vancouver, B. C. and made his way to Seattle. When he began his career in the new world he could not speak a word of English. This is rather strange, as he was familiar with several Continental tongues, and his mother was of part English lineage.

All this happened more than fifty years ago, and Seattle was at its beginning. The young sailor utilized his knowledge of navigation to meet his difficulties linguistically, and for a time sailed a large schooner in the service of a fish cannery back and forth across the Straits of Juan de Fuca. This served as his preliminary training in English. Baumgardt was both an apt and an accurate scholar. The English which he acquired was idiomatic, grammatical, strong; with just enough foreign burr and twirl in it to give piquancy to his discourse. When he had sufficiently advanced to make himself understandable, he gave up his marine school and went to Portland, Oregon, where he secured work in a printing office, which probably had facilities for a higher grade of speech. Both craft and language were rapidly acquired by the eager young student, and not long afterward we find him embarking on his own with a combination stationery establishment and small printing office. On the side he acted as assistant to the United States weather observer. Dr. Ford A. Carpenter, of our Academy, was the observer who gave him this job.

Later he sold his business in Portland, and removed to San Francisco, where, in 1885, he was married to Miss Mary Louise Steinhauer. Shortly after his marriage he found employment at the Lick Observatory, where his knowledge of astronomy and mathematics served him a good turn, and made him useful as a man of all work.

In 1890 he returned to Portland and again established himself in the stationery and printing line. While the Baumgards were in Portland their son Mars F. was born.

In 1893, the Baumgards, with their young son, removed to Los Angeles. Here he secured work in a small printing office which was making a desperate struggle to pull through a collapsed boom. After helping to get through the pinch Baumgardt bought the concern, and launched out again for himself. The establishment shared in the prosperity of the growing city, and grew apace. When the writer of these lines was first cognizant of it, the Baumgardt Printing concern was located on Broadway, a few doors north of the Times office. It occupied full front, ground-floor quarters, and had every appearance of an up-to-date establishment, with plenty of business on hand. It undertook anything from calling cards to special trade papers and books of moderate size. I know it did nice work, for I had some done there. It printed all of the earlier issues of our Bulletin of the Academy of Sciences.

Mr. Baumgardt continued in the printing business for nearly thirty years. Finally Mr. J. D. Hooker, an intimate friend of
Baumgardt's, purchased an interest in the concern for his nephew, Fred Hooker Jones, and the firm became Baumgardt & Jones. In the destruction of the Times building by dynamite and fire in 1910, the adjoining structure, occupied by the Baumgardt & Jones plant, shared the same untoward fate. The partners concluded that it would suit their ends to take whatever insurance they could collect, and retire from business. By that time Baumgardt had made his try-out, and concluded that he would like to enter the lecture field.

Although a busy man in the printing line, Baumgardt's abiding interest in everything scientific led to his association with others of like tendencies, and he was one of the early members of a group of twenty or more who formed the Science Association of Los Angeles in 1891. This group comprised Dr. M. H. Alter (first president), an optometrist and dealer in optical goods and laboratory equipment; S. J. Keese, electrician; W. H. Knight, all-round student of science; Dr. Anstruther Davidson, botanist; Professor Lundberg, electrician; Prof. Melville Dozier, educator; W. L. Watts and George Parsons, geologists; Holdridge O. Collins, attorney; B. R. Baumgardt, W. A. Spalding, Abbot Kinney, author of a work on the Eucalyptus; Major E. W. Jones, Mrs. Mary Hart, and others, making about twenty at the first meeting. Mrs. Hart was chosen secretary, and filled that position satisfactorily for two years, until she changed her residence. Dr. Anstruther Davidson and W. H. Knight were the second and third Presidents. Baumgardt had so impressed himself on the Association as an earnest worker that he was elected Secretary, to succeed Mrs. Hart, and his performance of the duties must have been acceptable, for he was re-elected to the position for thirteen years successively—from 1893 to 1906. Then he was installed as President, which position he filled three terms—1906 to 1909. Baumgardt's special equipment and interest led to his early selection as chairman of the section on Astronomy and Mathematics, and that position he held with great credit for ten years or more. In fact Baumgardt, as Secretary and chairman of his section, was the inspiring genius and chief encourager all through the formative years of the organization. And his interest never lagged. He remained a member of the Board of Directors until his work on the lecture platform took him far afield, and then his place was filled by his son, Dr. Mars F. Baumgardt, who is still a member of the Board, and who served a year as President.

Early in its career the name of the organization was changed to The Southern California Academy of Sciences. And it was at the same time that the various sections were instituted, to give specialists a chance to flock together and join in congenial research and study. These sections were also feeders for the Academy, as the results of their work could be drawn upon for the general meetings.
In one of the Academy's bulletins early in 1914 there is a note by the Secretary, Holdridge O. Collins, to the effect that Mr. B. R. Baumgardt had just returned from a visit to San Francisco, where he delivered a series of lectures for the benefit of a reading room just established by the Santa Fe Railway Company for its employees. That was probably the beginning of Baumgardt's lecturing career. At least it was the first extension of his lecture field, and probably planted in his mind the idea of adopting that as a profession. His preliminary training, as stated, had been in numerous lectures before Academy of Sciences audiences.

Before the end of 1914 he was well launched on his eastern circuit. At the annual banquet of the Academy, October 17, 1914, the toastmaster, W. A. Spalding, made a brief address, reviewing the achievements of the organization and some of its members, from which the following is taken:

"To our associate, Mr. B. R. Baumgardt, the speaker of the evening, the Academy owes a debt of gratitude deep and enduring. It was he, as Secretary, in the old days for many successive terms, and afterward as President, who did more than any other man to keep interest awake and hold together the struggling organization. It is a great pleasure to know that, in entering the field as a professional lecturer, on matters of scientific, historical and ethical interest, he has achieved so pronounced a success, and that, in coming back to us with honor and prestige, his love for the old-time organization is always expressed anew. I venture he will acknowledge that his years of earnest effort in this Academy constituted his preparatory course for the lecture field."

Mr. Baumgardt's address on that occasion was on "The Trend of Modern Thought in Europe," analyzing the origin of the World War, a subject of all-absorbing interest at that time.

Dr. Baumgardt was the author of treatises on "Tidal Evolution" and "The Symbolism of the Universe." Baumgardt himself was a never-failing source of supply for the Academy. During his service as Chairman of his section, Secretary and President, he delivered many addresses on his special topics, and contributed greatly to the general discussions. After he adopted the profession of traveler and lecturer, he was always at home for the summer interregnum, and for many years he was requisitioned for the address at the annual meeting. The records show that, altogether Baumgardt delivered before the Academy of Sciences, twenty-four lectures. His great success in the lecture field of the United States, and even abroad, did not dim his regard for the home people and the old association, with which he
had largely attained his early training as a platform speaker. In addition to his addresses before the Academy, he also gave through the series of years, seventy-one lectures at the Scottish Rite Cathedral in Los Angeles. He also gave annual lectures before the University Club of Los Angeles, of which he was elected an honorary member. Be it remembered that all of this service for the home people was rendered gratuitously. He commanded handsome honorariums when lecturing elsewhere, but, for his home the best fruits of his genius were a free-will offering. In all the record of scientific bodies it would be hard to find a parallel to such devotion and constancy.

But Baumgardt was made of the stuff that wears. He could always go back to former friends and constituents and patrons and find a hearty welcome. The reason lay in the fact that he always had something new, interesting and instructive to give, and he gave it in such a clear, forcible, earnest way, that it was worth remembering. In the line of his specialty—astronomy—he enjoyed unique facilities for presenting for the first time celestial pictures taken through the greatest telescope in the world, by the most improved photographic device at the Mount Wilson Observatory. Himself employing the best of slides and projection instruments, his talent for popularizing the far-away facts of astronomy, and bringing them within the comprehension of the average layman found full sway. He gave the public the very best to be had in his line, and that in a most acceptable and understandable way.

After meeting unqualified success on scientific lines, he reached out for other fields to conquer. Then, as an alternative and variant for his lecture season through the winter months, he took to summer travel abroad, and gathered great stores of pictures, making a careful study of the country visited, its people, customs, traditions, history, art, literature—everything that engaged his inquiring mind. Altogether he crossed the Atlantic ocean thirty-six times, and the Pacific three times. His lecture on “The Holy Land” was a revelation to students of the Bible. His lecture on the Isles of Greece was a panorama and a poem. His lecture on the “Golden Age of Pericles” was an epic in art. And for the beautiful colored slides that illuminated these travel lectures, Baumgardt never failed to give credit to his devoted wife, who had prepared them for him. That was another of the great advantages which he enjoyed—a helpmeet in thorough sympathy with his ambitions, and capable of lending a hand.

Altogether, between science, travel, history, art, literature, and what not, Baumgardt had a repertoire of more than a hundred lectures. And on appointment he could stand before an audience and give any one of them without a manuscript—without even consulting notes. Sometimes the lecture might be an
hour or an hour and a half in length; sometimes it was replete with dates, dimensions, names of characters, historical events. In his literary lecture on “Goethe’s Faust,” he recited, in the original German what must have amounted to a page or more of the text, and followed by giving the same in English translation. This leads up to comment on Baumgardt’s memory, which was his most marvelous endowment. Psychologists tell us that the subconscious mind is the storehouse of human memories, and nothing is lost that once enters that granary. The reason why people forget things is because the connection between the conscious and subconscious mentalities fails to work—line trouble or static, may be. Baumgardt must have enjoyed an almost perfect connection at his lectures, for he never hesitated or stumbled in giving particulars. His facility in this line always excited the admiration of his hearers. His capacity for languages was equally marvelous. He had a speaking knowledge of nine languages, including English, French, German, Swedish, Norwegian, Danish, and I know not what others; and he also had a smattering of the all but impossible Russian, which enabled him to make his way in that country, by the aid of a handy guide-book.

Recurring to Baumgardt’s facility for return engagements, it may be worth while to dip mildly into statistics, and show how wonderfully his system worked, and the high character of his clientele. Following is a list of patron societies, organizations and universities and the number of engagements which he filled with each:

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<th>INSTITUTIONS</th>
<th>LECTURES</th>
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<td>Tremont Temple Courses, Boston</td>
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<td>Carnegie Hall, New York</td>
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<td>Kansas City University Extension Society</td>
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<td>Belasco Theater Courses, Washington, D. C.</td>
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<td>Columbia University Inst. of Arts and Sciences, New York</td>
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<tr>
<td>American Institute, New York City</td>
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<td>Brooklyn Institute, Brooklyn, N. Y.</td>
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<td>Goodwyn Institute, Memphis, Tenn.</td>
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<td>Academy of Sciences, Los Angeles</td>
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<td>The Scottish Rite, Los Angeles</td>
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Here is a total of 583 lectures delivered at widely diverse points during the period of about twenty years. It is doubtful whether the record of Ralph Waldo Emerson, Wendell Phillips, John B. Gough, Anna Dickinson, Robert Ingersoll, Mark Twain or any of the popular lecturers of the past decades exceeds this of our friend Baumgardt. And in his vacations he took occasion to make extensive excursions in foreign lands, and prepare more lectures, and pictures to illustrate them. The pictures were an important factor in nearly all of his discourses and this was a modern device of which the old-time lecturers could not avail themselves. Baumgardt's era was one of wonderful opportunities, and resources, and he had the genius to grasp them all and make the most of them.

In his excursions to Europe he generally passed through England, and doubtless visited his birthplace, Liverpool. He delivered several lectures in London. At any rate he impressed English scientists to the extent that, in 1927, he was elected a Fellow of the Royal Astronomical Society of England, in recognition of his contributions to Science. Up to that time only seventy-six Americans had been thus honored.

Besides the Royal Astronomical Society and the Academy of Sciences, already mentioned, Dr. Baumgardt's affiliations were the University and Gamut clubs of Los Angeles, Explorers' and Transportation Club of New York; Royal Societies, London; Pentalpha Lodge of Masons, the Scottish Rite and Thirty-third Degree (honorary).

Perhaps enough has been said to indicate Baumgardt's genius and outline his achievements. About the other side of his character—the strictly human side, the social, the sympathetic, the lovable side—a volume might be written, but a few paragraphs must suffice. He was unspoiled by his success, and apparently unmindful of his own eminence. For his lifetime friends, as for new acquaintances, he had a genial smile, a kindly word, a hearty hand-shake that radiated "Peace on earth and good will to men." He was cordial, he was hearty, he was genuine. He was wide awake to every subject concerning humanity, nature, the universe. He had positive opinions on every current topic, and never hesitated to express them frankly and forcibly. If there was something in his utterance that suggested the didactic and oracular, it was due to his tremendous earnestness, and was perhaps only to be expected from one accustomed to addressing large audiences. If an argument arose on a mooted point, he showed a characteristic of his English forbear by bluntly and emphatically asserting his own opinion. And anybody who had argument with him needed to be well heeled with facts and a ready flow of language. Yet he was ever concerned about tracing
truth, to its ultimate hiding place, and when convinced, ready to acknowledge and correct an error. A mutual friend who had quite an extended discussion with him at his home, told me that Baumgardt went to his Encyclopedia not less than six or eight times to settle points of difference and uncertainty. Above all things else he wanted to be right. His veneration for the true, the beautiful, the good was thoroughly scientific.

I have referred to the close personal friendship that existed between Baumgardt and J. D. Hooker. Mr. Hooker was a man of large wealth and generous ideas, with a strong leaning for the cause of science. We used to hold sessions of our Astronomical Section in a large room on the third floor of his Adams Street residence. In the earlier, more cramped years of the Academy we generally brought up with a deficit at the end of a year, and John D. Hooker, without a grimace, wrote a check for the amount. He contributed $1,500 altogether to assist the Academy in excavating and preparing fossils from the Brea Beds, which formed the nucleus of the pre-historic exhibit at the Museum of History, Science and Art in Exposition Park. Thus it was that we called Mr. Hooker our "good angel" and regularly elected him our First Vice-President. When he was making a final adjustment of his affairs, Mr. Hooker had in mind the allotment of a handsome sum to the Academy, and he told Baumgardt to look up a suitable up-town lot upon which a building could be erected for a permanent home and endowment. It is certain the suggestion was well received by Baumgardt, and he lost no time in beginning his quest. Before he was ready to report, however, Dr. George Ellery Hale, on a visit in Los Angeles, had an interview with Mr. Hooker, and laid before him a scheme for creating the greatest reflecting telescope in the world, with a disc of one hundred inches. All it required was sufficient money to pay the expense. Mr. Hooker was quite impressed with the feasibility of the plan, and at his next meeting with Baumgardt, laid the situation before him. But, to erect a fine building for the Academy of Sciences and back the big telescope project also would involve a greater outlay than his budget justified. So he shifted the problem to Baumgardt's shoulders.

"I will not crowd you for a decision," said Mr. Hooker. "Think it over; sleep on it, and tell me your candid conclusion. Which scheme would benefit the cause of science the more, the building or the telescope?"

It was a severe test for our friend Baumgardt, but after wrestling with it for a day and a night his scientific conscience triumphed, and he said to Mr. Hooker:
“Endow the telescope; it will be of the greater benefit to the cause of science. A building can be erected at any time, but this may be the one chance to assure the greatest telescope in the world.”

So the endowment went that way, and Mr. Hooker gave, altogether, $135,000 for that marvelous enterprise. The Carnegie Fund joined forces and contributed for the erection of the building that incloses the great telescope.

Be it remembered, however, that two members of our Academy decided a momentous question against their own institution and in favor of the larger and more enduring cause of science.

Baumgardt clung tenaciously to old friends, old ways, old memories. He kept at hand a telescope of moderate size, through which he often viewed the stars well into the night. In an out-building just behind his residence, he had a well-equipped little printing office, where, the spirit moving, he could set type with his own fingers, in his own composing stick; collect the typed matter on his own galley; make it up on his own imposing stone; lock it in his own chase with his own quoins, shooting-stick and mallet, and print it on his own press, propelled by his own foot.

Dr. Mars Baumgardt tells me that his father left, locked in forms, ready to print, a considerable collection of poems that were his favorites. That is his last tribute and memorial to the craft that he loved to the end. The sheets are to be printed and distributed among friends.

In Baumgardt's domestic life I never discovered a flaw. The wife of his youth was the wife of his struggling years in the printing shop, the wife and efficient helper of his triumphant lecture career. There were no eccentricities or peccadilloes of genius to be ignored or forgiven or forgotten by friends. The Baumgardts raised two sons whom they educated and launched on professional careers. Mars F., with an astronomical name, must have absorbed astronomy from childhood, for he has constellations, stars, orbits, periods, distances—most of the known facts of the celestial sphere—at his tongue's end, and can talk of them as interestingly as did his father. In proof of this I may say that he has delivered weekly lectures over the radio for more than nine years. For twenty-one years he was in charge of the private observatory of Mr. W. A. Clark on Adams Street, this city. But astronomy is only an avocation, a side issue, for Mars. His profession, by which he earns bread and butter for himself and family, is optometrist—helping people to see things—and he is successful in both vocation and avocation. The second son is Dr. Howard C. Baumgardt, who has a lucrative practice in dentistry.

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Mrs. Baumgardt, the loyal companion and helpmeet of our friend in all his years of struggle and achievement, died in August, 1934. Her demise was the result of an acute attack, and was unexpected. It was a crushing blow to her husband and family. In response to a letter of condolence Dr. Baumgardt wrote as follows:

“It is difficult to find words which adequately express my appreciation and thanks for what you contributed at the last farewell to my dear wife. It was all so sympathetic and beautiful, so full of the spirit of resignation. Please accept the sincere thanks as well as the gratitude of all the Baumgardt family.

“There were many contributing causes to the passing of Mrs. Baumgardt, and not the least was the shock of the great earthquake. She never was the same woman after it. It affected her already weak heart. Since then she suffered much, but always with fortitude and patience. The last hours brought relief from bodily suffering. Quietly, peacefully, the anchor was heaved, and she embarked on that mysterious sea that has never yet reflected the shadow of a returning sail. ‘After life’s fitful fever, she sleeps well.’

“But, as I said the evening you called, I am left without a rudder. For half a century she has been my inspiration, my all-in-all. And now it seems to me that life yields nothing further. With Hamlet I feel how weary, stale, flat and unprofitable are all the uses of this world. But enough. I must not inflict my burdens upon one who knows only too well what the anguish of parting means.’

It only remains to add that, as Mrs. Baumgardt’s fatal illness had its inception in the great earthquake, so was Bernhard R. Baumgardt’s demise hastened by the shock of his wife’s death. Only two weeks before he had returned from his last European trip. He was not in good physical condition when he went, and the trip did not improve him. The day before the collapse he realized that the trouble was with his heart, and he made a call on his physician for an examination. The doctor looked him over thoroughly and made a cartograph of the heart action, promising to submit a complete report as soon as the graph was developed. The next morning Dr. Baumgardt realized his serious condition without a report. He summoned his son Mars and Mr. A. Beaman, a close friend. To them he said:

“My work is finished. I am a dying man.”

Mr. Beaman tried to dissuade him, urging his apparently good physical condition and the probability of further years of activity.
“There’s no use arguing the matter,” replied Baumgardt, “I know what I know. I have a few last commissions to give. Will you take them?”

After naming several items of business that needed attention, he continued:

“Please let my funeral services be simple. I would like W. A. Spalding to read ‘God of the Open Air’ and William Rhodes Hervey, Master of Scottish Rite bodies in Los Angeles, to give the address.”

Mr. Beaman made penciled notes of all his requests and promised to see them executed.

During the night following, Baumgardt, while asleep, passed to the great unknown.

The funeral services were held in the Scottish Rite Cathedral, Hope Street, on the afternoon of June 21. A large concourse of friends and Masonic Fraters was present to pay the last honors. Selected members from the Scottish Rite Orchestra rendered favorite selections from Beethoven, Tschaikowsky and others, which had been designated in the last request, and there was a piano solo by Edith Knox, daughter of a fellow Thirty-third Degree Mason. Sickness prevented Judge Hervey from speaking the farewell words, but Mr. Julian Arnold, son of Sir Edwin Arnold, a long-time personal associate, performed that service in an appreciative and sympathetic address, concluding with the beautiful sentiment, “He loved the stars too fondly to be fearful of the night.” Van Dkye’s beautiful poem, “God of the Open Air,” was read. It was the only prayer offered.

In accordance with instructions, the body was cremated, the ashes taken to sea off San Juan Capistrano Point, and there committed to the Cradle of the Deep. The same disposition had been made of the ashes of that other dear one eleven months before.

Following is a copy of a paper found among Dr. Baumgardt’s documents, which he probably read at the obsequies of some friend, and which might have been fittingly given at his own:

“First our pleasures die; and then
Our hopes; and then our fears, and when
These are dead, the debt is due;
Dust claims dust, and we die, too.”
The time has come to say the last farewell to a beloved friend and companion of life's pilgrimages; one whom some time ago we saw in possession of nature's many gifts, life, health, a cheery disposition and a smiling spirit. Now he has left to embark upon that mysterious sea that never yet has reflected the shadow of a returning sail; that shoreless ocean whose length and breadth and depth we find ourselves unable to sound.

The breathing miracle has passed into the realms of silence. Death, the kindly old nurse and last physician, has restored him to nature's care. The finger of the Creator touched him. Now he sleeps. How mighty is Death, since all who live must come under His dominion. "'Tis the old, old fashion, the fashion that came in with our first garments and will last, unchanged, till our race has run its course, and the firmament is rolled up like a scroll." 'Tis the old, old fashion—death and immortality. For, perhaps, the day of death we so often feared may be but the birthday of never-ending life.

In the mysterious procession of life, our departed friend was approaching the constellation that marks the decline of day, with the lengthening shadows falling from the West. Then mortality overtook him, and he united with the innumerable caravan which sooner or later overtakes us all. For, whether it be when life has just begun, and the sun's rays are still gathering strength, or at the close of the voyage when the surging breakers are heard as they beat on the shores of the infinite—a common lot awaits us all. "All that lives must die, passing through Nature to Eternity."

At the closing it is difficult to pronounce the last farewell. The best-intentioned words must be at best weak. To some it must seem hard not to ask why he should, at the zenith of his achievement, go down into the slumber of silence. The only answer is that the Great Architect of the Universe alone knows; perhaps it is best that we should not.

"Sometime, when all life's lessons have been learned,  
And sun and stars forevermore have set;  
The things which our weak judgments here have spurned,  
The things o'er which we grieved with lashes wet.  
Shall flash before us out of life's dark night,  
As stars shine best in deeper tints of blue;  
And we shall see how all God's plans were right,  
And how, what seemed reproof, was love most true."

W. A. Spalding
PROCEEDINGS OF THE ACADEMY

October, 1934 - September, 1935

REGULAR MEETINGS

The regular meetings of the Academy are held the fourth Friday evening of each month at 7:30 p.m., in the Lecture Room of the Los Angeles Library.

October 18, 1934:

The first meeting of the fall was held in the Lecture Room of the Public Library. In the absence of the President, Mr. Sargent, the meeting was called to order by Dr. John A. Comstock of the Board of Directors. Dr. Comstock introduced the speaker of the evening, Mr. Walter Gordon Clark, consulting engineer and expert on refrigeration. Mr. Clark gave a most interesting address on “Low Temperatures” and illustrated his remarks with experiments using liquid air and carbon dioxide. After the lecture and demonstration, the speaker answered many questions relative to the properties and use of refrigerants.

November 15, 1934:

The second fall meeting of the Academy was presided over by President Harry K. Sargent, who introduced the speaker, Dr. R. B. Cowles, Associate Professor of Zoology at the University of California at Los Angeles. In his lecture, “Afield in the African Veldt,” Dr. Cowles gave an account of personal experiences in South Africa and showed many beautiful and instructive views of the flora, fauna and people of the region. The lecture was indeed a treat for the large audience that filled the Lecture Room.

December 20, 1934:

At this meeting, the members and their friends were taken on an imaginary trip to the high mountains of Central and Southern California. The speaker, Mr. W. Scott Lewis, illustrated his lecture, “Sierra Trails,” with many beautiful lantern slides made from his own photographs of mountain scenery. The views of the Mt. Whitney region were especially fine.

January 17, 1935:

“The Reptiles of California” was the subject of Dr. R. B. Cowles of the University of California at Los Angeles, at the regular January meeting. The natural color slides which illustrated the lecture were the most life-like reptilian views ever shown at any meeting of the Academy. We were glad to have Dr. Cowles with us again and greatly enjoyed his remarks concerning the habits and life history of each snake or lizard as it was projected upon the screen.

February 21, 1935:

An audience which filled the Lecture Room listened to Dr. John G. Hill of the University of Southern California, who gave
a vivid account of his experiences among the South Sea Islands. His lecture, "The Fire Walkers of Raiatea," was illustrated with three excellent moving picture reels which pictured the beauties of Tahiti, Raratonga and Raiatea and showed the customs and habits of the natives.

March 21, 1935:

"Novae or New Stars" was the subject of President Harry K. Sargent who was the speaker at the regular March meeting. Illustrating his lecture with very interesting lantern slides, Mr. Sargent traced the development of our knowledge concerning these astronomical oddities.

April 18, 1935:

Mr. Eugene Murman of Glendale was the speaker of the evening and gave the members another opportunity of viewing some of his beautiful hand-colored slides. His subject, "Orchids of the World," was illustrated with slides from his own sketches.

May 16, 1935:

The wonders of Bryce Canyon, Utah, were shown on the screen by Mr. W. Scott Lewis at the regular meeting on May 16. The title of his lecture was "The Silent City of the Gnomes," and those present were taken on an imaginary visit to the terraced walls of this famous canyon where erosion has cut out fantastic forms that resemble nearly every conceivable type of architecture.

Annual Meeting:

The annual dinner and meeting was held on Monday evening, May 6, at the Mona Lisa Cafe. After dinner, a short business session was held and informal talks of a reminiscent nature were given by Mr. W. A. Spalding, Mr. W. A. Butterworth and Professor Melville Dozier. President Sargent gave a summary of the financial condition of the Academy and Mr. Hill read the Secretary's report. Dr. Richard H. Swift announced the results of the annual election for the Board of Directors. All members of the Board were re-elected. President Sargent introduced the speaker of the evening, Dr. Carl S. Knopf, of the University of Southern California, who gave a masterful address on "The Genesis of Scientific Thought."

Board Meeting:

A meeting of the new Board of Directors was called by President Sargent immediately following the annual meeting on Monday evening, May 6. The principal item of business was the election of officers at which time Mr. Sargent was re-elected President and Treasurer, Dr. Ford A. Carpenter was re-elected Vice-President and Dr. Carl S. Knopf was elected Secretary. Mr. Hill was appointed by the President as Chairman of the Program Committee.

Howard R. Hill, Secretary
BULLETIN of the SOUTHERN CALIFORNIA ACADEMY of SCIENCES

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Publications of the
Southern California Academy of Sciences

The Academy has published to date the following:

PROCEEDINGS. 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.
MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station—1897 to 1907. Ten numbers.

All issues of the above are now out of print.

 Bulletin of the
Southern California Academy of Sciences

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The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

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LOS ANGELES, CALIFORNIA

Vol. XXXIV  September-December, 1935  Part 3

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Issued Jan. 15, 1936
Southern California Academy of Sciences

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Office of the Academy
Los Angeles Museum, Exposition Park, Los Angeles, Cal.
NOTES ON SOUTHWESTERN PLANTS
By F. Raymond Fosberg and Joseph Ewan

The present series of notes, chiefly distributional, have accumulated during several years of plant collecting in the southwestern United States and northwestern Mexico. To these, based on the authors' collections, are added a few notes from certain collections of others received chiefly in exchange. Of the range extensions noted, perhaps some of those included for Mexico are of little phytogeographic importance, but since floras are, and probably will be for some time to come, written on the basis of political boundaries, such notes seemed worth recording. The citation of original place of publication is given for species new to a region or otherwise unfamiliar. Genera are arranged alphabetically within families, except in the Compositae where they are primarily grouped by tribes.

The specimens cited are, except as noted otherwise, at either the Pomona College Herbarium or the Los Angeles Museum Herbarium. Duplicates of many of them are in the herbaria of the University of California and the University of California at Los Angeles or Stanford University.

NEW MEXICO

The following six species and varieties are not recorded by Wooton and Standley in their "Flora of New Mexico" nor in any other publication to our knowledge as occurring in that state. Other compositae determined by Dr. S. F. Blake.

Typha angustifolia L.

Amaranthus fimbriatus (Torr.) Benth. var. denticulatus (Torr.) Uline and Bray
La Mesa (3 mi. west), Dona Ana Co., 10 IX 1930 Fosberg S4026. Only a very few plants seen and only in one spot, on sandy desert among scattered brush.

Sida filiformis Moric.
Pyramid Peak, Dona Ana Co., on the bare, rocky summit, 6 IX 1930 Fosberg S3203 and Conkling Cave at the foot of Pyramid Peak, on limestone alluvium, 2 IX 1930 Fosberg S3521.
Ayenia pusilla L.
Organ Mts. (at the foot of the south end), Dona Ana Co., 9 IX 1930 Fosberg S3719. Growing among large boulders at the mouth of a deep canyon.

Franseria confertiflora (DC.) Rydb.
La Mesa, Dona Ana Co., on a sandy ditch bank, 10 IX 1930 Fosberg S4074.

Helenium microcephalism DC.

Sartwellia mexicana Gray ex Watson
Jornada Range Reserve, 25 miles north of Las Cruces, Dona Ana Co., 27 VIII 1929 Lincoln Ellison 852. Herb. Univ. Calif. at Los Angeles. Growing in caliche soil near Middle Well. The first record for the United States, fide Blake, being previously known from Coahuila and Zacatecas, Mexico, according to Rydberg, l. c. The Jornada Range Reserve, a U. S. Forest Service range experiment station, is "a typical semi-desert range, adjacent to the Rio Grande Valley . . . about 50 miles north of the Mexican boundary." (Ecology 10:392.)

ARIZONA AND SONORA

Calochortus Kennedyi Porter var. Munzii Jeps.
East slope of Tumacacori Mts. west of Nogales, Santa Cruz Co., Ariz., 6 IV 1932 Fosberg 7935 and 15 miles southeast of Vail, Pima Co., Ariz., 7 IV 1932 Fosberg 7937. Previously recorded from southern Utah west to the ranges of extreme eastern Inyo and San Bernardino counties, Calif.

Calochortus Kennedyi Porter
Covered Wells, Pima Co., Ariz., 7 IV 1932 Fosberg 7938 and 15 miles north of Magdalena, Sonora, Mex., 5 IV 1932 Fosberg 7936. These collections definitely establish the presence of this species in southern Arizona and extend its range into Sonora, Mexico.

Euphorbia lata Engelm.
Fifteen miles north of Magdalena, Sonora, Mex., 5 IV 1932 Fosberg 7430 (in Herb. Univ. Calif. at Los Angeles). Growing on the dry, flat floor of the valley, an old flood plain, in company
with Prosopis chilensis. This species, previously known from "Kansas to Texas and New Mexico", may represent a composite element as the present collection has the leaves broader and blunter than specimens seen of this species.

**Haplopappus gracilis (Nutt.) Gray**

Sells, Papago Indian Reservation, Pima Co., Ariz., IX 1931, S. W. Hutchinson 6927 (in Ewan Herb.). A collection remarkable for having the receptacle conspicuously "setigerous" chaffy-bracted. Indeed, so pronounced is the development of these receptacular bracts that the plant violates generally proposed keys to the Tribe Astereae. Dr. Blake, to whom the collection was submitted for determination, directed our attention to Hall's comment: receptacle with "numerous linear scales about 1 mm. long (these resulting from breaking down of the walls of alveoli)" (Genus Haplopappus, Carn. Inst. Wash. Publ. 389:63, 1928). In the Hutchinson collection the scales would suggest, says Dr. Blake, "an excessive development of the alveoli [rather] than a breaking down" (letter of 26 VIII 1933). A similarly chaffy receptacle has been recorded by Blake in H. spinulosus var. scabrellus (Greene) Blake (Contr. Gray Herb. 52:25, 1917).

**BAJA CALIFORNIA, MEXICO**

In checking the following recent collections against published lists for the region, such as T. S. Brandegee's "Southern extension of California flora" (Zoe 4:199-210. 1893), the disappearance of species known from the Coronado Islands off extreme northern Baja California upon reaching Cedros and Guadalupe islands is impressive. The conspectus of the insular floras prepared by Alice Eastwood (Proc. Calif. Acad. Sci. ser. 4, 18:393-484, 1929) has here been employed, along with Greene's paper on the Coronado Islands (West. Am. Sci. 1:69-71. 1885).

**Elymus condensatus Presl**

Descanso Bay, on the inner edge of the sand dunes, 5 IX 1931 Fosberg S5690 and South Coronado Isl., on a dry steep slope, 15 VIII 1931 Fosberg S5807. Recorded for North Coronado Isl. by Greene, i.e. but not known from Guadalupe or Cedros islands.

**Chlorogalum parviflorum Wats.**

Hills southwest of Valle Redondo, on dry open slopes of hard adobe soil filled with rocks, 30 V 1932 Fosberg 8388. Recorded for northern Lower California by Orcutt without indication of definite locality (Fl. So. and L. Calif. 10. 1885).

**Silene laciniata Cav.**

South Coronado Isl. on steep burned-over slope, 15 VIII 1931 Fosberg S5809. Reported by Greene for North Coronado Isl. but unknown from either Guadalupe or Cedros islands.
Convolvulus occidentalis Gray var. angustissimus Gray
Hills northeast of Valle Redondo, in chaparral, 30 V 1932 Fosberg 8418.

Solanum Douglassii Dunal

Cordylanthus rigidus (Benth.) Jeps.
Tecate, in chaparral, 30 V 1932 Fosberg 8461. This is the “C. filifolius” of Orcutt’s list (Fl. So. and L. Calif. 9. 1885).

Galvesia juncea (Benth.) Gray
Punta Banda, Todos Santos Bay, 6 IX 1931 Fosberg S5702. The most northerly record of this species, previously, seems to be from San Antônio Cañon, Baja California, so that this is a considerable extension of range.

Scrophularia californica Cham.
Tecate, in chaparral, 30 V 1932 Fosberg 8459. This approaches var. laciniata Jeps. in leaf shape but is not hairy.

Galium angustifolium Nutt.

Stephanomeria exigua Nutt.
South Coronado Isl., on talus slope just above sea level, 15 VIII 1931 Fosberg S5800. Not recorded by Greene for the islands nor is it known from Guadalupe or Cedros islands.

Chrysopsis villosa Nutt.
Descanso Bay, growing abundantly on shifting sand dunes near the ocean, 5 IX 1931 Fosberg S5686. This collection seems to represent an underscribed variety, related to var. echioides (Benth.) Gray, but with larger heads and longer, more erect hairs. The late Dr. H. M. Hall, when it was sent to him, marked it “Chrysopsis villosa var. ?”. It seems inopportune to describe it as new at this time. The genus sorely needs a monographic revision upon the basis of abundant collections from its wide range. In its present condition its varieties are only a source of confusion.

Corethogyne filaginifolia (H. & A.) Nutt. var. virgata (Benth.) Gray
Descanso Bay, on sand dunes, 5 IX 1931 Fosberg S5689. Recorded for northern Lower California by Orcutt (l. c. 6) without indication of variety or definite locality.
Helianthus gracilentus Gray
Tecate, in chaparral, 30 V 1932 Fosberg 7478.

Hemizcnia paniculata Gray ssp. typica Hall ex Keck

Hemizonia tenella (Nutt.) Gray

Baileya pauciradiata Harv. & Gray
Banded Agate Mt., northeastern Baja California, in a sandy wash, 29 V 1932 Fosberg 7470.

Artemisia dracunculus L. ssp. dracunculina (Wats.) Hall & Clements
Descanso Bay, on sand dunes. 5 IX 1931 Fosberg S5688.

SOUTHERN CALIFORNIA

Juncus lescurii Boland.
Mandalay Beach, north of Hueneme, Ventura Co., growing on sand dunes near the ocean, 28 VI 1931 Fosberg S5183 and 5 VII 1931 Fosberg S5332. Inflorescence condensed and head-like. Not previously recorded south of Monterey County. Determination verified by Dr. P. A. Munz.

Eriogonum plumatella Dur. & Hilg.

Salicornia depressa Standl.
Del Rey salt marshes, Los Angeles Co., VI 1930 Fosberg S3062. Previously known from vicinity of San Diego and northern Lower California.

Myosurus cupulatus Wats.
Vicinity of Keyes Ranch, Little San Bernardino Mts., San Bernardino Co., 1 V 1930 Fosberg without no. These tiny plants, whose identity was determined by Dr. P. A. Munz and recently recorded by him (Man. S. Calif. Bot. 174), were growing most unexpectedly in a shaded crevice under great granite boulders. Heretofore known from no farther west than the Providence Mts. of eastern California. There is a sporadic affinity shown between this range and the Providence Mts. to the east. It would present a provocatively interesting study if done in detail.

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Lotus leucophyllus Greene

Conejo Pass, Ventura Co., northwest end of Santa Monica Mts., 28 VI 1931 Fosberg S5186. Not heretofore known from nearer the coast than the Liebre Mts., Los Angeles Co. Determined by Dr. P. A. Munz.

Lotus rigidus (Benth.) Greene

Rogers Canyon, Santa Monica Mts., Los Angeles Co., 23 II 1929 E. L. Peterson (Ewan Herb. 4487). Transmontane desert border species not previously known to reach the coast at any point over its wide range. For a graphic presentation of its range see Ottley, Univ. Calif. Publ. Bot., vol. 10, map 3, 1923. The appearance of this plant in these coastal mountains recalls the discovery of Porophyllum gracile, a typical deserticolous species, in the Santa Ana Range of Orange County (J. T. Howell, Madroño 1:253, 1929). Peterson's collection, unfortunately rather scant but unmistakable, is a good match for Parish Bros. 14 from "Agua Caliente" (i. e. Palm Springs, now Riverside Co.).

Condalia spathulata Gray

Twenty-four miles north of Ogilby, Imperial Co., 21 III 1932 Peirson 9794. This corroborates Parish's long-time record for Mesquite in the same county. Peirson found the species here as large shrubs, often over 8 ft. high. He also noted the plant as growing at Midway Well.

Petalonyx nitidus Wats.

Arrastre Creek at Horsethief Flat, San Bernardino Mts., on gneissic talus of a southwest slope, 4 VIII 1932 Fosberg 8651. The species here formed rounded bushes from caespitose clumps. This station is somewhat more than 2,000 feet higher than its previously known occurrence at Cushenbury Springs.

Brandegea Bigelovii (Wats.) Cogn.

West end of Sheep Hole Mts., San Bernardino Co., on granite debris at the bottom of a small canyon, 24 IV 1932 Fosberg 8020. Not heretofore recorded from the Mohave Desert.

Elaeagnus utilis Nels.

See Am. Jour. Bot. 22:682. 1935. The record of this species, not previously known from southern California, published recently by Munz as Shepherdia argentea Nutt. (Man. S. Calif. Bot. 620) is deserving of further comment. It was made at Rancho Verde, Victorville, San Bernardino Co., 21 V 1932 Fosberg 8201. Collected in flower from a staminate tree 4 or 5 meters tall, the only one seen, in the bed of the Mohave River. The single tree was growing in a rather dense stand of Salix and Populus. No pistillate trees were seen.
Asclepias albicans Wats.
West end of Sheep Hole Mts., San Bernardino Co., 23 IV 1932 Fosberg 8199. Growing in a rocky draw in decomposing granite. Although agreeing with the description in other particulars, this collection differs in having the follicles directed horizontally or downward rather than erect. This insignificant difference scarcely merits a name, even as a form, though the several keys to the species consulted dwell upon this point. This collection extends the range of the plant to the Mohave Desert.

Salvia leucophylla Greene
Carbon Canyon, Puente Hills, San Bernardino Co., 19 VI 1931 Fosberg S5126. This collection taken from a plant wholly white-flowered, growing in a colony of normal plants with lavendar flowers. Perhaps the Wilder collection cited by Munz (Bull. S. Calif. Acad. Sci. 26:24. 1927) was actually made in this county.

Castilleia linariaefolia Benth.
Mission Creek, San Bernardino Mts., Riverside Co., in a marshy alkaline place near the mouth of the canyon, 940 m. 12 VII 1932 Fosberg 8598. Here penetrating into confines of Colorado Desert where it has not been heretofore known.

Chrysanthemum coronarium L. Sp. Pl. 890. 1753

Chrysanthemum Leucanthemum L. Sp. Pl. 888. 1753

University of Hawaii, Honolulu and University of California, Berkeley
SOME UNPUBLISHED CYLINDER SEALS

By Dr. R. H. Swift

“In Babylon every man has a seal and a staff, curiously wrought.”
Herodotus: Book I, Clio. (Cary trans.)

The writer wishes to place before the Academy the results of a study of a fine collection of ancient Near Eastern seals presented to him by Prof. H. C. Parker. Seals, next to the clay tablets, are the most numerous mementos in the remains of those ancient civilizations. To archeology they present an intimate insight into the mythology and close personal life of the people. In spite of the abundance of these fine examples of glyptic art, the literature on the subject is unusually scant; an outstanding exception being the work of William Hayes Ward, for the Carnegie Institution in 1910, to which the author of this paper acknowledges valuable assistance.

The intricate commercial and business systems early developed by the ancient Levantine civilizations demanded personal identification and guarantee. The finger or nail mark was first used to attest the clay document and persisted, according to Menant, for buyer and witnesses, even after the seller used his seal. A lessee, a creditor, a contractor, a guarantor—in other words, the one who gives up claim or takes an obligation—seals. In partnerships both parties used their seals.

Cylinder seals are possible of geographical classification into Egyptian, Chaldean, Babylonian, Assyrian, Hittite, Syrian, Phoenician, Mycenaean, Cyprian, and Achaemenian Persian.

The earliest Sumerian cemeteries at Abu Hatab and Farra contain seals. In the author’s opinion the seal, as a mark of identification, antedates writing. Pére Scheil places the oldest prior to 4000 B. C. The most ancient seals that have come down to us, were on fragments of the Persian Gulf oyster shell, *Tridaena squamosa*. An interesting theory as to the origin of the cylinder seal is suggested by the character “Mu,” meaning a name, being an arrow with two crossed parallel lines, the owner’s mark cut in the shaft, according to Dr. Hilprecht.

The sizes vary from 3/4 of an inch to 2 inches. Early Babylonian cylinders were slightly concave on their surfaces, straight after the Kassite period, and often convex in Persian times. Flat seals were not used by the early Chaldeans, but they supplanted the cylinder after the ninth century before the Christian era. Cones were used by the Seleucidae and the Parthians. The early use of papyrus and a preference for seal rings made the cylinders rare in the Nile valley (see Bulletin, Vol. XXX, Pt. 1, Pl. III, No. 7).
There was a great variety of material used in the cylinders. The earliest substance may have been sections of reed, but none have come down to us. Hematite is the most commonly found but chalcedony, obsidian, agate, jasper, lapis, marble, serpentine, quartz, carnelian and silver are known, the latter being very rare. The Assyrians preferred fine stones, such as onyx, chalcedony or lapis, from the hills of Elam or Persia.

Fabrication and engraving seems to have first been done with but two tools, a burr and a fine chaser of corundum, the cut being freehand. After about 1500 B. C. the revolving burr, disk and tube, for making dots, lines and circles or crescents was employed—the “terebinarum ferva” of Pliny. This technique was probably learned from Egypt. Copper tools with emery were used in later workmanship (see Jer. 17:1). Emery and corundum were imported from Ethiopia, Elam and Cyprus. A common error is to mistake crudity for great antiquity, where cheap or unskilled attempts were made in later days.

Methods of wearing or carrying the seals seem to have varied. The worn holes would indicate an unfixed mounting. Metal mounts have been found (8).* Bronze stems with rings were found at Khorsabad, and now are in the Louvre. Roller or swivel mountings are suggested from some of the impressions, yet none have been found, as far as I have been able to determine. The rarity of oxidized areas in the holes, as we find in the scarab of Egypt, would rather indicate that such modes of mounting were rare. In the Kassite period bands of embossed gold have been found about the cylinders. The fact that we seldom find a whole sharp impression, but usually several separate side strikes, would confirm the Chaldean illustrations showing the seal on a wrist cord. Such depiction is not seen on the Assyrian figures, where it may have been the custom to hang the cylinder around the neck or in belt-bags.

The intimate and personal nature of the cylinder seals caused an amuletic or talismanic power to be attributed to them, from the earliest times. Often they were buried with other personal effects at the death of their owner, but usually blanks or special funery seals were interred, while the originals passed to the heir.

The work of the industrial artizan is actually a reflection of the artist in the fine arts. In the engravings on the seals a rich field is open to the student into the popular ideals of these ancient nations, the art of a vigorous and progressive race, and leads deeper into the realization, ultimately gained by all engaged in archeology, that life today differs in no essential factors from those of five thousand years ago. In fact, much that we call modern may be seen here in humble early conceptions or, to our greater astonishment, we find systems in common use which we have been led to believe were the products of the minds of men.

* The numerals in brackets refer to numbers on Plate 56. See page 189.

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of our own generation. We find advanced legal codes and commercial methods comparable to those of our exalted Twentieth Century. Many of our standards of weights and measures have come down to us from Babylonia, via the Phoenicians, Greeks and Romans. From their Sexagesimal system we have the twelve divisions of the clock, the twelve months of the year, the twelve inches to the foot, the seven days of the week, the mile, the British currency and the 360 degrees in the circle.

The wages of the seal engravers were from three to five grains of silver per day, that metal being, however, near one hundred times its present value. Private names were often engraved on stock seal blanks, chosen because of a depicted reference to some preferred or guiding deity.

In the earlier engraving, animal forms were more accurate than the human figures (12 and 13). The human depictions in Periods II and III (see table) are usually shown with a bird-like profile, prominent nose, a great eye, and either nude or in short garments. In Period IV the forms become fixed and conventional, wings are given to the gods, and a new group of symbols appears. In Period V, long inscriptions with but few figures are common. The length of the inscription is reduced in the characteristic seal of the Second Babylonian Empire, or Period VI. The Hittite commonly used "rope patterns" (7 and 11). The Assyrian of this period seldom engraved inscriptions, tending chiefly to the use of sacred symbols as the "Hom" or sacred tree (2), winged globe (4) probably from the Egyptian symbol of Rā, and fantastic animals. The costume also differs from the Babylonian, in that the mantle fringes cross the body at an angle (4). With the fall of Ninevah the art on the cylinder rapidly declines. In Period VII the "trouser" costume (6) of Persia, together with flower designs (7) appear.

Onto the cylinders are graven the current myths and rich symbolisms expressing the religious fervor of the masses. The early Semitic conquest and amalgamation, brought to the Sumerian the anthropomorphic concept of the gods, supplanting that of the "Zī," or spirit of life, manifest in all things that have motion—water, man, wind or beast. The god concept was pictured as a star. Analogies of the Babylonian and Assyrian pantheon are to be found in Greek, Roman and Norse mythologies, indicating a common Sytho-Aryan prototype. The Babylonian gods were humanized, while esoteric Egypt, to the end, seemed to feel instinctively a kinship in life's mysteries and pictured her gods as part animal. The materialistic Babylonian and conquering Assyrian, saw no greater power than man, hence his gods were human rulers of the elements, the heavens, the earth, the watery sea, the time-measuring moon, and the storm—Anu, Enlil, Ea, Sin, and Adad.

A tablet in the British Museum lists seven supreme gods, fifty deities of heaven and earth, three hundred celestial and six hundred terrestrial spirits. A henotheism of local or personal
supreme deities followed, as shown by the figures and given-names (3 and 16) on the seals. One god is held supreme, as in the earlier Biblical references, but no true Monotheism is found. This local supremacy led to the confused shifting of attributes of the deities, so puzzling to modern students.

Lenormant shows that at the birth of every child a dedication was made to some god, after and throughout life to be know as theirs. If wicked, the deity would withdraw protection. They were rather ambiguous as to the post mortem existence of the "Ekimmu" or soul, in contrast to the Egyptians' certainty of their "Ka." The unburied dead wandered about haunting the living, whose only protection against the death spirit was the dog (12), according to the Zend-Avesta. The properly buried ones dwelt in "Aralu," the dark land, ruled by Nergal (10) and Belis-Allat, and led a rather drab existence.

An absolute creation was not conceived, but rather the establishment of order out of chaos, as in the Hebrew account, and the role of the genius of this act was attributed to the local supreme god—Ea in Eridu, Enlil in Nippur, and Marduk in Babylon. On the seals we see Marduk, vanquisher of Tiamat (5), the monster of chaos (see Fourth Tablet of Creation, British Museum. No. 93,016). The gods alone may eat of the tree of life (2), as in the Bible story (Gen. 3:5).

Emblems of the gods are numerous on the cylinders among which are the three dots, meaning thirty, or the crescent moon of Sin (6, 12 and 16); the star of Ishtar (2); the thunderbolt of Adad (1); the winged disc of Ashur (4 and 5) (see Malachi 4:2); the rhomb (female emblem) of Belis, goddess of fertility (2, 4 and 5); the fish of Shamish (2); the libra of Nebo (6 and 10); the scorpion of Iskhar (13); the dog of Gula-Bau (12), and the spear or simitar of Marduk (17). These symbols are often my only means of identifying the deity depicted in conventional form.

Myths and popular tales are shown on these seals. The conquest of Ereshkigal, queen of hell, by Nergal (10), after which he marries her and becomes king of the underworld, as told on tablets found in 1887 at Tell-el-Ämarna (No. 82 in British Museum) in Egypt. Enlil gives his sacred and mystic name to his son Marduk, who thus becomes Bēlu, or Baal (lord of all), later to become the word for "god" in other countries (9). On one seal (8) our attention is directed to the story of Ishtar's descent into Hades, the land of no return, where she is divested of her clothing and smitten with disease by Ereshkigal, queen of that dread region. The messenger of the gods sees that with the goddess of love gone, no sex life is possible on earth. He rushes to Shammash who makes a successful appeal to Ea to save her, which is done, and the world again loves. I feel that this is the story depicted on this seal and is not intended to represent the goddess Zirbanit, imported in later times from the west, as contended by Lenormant.
The Gilgamesh epics have furnished numerous subjects for
the seals (12 and 13) as this hero was to the Babylonians what
Hercules or Odysseus was to the Hellenes, and Seigfried to the
early Teutons. He was probably a historic personage, a ruler of
Uruk, about whom have developed clouds of legend drawn from
the trials and tribulations of the prehistoric past of the race.
From the episode of the deluge, associated with the great epic
of this hero, the Hebrews procured the story to be found in the
Pentateuch.

Another common myth theme on the cylinders is that
of Marduk's victory over the monster of chaos (5). The prob-
able symbology of spring vanquishing the rigors of winter, as
shown by the festival celebration of this event on New Year's day
in Babylon, was the origin of this dramatic tale.

Thus the stimuli for the legends of Babylon, as elsewhere,
seem to have been either tribal pre-history or the symbolism of
the phenomena of nature.

From the seals we also find interesting corroborations of
names found in history, making possible an exactitude in dating
by similar styles, subjects and location, in uninscribed specimens.

About 2100 B. C, we find Hammurabi, sixth of the line of
Amorite kings of Babylon, whose code of laws has been the
admiration of the modern world since their discovery in 1901.
We have in a group of some fifty-five letters a vivid depiction
of life during his brilliant reign (see "The Letters and Inscrip-
tions of Hamurabi" by King). Among these letters are several
addressed to Sin Idinam, at one time director of drafted labor.
On seal No. 3 we have the seal of this man's son, or possibly
the prince, son of Sin Idinam I, Lugal of Larsa, 2191 B. C. (see
A. T. Clay, "Miscellaneous Inscriptions of the Yale Babylonian
Collection," page 30).

An Adamu (16) of Ur, c. 2500 B. C., is of record (see Lutz,
"Sumerian Temple Records of the Late Ur Dynasty," pp. 141,
159) but the name is common.

New light on the antiquity of the seals, as well as a possible
origin, has been cast by the recent work of Sir John Marshal in
the Indus valley on the sites of the cities of Harappa and Mohenjo,
abandoned c. 2700 B. C.

In closing, the writer wishes to acknowledge his indebted-
ness to Prof. Herschel C. Parker for the specimens for this
study, to Dr. Carl S. Knopf for his aid in the cuneiform trans-
lations, and to many authors whose references to the seals, scat-
tered through the literature, have been compiled in this paper for
the benefit of collectors and museums as an aid in a better under-
standing of the significance of the cylinders. If nothing more,
we may gain in feelings so ably expressed by H. G. Spearling:
"As the old cylinder rolls once more over the plastic clay, we
see appear in strange relief the very forms which greeted the
expectant eyes of men who lived in long forgotten days in far-away Chaldea, eyes that rejoiced at the plain evidence of the protection of those immortal gods whose godship has not lasted as long as the poor stone engraved to celebrate their power and immortality. Eyes that glistened with warm sympathy as upon the clay the simple tale was told of the misfortunes of some persecuted goddess (8), eyes that shone with delight at the story of a hero’s great success (5). In imagination we may see the pride of ownership setting its seal on stores of corn, wine and oil, or signing a contract hopeful of much gain.

**Periods and Approximate Dates of the Civilizations of Western Asia**

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Description of Figures on Plate 51

1—Early Period V, babylonian, hematite seal. A female (?) worshiper offering a kid to Nergal, Chaldean Mars, who stands with his foot on a victim, an upraised sword in one hand and a baton of the five planets in the other. Behind Nergal stands a male figure, possibly the owner, facing the sea-god Ea, who stands on the "goat-fish," holding the triple club.

2—Early Period VI, wheel-cut, Assyrian cylinder of translucent agate, showing two winged man-bulls guarding the "Hom." tree of life. In the field are symbols of the fish, identified with Shamash, the star of Ishtar, a rhomb, female sign of Belis, and above the wing of the left guardian, the Seven Sibitte, or heavenly bodies, while below the creature is the crescent of Sin.

3—Black lodestone, Period IV, Babylonian cylinder seal of fine workmanship, with Ramman, Shala, the figure of a man, probably the owner, and two lines of inscription: "Ri-ish Marduk-ub-shu. Dumu En-Zu l-din-nana." (Rish Marduk Ub-Shu, son of Sin Idinam) c. 2100 B. C.

4—Early Period V, Assyrian cylinder of lapis lazuli, with the god Assur seated on an ornate throne of the planets before a fire-altar, where a worshiper, followed by an iHex, stands in reference. Above the animal is the winged disc of Assur.

5—Red chalcedony, Period VI, wheel-cut cylinder of western Assyria, showing the kneeling Bel Marduk slaying the dragon Tiamat. The winged disc of Assur appears over a rhomb, sign of fertility. Bel holds a scimitar in his left hand, while he plunges a dagger across a small altar into the dragon. Probably of the period of Assurbanipal, 7th century B. C. Phoenician workmanship is suggested in the numerals "15" behind the god. (See M. deClercq, Cat. No. 321.)

6—Early Period VII, Persian seal, showing processional of four men, deeply cut, characteristic of the period of the early Achaemenian kings, c. 600 B. C., by the squatty, heavy figures in trouser-like lower garments. The scene is suggestive of a return from battle with two diminutive captives and a wounded warrior carried by a horseman. Weapons are seen on the backs of the men, and the leader carries a large staff, possibly a modified symbol of the Kassite god of war, Shaqamuna. Over the horse's head is a squirrel-like animal, possibly the tribal totem or owner's crest.

7—Period VI, green serpentine cylinder. Probably western Syro-Hittite with Middle Minoan culture influence. Well balanced, unusually delicate design of flowers on leaves arranged as crosses in double register with a rope pattern, or guilloche, on a flattened surface. Possibly more for a decorative pendant than a seal. Traces of an older engraving are seen.

8—Hematite, Babylonian cylinder seal of early Period V, with modern replica of ancient mounting. Figures of Pap-Sukal, the messenger, informing Shamash of Ishtar's descent into hades, the land of no return. The goddess stands divested of her garments, according to the legend.

9—Period V (?), animal "button-seal" in blackened ivory, representing a hedge-hog. On the base are two figures facing, carved in Syro-Babylonian style. Possibly Marduk receiving The Name from Enlil.
10—Hematite, wheel and point cut cylinder, probably Period V, Babylonian provincial. The bearded god Nergal stands with foot on kneeling victim, possibly Ereshkigal, who holds an offering jar. The god holds a weapon to the head of the figure at his feet. In the field above the victim is a crude locust and behind Nergal is the mace-like “libra,” possibly a key. The type of cut is unusual in that the head-border enclosed engraving is at right angles to the long axis of the cylinder.

11—Period VI, eastern Syro-Hittite hematite cylinder with repeated figures in six columns, consisting of three ibexes, or goats, three Phoenician emblematic hands, five human heads, three dogs, or lions, two seated children, and a dividing row of fifteen crescents or “nail marks,” possible a crude rope design.

12—Rude archaic hematite, Babylonian or Elamite, cylinder of Period II, depicting the conflict of Gilgamesh and Eabani with wild bulls sent by Ishtar to punish the hero for his indifference to her advances. Two winged gates of Ishtar are seen above the vase and “libra,” or key. Three balls, symbol of “30,” the month sign of the moon god Sin, are to be seen over what may be intended for Adad and the bull, but more likely a dog with a dancing figure above.

13—Small, late Period II, Babylonian cylinder of lapis lazuli, archaic minute cut, with crowded figures, probably another episode of the legend of Gilgamesh, showing the hero fighting a leopard, with Eabani between two ibexes, one of which is being attacked by a lion. In the field is a scorpion, symbol of the Kassite Venus, Iskhara.

14—Period IV, Babylonian, or archaic Assyrian hematite cylinder of problematical interpretation. We have either a seated deity before a large ornate altar, drinking through a long tube from a large jar which is being filled by an attendant, or an early alchemist before a still and other apparatus. A fire burns under what may be a series of tubes, condensation taking place into the large jar from which the assistant is examining a sample in a small test-jar, while the “chemist” sits with a staff or wand, directing the process. It is similar in many ways to “tube drinking” scenes on other seals (see Ward’s Cat., Morgan Coll. No. 148).

15—Late Period V, hematite seal, possibly Syro-Hittite in Babylonian style. Crude and crowded. A figure probably intended for the goddess Beltis is seen seated on a lion and holding a child on her lap. The god Nergal stands on a prostrate victim while a crude nude figure offers him a bull (?). Two figures, possibly intended for Ramman and a diminutive Shala, are seen.

16—Period IV, hematite cylinder, probably time of Gudea. The sides are slightly concave and the workmanship fine. The sun god Shamash is seen receiving a worshiper, who is being led into the divine presence by the goddess Aa. The moon symbol of Hurki is seen in front of the god. A two-line inscription reads “En-Zu-Ga-la-ab; Dumu A-da-mu-ta-a-a.” (Sin Gabab, son of Adamuta.)

17—Period IV, Babylonian hematite seal showing Marduk with scimitar, Ramman and a worshiper, with an inscription in two columns: “Dinger Bel (or Samas); Dinger Za-Za (or Igigi).” (Lord Bel (or Shamash), the Igigi, or Spirits of the Lightning (or the Goddess Aa).)
PLATE 51
NOTES AND NEW SPECIES (LEPIDOPTERA, PHALAENIDAE)

By Foster H. Benjamin
Bureau of Entomology and Plant Quarantine, Washington, D. C.

The following notes and descriptions resulted from identification of material for Dr. John Comstock and for various other workers, including Mr. S. E. Crumb, Mr. Fred Lemmer, and Dr. A. G. Richards.

Heliosea Grote
Genotype, Heliosea pictipennis Grote

Besides the genotype, the writer includes "Melicleptria" fasciata Henry Edwards, "Melicleptria" sabulosa Smith, "Melicleptria" cresina Smith, and "Melicleptria" celeris Grote.

All agree in having the fore tibia armed with only a single inner and a single outer claw, and no spines. While no characters were seen in the male genitalia upon which to base any separation of species within this group, H. celeris certainly seems specifically distinct by its larger size, different coloration, and different maculation. All of the other names mentioned above appear to represent only a single variable species.

Typical pictipennis has a fasciate hind wing and a rose purple ground on the fore wing. Typical fasciata differs from this only by the ground of the fore wing being duller and with less of the bright purple coloration. The male type of sabulosa has the fore wing as in fasciata and differs only in having the fasciate white band of the hind wing slightly interrupted by black, causing a spotted appearance. The fore wing of cresina has the median pale area reduced in width, the hind wing with a fasciate white band. Possibly it is a distinct species, but as no trustworthy specific character is evident the writer is inclined to consider it a race.

"Melicleptria" antonito Smith is more or less of an intermediate between Heliosea and Melicleptria, indicating that ultimately Heliosea may fall as a subgenus. The male type of antonito has one fore tibia armed with one inner and three outer claws and two inner spines; the other fore tibia is similar, but with four outer claws. The genitalia agree with those of Heliosea in lacking a definite clasper, and differ from Heliosea by having a harpe of slightly different shape with a reduced corona.

Names are lacking for two units in the genus Heliosea. From the superficial standpoint these would immediately be assigned to specific status, but the writer prefers to associate them as follows:
Heliosea pictipennis defasciata, new subspecies

Entirely similar to *pictipennis fasciata* excepting that the hind wing is nearly uniformly black above, and on the under side the white of the hind wing is largely restricted to the apical and subapical portions of the wing.

Type locality: Death Valley, Calif.

Number and sexes of types: Holotype male, allotype female, two male and one female paratypes, all March 29, 1928, submitted by Dr. John Comstock.

Location of types: In U. S. National Museum, Cat. No. 50075. Paratypes returned to Dr. Comstock.

Heliosea celeris melicleptrioides, new subspecies

Entirely similar to *celeris celeris* excepting that the ground color of the fore wing is olive fuscous, and the median band is conspicuously cream white creating the habitus of a *Meli-cleptria*, while the hind wing has much less of the deep red orange of the typical subspecies.

Type locality: Keddie, Plumas County, Calif.


Location of type: In U. S. National Museum, Cat. No. 50076.

Schinia crenilinea Smith


*Eupanychis crenilinea*, Hampson, 1903, Cat. Lep. Phal. B. M. 4: 95, pl. 69, f. 8.

The type (labeled Houston, Texas) and two other specimens labeled “Ark.” and “Hope, Ark.” are in the National collection. The type lacks the front legs. On the character of the armature of the fore tibia, one Arkansas specimen would fall into the genus *Lygranthæcia*, and the other into the genus *Schinia*. The species seems related to *Schinia balba* Grote and to *Schinia walsinghami* Hy. Edwards, and not to *Eupanychis spinosa* Guenee (genotype of *Eupanychis*). Therefore *crenilinea* should be removed from its present placement in *Eupanychis* and associated with *Schinia balba*.
Eupanychis spinosæ Guenée


_Eupanychis spinosa_, Grote, 1890, Revised Check List, p. 34; Hampson, 1903, Cat. Lep. Phal. B. M. 4: 94, fig. 30; Holland, 1903, Moth Book, p. 226, fig. 136.


The type of _spinosa_ is in the National collection via the Oberthür and the Barnes collections. The pin of the specimen bears the label "Heliothis Spinosaæ Gn. Spec. 937 Canada Coll. Feist, C'est l'individu qui a servi a ma description." This specimen is a female, as stated on the original plate, and not a male as stated in the original description. The hind wing has the white ground color (mentioned in the original description) somewhat stained. The yellow tint shown on the original figure (in contradiction to the description) is presumably only the artist's guess regarding the original coloration. This type is a specimen of the species usually identified as _spinosa_ in collections.

Grote and Robinson, 1870, listed the name _hirtella_ as a synonym.

The name _Eupanychis camina_ Smith is based on a single female specimen, Weed and Fiske no. 2164, Hampton, N. H. A topotype bearing the same Weed and Fiske number, and agreeing perfectly with Smith's description, is in the National collection. It is merely a faded example of _E. spinosa_.

Specimens of this species are not abundant in collections, those in the National collections being mostly from Lakehurst, N. J. (Fred. Lemmer) and from Brown's Mills, N. J. (F. H. Benjamin), a few other specimens being labeled with the names of towns in the pine barren regions of Long Island and of New Jersey.

_Eupanychis scissoides_, new species

Head and thorax rufous brown. Fore wing with the ground color rufous brown, more or less obscured by olivaceous in the median area; ordinary lines and spots indistinct; basal line invisible; transverse anterior line geminate, irregular, in general excurved; median shade of the ground color, outwardly oblique from costa through reniform area, inwardly oblique to inner margin; transverse posterior line obscurely geminate, more or
less produced into a series of small points, excurred around cell, incurved in submedian interspace; subterminal line nearly invisible, indicated by blackish in tornal region; terminal line composed of black dots between the veins; fringe rufous brown, slightly tinted with purplish, and scarcely interlined. Hind wing bright yellow, suffused with black at the extreme base and along inner margin, with a conspicuous quadrate black discocellular mark, and a broad black marginal band; fringe pale, obscurely interlined with purplish rufous. Beneath: Ground color bright yellow; fore wing with a black basal dash connected to a black orbicular; a black reniform outwardly oblique connecting a purplish rufous region, along the costa and at the apex, with a broad black area extending over the tornal region and to opposite the cell, thus isolating a small area of the bright yellow ground color distad of the cell. Hind wing with the costal margin powdered with purplish rufous, with black at base of wing extending along inner margin and joining the broad marginal band, the latter angulate at vein 4, purplish rufous above the angle, black below. Abdomen fuscous above, the segments distally margined with pale scales; beneath tinted with purplish rufous, and with a pair of basal hair pencils, in pockets, scarcely visible except on a slide.

Expanse: Male 20 mm., female 23 mm.

Number and sexes of types: Holotype male and allotype female, both labeled "St. Petersburg, Fla., Oct."

Location of types: In U. S. National Museum, Cat. No. 51085.

The bright yellow ground color of the hind wing, as well as the rufous brown coloration of the fore wing with its uncontrasting maculation, immediately separates the present species from *Eupanychis spinosa*. The new species superficially bears a startling resemblance of *Canidia scissa* Grote (see 1903, Hampson, Cat. Lep. Phal. B. M. 4: 17, pl. 55, f. 5), but the eyes are rounded (as in *Eupanychis*), and not greatly reduced in width (as in *Canidia*); the fore tibia has one claw and two long curved spines on the inner side, and one claw and two short spines on the outer side, while the fore tibia of *C. scissa* has one claw and three rather weak spines on the outer side, and two claws and two weak spines on the inner side. The genitalia of both species are typically heliothid, hence resemble one another strongly, but differ in almost every detail. Those of the new species are much the larger, with more elongated harpes, a more triangular shaped tegumen, and the vesica is much more heavily spiculated.
Euxoa camalpa Dyar


Euxoa clavigera Dyar, 1922, Ins. Insc. Menstr. 10: 166; Draudt, 1924, in Seitz, Macrolepid. 9: 40, pl. 6 d.

The writer considers the types to represent sexes of a single species of Euxoa. The male antenna is heavily bipectinate, almost as in Agrotis (Porosagrotis) orthogonia Morrison. The bifurcate clasper has the outer arm very short, the inner arm of moderate length.

Both of the published names apply to the race from the region of Mexico City, Mexico. The ground color is quite dark, and in addition there is a heavy black irroration; in consequence the maculation is not conspicuously contrasting. The superficial appearance is not unlike that of a well marked Euxoa messoria Harris excepting the pale veins of the median area of the fore wing which resemble those of Porosagrotis.

Euxoa camalpa manca, new subspecies

Similar to typical camalpa but the ground color very pale, the maculation extremely contrasting, the general appearance like that of pale Agrotis (Porosagrotis) orthogonia Morrison, rather than that of a Euxoa.

Type locality: Alpine, Tex.

Number and sexes of types: Holotype male, allotype female; 15 male, 50 female paratypes, various dates, April to August, 1926, all O. C. Poling, collector.

Location of types: In U. S. National Museum (Cat. No. 50674) excepting three paratypes, the latter specimens having been submitted by Dr. John Comstock for identification and returned to him.

Notes: Most authors would unquestionably consider the present insect as specifically distinct, but the writer prefers to describe it as a subspecies of camalpa because no differences of specific significance were found in either antennae or genitalia. Anyone having difficulty in visualizing the startling difference in appearance between typical camalpa and manca may consult Draudt's figures of clavigera and of orthogonia (l. c., pl. 5 h). While these figures are incorrect in many details, the general colorations and habitus are essentially correct.

1 Only a few of the basal joints of a single antenna are present on the male type (of clavigera), but these few joints indicate an antenna entirely similar to that of the following subspecies.
Euxoa bicollaris Grote

Specimens with a broad black band on the collar, thus resembling *abnormis* Smith, were received by the writer about ten years ago from Mr. E. A. Dodge, and were labeled Exeter, Tulare County, Caliû. These specimens present an extremely washed-out appearance, with many of the markings obsolescent, but with the reniform conspicuous. They agree perfectly with Hampson’s figure of a type of *bicollaris* (Cat. Lep. Phal. B. M. 4, pl. 62, f. 10) and in view of the locality are almost certainly that species. The antennae of the males are somewhat more heavily serrate than those of *abnormis*, judging from the unique type of the latter species, but seem slightly less heavily serrate than those of the species usually determined as *bicollaris* in collections, discussed below under the name *sponsa*. The genitalia are of the same general pattern as those of the following new species and of *sponsa*, and a very close relationship of these species having a broad black band on the collar is evident in spite of some minor differences in antennal serrations which have previously been used as grouping characters.

Euxoa invoca, new species

Male antennae minutely serrate and fasciculate. Head and thorax sordid luteous to gray, with a black admixture; collar with a broad black transverse band. Fore wing sordid luteous powdered with black, appearing sordid luteous gray; ordinary lines, excepting the subterminal, poorly defined, the latter an irregular pale shade inwardly defined by fuscous, sometimes brownish, shadings; orbicular large, round or slightly oblong, pale, more or less defined by a thin black line, the center irro- 
rated with black; claviform usually obsolescent, occasionally 
dicated by a few black outlining scales; reniform strongly kidney- 
shaped, pale luteous, with central dusky crescent, and more or 
less outlined by a thin black line; a thin, black, broken terminal 
line; fringe luteous at base, with a darker interline outwardly 
defined faintly by luteous, distally dusky. Hind wing sordid 
whitish, more or less heavily suffused with fuscous, darkest on 
the veins, on the obscure discal mark, and distally; a thin fuscous 
terminal line; fringe luteous at base, tipped with white, and with 
a fuscous interline. Beneath: Fore wing sordid luteous white 
powdered with fuscous, the discal mark obscure; hind wing paler 
luteous white, the fuscous powderings strongest toward the costa, 
on the discocellulars to form a spot, and sometimes forming an 
obscure median shade. Expanse: Male 34-38 mm., the female 
averaging slightly larger.

Somewhat similar in appearance to *abnormis* Smith, and 
formerly isolated in the Barnes collection as possibly that species. 
The antennal serrations, however, resemble those of *bicollaris*,

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being distinctly heavier than those of abnormis. Paler than any
described species in the group excepting bicornaris, and super-
ficially differing from that species by the fore wing being more
powdery, with better defined markings, and appearing grayer.
The genitalia are essentially like those of bicornaris, sponsa loya,
and other species of forms of this series, all of which seem to
possess somewhat variable genitalia from the standpoint of the
exact sizes and shapes of the parts of the bifurcate claspers and
the harpes, even in specimens from identical localities. How-
ever, the harpes of the present species seem more strongly ex-
curved along the ventral margin than those of other species of
the group.

Type locality: Inyo County, Calif.
Number and sexes of types: Holotype male, allotype female,
and 12 male and 10 female paratypes, all 15-30 June 1922 (O.
C. Poling).
Location of types: In U. S. National Museum, Cat. No.
50597.

**Euxoa sponsa Smith**

Several specimens were reared from larvae by Mr. S. E.
Crumb. Both he and the writer consider these specimens to rep-
resent only a single species. One of these appears to agree per-
fectly with the type of sponsa, while the others vary toward
strongly rufous tintings, which with their size and markings make
the series appear intermediate between loya Smith and monte-
clara Smith (obscura Hill). The writer has been unable to iso-
late any stable genitalic difference between specimens represent-
ing these names. Typically loya seems to be a form from the
Sierras, with somewhat more luteous in the region of the reni-
form and a somewhat less chunky appearance than in typical
monteclara. The two latter names have been treated as syno-
nymic in the Barnes & McDunnough Check List and the present
evidence leads to the conclusion that sponsa is also a conspecific
form. However, sponsa may not be the oldest specific name
available. *E. satís* Harvey belongs in the group, and when suffi-
cient specimens are obtained to establish synonymy this name
may take specific priority. Excluding the brighter satís, speci-
mens of the sponsa complex, especially those belonging to the
monteclara form, have very largely constituted the “bicornaris”
of collections.

**Euxoa atropulverea Smith**

This species was originally described from three females.
The type, in the U. S. National Museum, has not as yet been
perfectly matched with any male. The habitus strongly suggests
a dark example of scotogrammoides McDunnough.

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EUXOA BRUNNEIGERA Grote

Topotypical specimens are large for their group, the fore wings of a rich red brown with a conspicuous silken glint.

EUXOA BRUNNEIGERA LATEBRA, new subspecies

Male antennae finely serrate and fasciculate, slightly variable, much as in typical brunneigera. Collar usually with a distinct narrow transverse blackish stripe which occasionally becomes obsolete. Fore wing dark fuscous brown with a silken glint and showing little of the usual red brown tintings; markings essentially as in typical brunneigera. Hind wing nearly uniformly smoky. Beneath: Whitish strongly powdered with fuscous, with common medial line, and a discal spot on each wing. Sexes similar in appearance. Expanse: Male 33-38 mm., female the same.

Male genitalia similar to those of typical brunneigera, somewhat smaller in size, somewhat variable in the exact shape of the harpe, in the lengths of the arms of the bifurcate clasper, and in their proportions to one another.

Type locality: Truckee, Calif.

Number and sexes of types: Holotype male, July 16-23, allotype female, Aug. 16-23, and 6 male and 10 female paratypes with various dates, July 1 to Sept. 30.

Location of types: In U. S. National Museum, Cat. No. 50097.

Notes: The present series was separated by Dr. Barnes as a distinct species with a note that it was the brunneigera of the National Museum. While its darker coloration makes it unique in the brunneigera group, the writer prefers to at least temporarily consider it a subspecies, although its claim to specific rank is at least equal to that of many of the so-called species of Euxoa. It is, to a large extent, the basis of records of brunneigera from California by J. B. Smith, and a series from Placer County, bearing a Koebele rearing number 141, is in the U. S. National Museum. This series is the brunneigera of Cockerell (1905, Can. Ent. 37: 361) and of Dyar (1899, Proc. Ent. Soc. Wash. 4: 318; and 1903, in Hampson, Cat. Lep. Phal. B. M. 4: 270), the latter author describing the larvae.

EUXOA BIFASCIATA Smith

The writer has never seen another specimen exactly like the type which is figured both by Hampson and by Holland, the latter figure by far the more accurate.
Euxoa bifasciata lowensis, new subspecies

Male antenna finely serrate and fasciculate. Base of collar with an evanescent black stripe. Fore wing with the ground color ochreous, more or less suffused with rufous purple; markings as in bifasciata, but all of the lines thin and neat, almost lacking the geminate appearance and not diffused; orbicular and reniform inconspicuously outlined in black; subterminal line indicated by its shading; median shade often obsolescent in the male, usually easily visible on the female. Hind wing whitish, strongly tinged with dull purplish brown, darker in the female. Fringes as in bifasciata and some of the paler brunneigera forms. Beneath whitish, slightly tinged with luteous and powdered with darker scales, the usual common line obsolescent in the male, indicated in the female, the usual discocellular spots practically absent in both sexes. Expanse: Male 34 mm., female 29 mm.

Male genitalia essentially as in the brunneigera group but the inner arm of the clasper, like that of the type of bifasciata, more strongly S-shaped.

Type locality: Mt. Lowe, Calif.

Number and sexes of types: Holotype male, allotype female, and 7 male and 4 female paratypes, all Aug. 1-7 1921.

Location of types: In U. S. National Museum, (Cat. No. 50098); paratypes returned to Dr. Comstock.

Notes: Received from Dr. John Comstock for identification. The present insect is possibly distinct specifically, but the writer prefers to describe it as a subspecies of bifasciata.

Euxoa bifasciata bisagittifera, new subspecies

Male antennae serrate and fasciculate, the serrations appearing longer than those of bifasciata and of lowensis, possibly because of the larger size of the individuals. Ground color of the head, collar, and fore wing concolorously ochre drab slightly powdered with fuscous, the collar with no interline or with only a slight trace of one; markings as in brunneigera except that the gemination of the lines is not so pronounced, while the median shade is obsolescent, and the transverse anterior and posterior lines more conspicuous, thus creating a bifasciate appearance. Hind wing suffused with ochre drab, paler basally. Beneath: Whitish, strongly tinged with ochre drab and powdered with fuscous, with a common line, and with a faint discocellular spot on each wing. Expanse: Male 37 mm., female 37-39 mm.

Male genitalia essentially of the same general pattern as those of the brunneigera group, but the inner and outer arms
of the bifurcate clasper are subequal in length, and the harpe much more boot-shaped.

Type locality: Glenwood Springs, Colo.

Number and sexes of types: Holotype male, Sept. 1-7, allo-type female, Aug. 20, and 1 female paratype, Aug. 24-30.

Location of types: In U. S. National Museum, Cat. No. 50099.

Notes: The present insect formed, in part, the "bifasciata" of the Barnes collection. While very probably specifically distinct, the writer prefers to describe it as a subspecies and retain it in that status until a sufficient quantity of the true bifasciata is obtained to indicate the correct rank of these closely related organisms.

**Euxoa pleuriticoides, new species**

Male antennae serrate and fasciculate. Head, thorax, and fore wing pale olive brown, suffused with darker olive brown, irrorated with whitish and fuscous; collar with a distinct, conspicuous but thin, transverse black line. Fore wing with the basal line black, geminate, visible as two conspicuous oblique dashes on costa, interrupted across base of cell, as two small spots below cell, invisible below submedian fold; transverse anterior line black, geminate, produced to points in the cell, on submedian fold, and below vein 1; orbicular slightly oval, nearly round, filled with fuscous, defined by white, obscurely outlined by a thin black line; claviform large, concolorous, more or less outlined by black; reniform kidney-shaped, with more or less of a luteous crescent in the fuscous filling, defined by luteous and whitish, faintly outlined by black; transverse posterior line blackish, faintly geminate, the outermost of the lines more or less obsolescent, strongly produced to points on the veins, excurred around cell, slightly incurred in submedian area; subterminal line inwardly defined by fuscous shadings which more or less form sagittate dashes between veins 6-5 and 5-4 and also form a subtornal blotch, the line itself pale, irregular, inwardly oblique from costa to vein 7, produced to points on veins 7, 6, 4, and 3, forming a W-mark on the two latter veins; terminal line a row of contiguous black crescents; veins disconcolorously marked with black and with white scaling; fringe luteous at base, with fuscous interline outwardly defined by a thin whitish line, terminally mixed fuscous and whitish. Hind wing white, with the veins, discal spot, and terminal margin marked with fuscous, the inner margin tinged with rufous; terminal line black; fringed luteous at base, with fuscous interline, distally conspicuously pure white. Beneath: White or whitish; the fore wing suffused and irrorated with fuscous; the hind wing with fuscous irrorating the costal and subcostal areas, tinging
the veins and slightly suffusing the outer margin; each wing with a broken black terminal line, a fuscous discal mark, and an obscure common shade-line lost below vein 5 of the hind wing; fringes as on upper side, but the markings more obscure. Expanse: Male 46-47 mm.

Superficially the present species resembles simona McDunnough and pleuritica Grote, but is the largest known species in this group. The male antennae are somewhat more heavily serrate and fasciculate than those of simona but on the whole the ratio between the serrations of the antennae of all three species seems about proportional to the average size of the adults of these species. The male genitalia combine characters of both of the other above-mentioned species; shape of harpe as in pleuritica, truncate, with the anal angle almost acute; sacculus as in simona, heavy; agreeing with the latter in possessing a clasper with a stout outer arm, the inner arm more like that of pleuritica; also agreeing with simona in the asymmetry of the bifurcate claspers.

Type localities and number and sexes of types: Holotype male, Crater Lake, Oreg., July 16-23; paratype male, Truckee, Calif., 8-26 (Coll. Jacob Doll).

Location of types: In U. S. National Museum, Cat. No. 50602.

Notes: A female labeled "Alamosa, Col." and "VIII-11" (Coll. Jacob Doll) may be conspecific.

Euxoa lillooet McDunnough


This species was described from six females from Seton Lake and Salmon Arm, British Columbia. It is represented in the National collection by a paratype from the latter locality, and by specimens from Stockton and Eureka, Utah, from Durango and Glenwood Springs, Colo., from Jemez Springs and Little Tesuque Canyon, vicinity of Santa Fe, N. Mex., and from White Swan, Wash.

Eubuchholzia Barnes & Benjamin

Type, Arsilonche colorada Smith

The generic characters have been discussed under the name Buchholzia Barnes & Benjamin (1926, Pan. Pac. Ent. 3: 68), subsequently amended to Eubuchholzia Barnes & Benjamin (1929, Bull. Brooklyn Ent. Soc. 24: 184).

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**Eubuchholzia colorada Smith**


* Cea cirphidia Hampson, 1910, 1. c. 9: 280, pl. 143, f. 13; Barnes & McDunnough, 1917, Check List, p. 72.

* Cea leucanidia Hampson, 1910, 1. c. 9: 280, text fig. 119; Barnes & McDunnough, 1917, 1. c., p. 72 (syn. of colorada).

* Cea colorada, Barnes & McDunnough, 1917, 1. c., p. 72.


The species seems to have a wide distribution yet is relatively rare in collections. Only five males and four females, mostly in poor but recognizable condition, are in the U. S. National Museum. These are labeled Glenwood Springs, Colo. [type female and female “cotype” of colorada]; Salt Lake City, Utah; Callao, Juab County, Utah; Pullman, Wash.; West U. S. A., Walsingham [type lot of leucanidia] [Crooked River, Oreg.]; and San Diego, Calif. Specimens vary in the depth of coloration, especially noticeable in the amounts of brownish suffusion on the hind wings, which in some individuals appear almost ochreous white, in others varying to heavily suffused with brown. The presence of, or absence of, black marking the discocellars of the fore wings seems of no significance. Capt. Riley reports the types of both of Hampson’s names to show no structural difference, special attention having been given to the peculiar frons. The male genitalia of individuals from Callao, from Pullman, and from San Diego seem identical.

The writer therefore concludes that Hampson simply named the two extremes of *E. colorada*. This confusion is partly accounted for by the fact that he misidentified a Colorado specimen of *Simyra henrici* Grote as colorada Smith and his description and figure under the latter name apply to *henrici*. The misidentification seems to have been the natural outgrowth of Smith’s erroneous assignment of *colorada* to *Arsilonche* (sensu *Simyra*), and partly because of the variability of *henrici*, that species also extending farther westward than generally known.
Graptolitha lepida Grote


*Graptolitha lepida*, Hampson, 1906, Cat. Lep. Phal. B. M. 6: 260, pl. 102, f. 16; Draudt, 1925, in Seitz, Macrolep. 7: 196, pl. 28g.

This species was first described by Grote in much detail as "*Lithophane lepida*, Lintner M.S.", with the only cited locality "Oldtown, Me. (Mr. Charles Fish)." Later in the same year Lintner described the species as new "from 2 males and 3 females taken at Sugar, at Center, N. Y., on October 1st, 8th, 9th, 12th and 15th by Mr. W. W. Hill. The types are in Mr. Hill's cabinet." He also cites the Grote reference and the Maine locality.

According to information furnished by Dr. A. G. Richards there is a specimen labeled type, Center, N. Y., W. W. Hill, in the New York State Museum, Albany, N. Y. The National collection contains 2 males and 3 females of which 1 male topotype (W. W. Hill) was recently obtained through the courtesy of Dr. Richards. The other two females are also topotypes (W. W. Hill), and one of them may be an actual type, of Lintner's *lepida*. The writer has no record of the present location of the Oldtown, Maine (Charles Fish) specimen from which Grote drew his description. It is not listed by Hampsen (i. e.) as being in the British Museum, where it should be.

The species has been amply described by Grote, Lintner, Smith, and Hampson, and is figured by the two last authors. The Hampson figure is good. The Smith figure is poor, obviously owing at least in part to faulty lighting during the process of photographing. The right side of this figure is much too pale for any known *lepidia* form, while the left side strongly resembles that of *vanduzeei* Barnes discussed below. Draudt's figure is probably copied from Hampson's.

Graptolitha lepidi vanduzeei Barnes

*Graptolitha vanduzeei* Barnes, 1928, Pan. Pac. Ent. 5: 9.

A single specimen, a paratype male, is in the National collection.

The genitalia do not indicate a species distinct from *lepida*. The abdomen had been glued on this specimen, but is presumably authentic as this example was one of the last received by Dr. Barnes, who did not repair specimens with parts of other specimens, and the chance of someone in California repairing with an abdomen of the rare eastern *lepidia* is remote.
Superficially the paratype of *vanduzeci* is almost identical with typical *lepidia*, excepting that there are a few whitish scales in the base of the reniform, in the claviform area, and in the subterminal area on the submedian fold.

While the original description compares *vanduzeci* with "*lepidia*," the latter name was employed by Barnes for a long series of specimens from the New Jersey pine barrens which in recent years have been distributed as *lepidia*.

**Graptolitha lepidia adipel, new subspecies**


Similar to typical *lepidia* but much smoother in appearance, the maculation of the fore wing much less distinct, the transverse anterior and transverse posterior lines connected or nearly connected by their own dentation in the submedian fold (as in typical *lepidia*) but with the strong black bar of typical *lepidia* and of its variety *vanduzeci* obsolescent or obsolete, the general lack of strong maculation causing the present variety to fall into the same couplet with the otherwise very different *unimoda*.

Lintner in Hampson's key. Hind wing darker red brown than that of typical *lepidia*.

Type locality: Lakehurst, N. J. (Fred. Lemmer).

Number and sexes of types: Holotype male, allotype female, and 64 male and 87 female paratypes bearing various dates, November, also April 5, April 23 and May 21.

Location of types: In U. S. National Museum (Cat. No. 51191); 105 paratypes returned to Mr. Lemmer.

Notes: Notwithstanding that the difference in habitus and in superficial characters between the present form and typical *lepidia* is about equivalent to that of *unimoda* Lintner versus *lepidia* Grote, and sufficient to cause *vanduzeci* to be described as a distinct species, the writer prefers to describe the specimens from the pine barrens as representing a subspecies of *lepidia*. No character was found in the genitalia to indicate specific distinctness. However, on other groups of the same genus, species, which are unquestionably considered distinct from one another, can scarcely be distinguished from one another by male genitalia. Hence the similarity of these structures as between typical *lepidia* and *adipel* cannot be considered as absolute proof of conspecific identity. Besides the type series, only two specimens taken by collectors other than Mr. Lemmer are in the National collection, and these are also labeled Lakehurst, N. J. The unusually late fall date of flight, when few people are collecting, at least partly accounts for the rarity of *adipel* in collections.
Mammifrontia Barnes and Lindsey

Genotype, Mammifrontia leucania Barnes and Lindsey.

Barnes and Lindsey, 1922, Bull. Brooklyn Ent. Soc. 17: 75, leucania (new species) sole species and designated type.

The original descriptions of the genus and species were based upon a unique female specimen labeled “Cedar City, Utah,” and “Holotype male,” but cited as a female in the descriptions. The generic description is inaccurate, as veins 3 and 4 of the hind wing are slightly stalked in the type specimen, a single spine is present between the spurs of the hind tibia, and, while the thorax of the specimen is rubbed, there is a decided indication that the prothorax originally possessed a tufted crest.

There is now an additional specimen, a male, in bad condition and lacking both hind legs and genitalia, in the National collection. The male antenna is practically simple, the joints being only slightly marked and fasciculated. In this male, veins 3 and 4 of the hind wing are connate. The specimen is labeled “Callao, Juab Co., Utah,” and was collected by Tom Spalding.

The female genitalia of the genotype are peculiar in that the bursa is small, the genital opening is strongly invaginated in the form of a V, and the two halves of the ovipostor are each obliquely truncate at the tip and also produced to a small caudo-lateral tooth.

Mammifrontia rileyi, new species

Head, thorax, abdomen, and fore wing ochreous; the prothorax tinged with purple. Fore wing more or less irrorated with rufous brown to fuscous purple, these darker colorations defining the ochreous-white veins; lower angle of discocellulars somewhat darkened; the ordinary spots and markings obsolete; fringe basally pale ochreous, distally white, with a faintly darker and usually purplish interline. Hind wing silken, pale cream white, the veins and the basal half of the fringe slightly darker cream color. Expanse: Male 29 mm., female 30-34 mm.

Number and sexes of types: Holotype male, Glendale, Calif., “April 11-26”; allotype female, id., “March 9-27”; paratypes as follows: 2 females, Los Angeles, Calif., “May 1-20-28”; 1 female, Los Angeles Co., Calif. (date illegible); 1 female, Verdugo, Glendale (Calif.), “June 1-15-25”; 1 female, Ventura, Calif., June 13, 1916, E. O. Essig collector, on wild rye; all, excepting the last mentioned specimen, from Dr. John Comstock for determination.
Location of types: In U. S. National Museum, Cat. No. 50603; 1 paratype deposited in the British Museum of Natural History; others returned to Dr. Comstock.

Notes: Named in grateful acknowledgment of the assistance of Capt. N. D. Riley of the British Museum.

The present species superficially resembles those specimens of *Leucania pallens* Linnaeus which possess the fore wings tinged with rufous, lack the subterminal black dots, and have white hind wings, thus differing from *M. leucania* which is a much smoother-appearing species lacking the contrasting white lines on the veins. Fresh specimens of the new species have a strong tufted crest on the prothorax, and a slight double ridge-like crest on the metathorax. These crests are easily lost by rubbing, and certain scale formations on the available specimens of *M. leucania* indicate that they are also present in fresh specimens of that species. Veins 6 and 7 of the hind wing are shortly stalked (connate in *M. leucania*); while veins 3 and 4 are connate in all specimens before the writer (variable in *M. leucania*), and there is no spine between the spurs of the hind tibia (a character which has been considered of subfamily significance, but which is not specific in the related genus *Apamea* and in several other Apatelinae). In view of the entire similarity of the other external characters usually used in defining apateline genera, including both the peculiar head structures and the habitus, indicating that the larvae are probably stem borers in grasses or similar plants, the writer prefers to place the new species with *leucania* in the genus *Mammifrontia*, rather than to create a new generic name. However, the female genitalia of the new species indicate that it is not as closely related to *M. leucania* as the external characters which are ordinarily used would seem to suggest. Each half of the ovipositor tapers toward the tip, being slightly curved, and neither tuncated nor produced to a caudo-lateral tooth; the genital opening is evenly produced, and is not in the form of a V; the genital tube is ridged with strong chiten in an irregular manner, and is more heavily spiculated than that of *leucania*; and the bursa is relatively large.

Examination of fresh material of *M. leucania*, especially males, is necessary before any decision can be reached regarding the value of a new monobasic generic name for *rileyi*. The present evidence would indicate two groups within a single genus similar to the groups in the allied genus *Gortyna* (type *micacea* Esper, *Hydroccia* of Hampson).
The male genitalia of *Mammifrontia rileyi* are similar to those of *Gortyna*, especially resembling those of *G. petasitis* Doubleday, thus correlating with the habitus and the head in indicating a boring habit for the larvae. The harpe has a small trigonate divided cucullus, with a corona extending only about half way to the finger-like anal angle; the editum is conspicuous; the clasper extends over a part of the cucullus; the ampulla is short and setulose, but is finger-like in shape; the sacculus basally extends into a lobate and slightly setulose pad (the clavus); the uncus is broad and tongue-shaped, but with a spine-like tip; the arms of the transtilla are relatively strong; the annellus is in the form of a curved plate (the juxta), relatively long and broad, and basally pointed; the aedeagus is striated near the orifice, and the vesica possesses a minutely scobinated band, a long cornutus, and about ten strong, short, heavily bulbed cornuti.

**Micrathetis tecion Dyar**


Specimens collected by the writer at Brownsville, Texas, are in the collections of the U. S. National Museum and Fred. Lemmer.

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**TWO UNUSUAL BUTTERFLIES TAKEN IN SOUTHERN CALIFORNIA**

**By E. L. Hulbirt**

On September 2, 1934, a fairly fresh male specimen of *Dalla pirus* Ed. was taken near Carlsbad by the edge of a salt marsh. While this little skipper is widely distributed in Arizona and Utah, its presence along the ocean front in Southern California is apparently a new record for locality.

A good male specimen of *Polygonus lividus f. arizonensis* Skin, was taken at Glendora on September 9, 1935. It was feeding on lantana blossoms and was easily netted. This butterfly has rarely been seen in California, and so far as we know it has not appeared before at any point as far north as Glendora.
NOTES ON THE LIFE HISTORIES OF THREE BUTTERFLIES AND THREE MOTHS FROM CALIFORNIA

By JOHN A. COMSTOCK and CHARLES M. DAMMERS

STRYMON ADENOSTOMATIS Hy. Edw.

Several years ago the senior author secured a single slug-like larva on Cercocarpus betuloides Nutt., which was raised to the final instar, but failed to pupate. Mr. Carl Coolidge was shown the notes made for this example, and expressed the opinion that it was Strymon adenostomatis. Our notes were held in reserve until such time as additional work would enable us to affirm or disprove Mr. Coolidge's conclusions.

On May 29, 1934, the junior author secured a quantity of larvae at Forest Home, San Bernardino Mts., Calif., on the same foodplant. The description of these tallies at every point with the first example, and as they were raised to maturity and produced S. adenostomatis, it is thus possible to confirm Mr. Coolidge's diagnosis.

The egg of this species has not been observed.

The early instars also remain to be noted in detail, but are similar to the mature larva, except probably for the first instar, which in all of the Lycaenidae are much more primitive than the subsequent phases.

Mature larva. Length, extended, 17 mm.

Body color, pale apple green. Each segment is crossed laterally and diagonally by four pale bluish-white raised bands or rolls. These are heavily covered with erect short orange hairs, those on the sub-dorsal area being longer and more densely developed, and of a rich orange-red color.

In some examples, this hairy covering is white except on the sub-dorsal area above mentioned, where it is tinged with orange.

Mid-dorsally there occurs a prominent white band, which is covered with short white hairs.

The cervical shield is pale mauve, with a broad orange band on each side of the central line. The entire shield is covered with minute orange hairs. This makes a very distinctive mark, by means of which the larva can be at once determined. The overlap is white. See Plate 51-A.

Legs, colorless, with brown points. Pro-legs, pale bluish-white, with orange hairs on the claspers. Spiracles, soiled yellow.

Abdomen, pale bluish-white, covered with short silky white hairs.

Head, brown. Ocelli and mouth parts brown.
The larva is illustrated on Plate 52. Pupation takes place on the foodplant in early June, the pupa being suspended by the usual girdle, and cremasteric button.

*Pupa.* Length, 12.5 mm.

Head, thorax and wing cases, dark buff, heavily blotched with black. Body, pale mahogany, with the same character of dark blotching. The first spiracle is a soiled white, the remainder being soiled yellow.

The head, thorax and body are covered with short white hairs.

Imagos began emerging June 25, 1934. There is only one brood annually.

We are of the opinion that the species overwinters in the ovum. The pupa is illustrated on Plate 52, fig. C.

Our examples were heavily parasitized by *Anisobas bicolor* Cush.

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PLATE 52

Larva and pupa of *Strymon adenostomatis*

A. Mature larva, lateral aspect, enlarged x 4.
B. Two segments of mature larva shown in dorsal aspect, enlarged x 4.
C. Pupa, lateral aspect, enlarged x 4.

Reproduced from painting by Comm. Charles M. Dammers
Heodes xanthoides Bdv.

The metamorphosis of this species has been unusually difficult of solution, in spite of the abundance of the butterfly in certain regions of Southern California.

As early as 1887 Henry Edwards\(^1\) briefly described the egg, but did not record the foodplant. In 1892 W. G. Wright recorded\(^2\) the habit of laying on sticks, stones and debris, but also failed to name the larval foodplant. The junior author owes his first knowledge of this to Mr. J. A. Corcoran of Los Angeles. Later, the senior author was given some interesting details, in a letter from Paddy and Victor McHenry of Burbank, dated September 10, 1934, which we quote in part:

Noted female ovipositing on June 15, 1934 upon a species of Rumex. . . . The eggs were laid singly on the dead leaves, twigs, and the debris at the base of the plant. In a few instances eggs were found . . . on the soil at the base of the plant like the others.

On some occasions eggs were discovered piled on top of one another. In one case five were thus noted. Most probably this condition is explained as individual layings, as the female in each observed ovipositing was seen to lay but one at a time.

The eggs that were examined immediately after laying were a very pale green, which in the course of a few days turned to a gray.

At the base of two plants which we examined fifty some eggs were taken.

Egg: Echinoid, with a flattened base. Size approximately 1 mm. in greatest diameter. Micropyle, small, deep and abrupt. The surface is covered with a network of walls, enclosing pits of irregular triangular, quadrat or pentagonal shape. The color of the egg is at first a pale green, later changing to white (rather than "gray"). The superior aspect of the egg is illustrated on Plate 53.

\(^1\) Entomol. Amer. III, p. 162.
\(^2\) Can. Ent. XXIV p. 73.

PLATE 53
Egg of Heodes xanthoides, superior aspect, enlarged x 25.

Photo by Menke, retouched by Comstock
The junior author secured numerous larvae in all instars, on February 10, 1935 at Alberhill, Riverside Co., Calif., feeding on *Rumex hymenosepalus* Torr., from which the following larval descriptions were prepared.

Larva, first instar: Length, extended, 2 mm. Color, pale greenish yellow, with a mid-dorsal narrow divided pale magenta band. On each side of this band arises a single stout curved dark brown hair arising from a dark brown papillus—one such hair to each segment.

A single colorless straight hair (one to each segment) arises just below the line of the overlap.

Two or three dark specks occur laterally on each segment. The overlap (infrastigmatal fold) is slightly lighter than the body. Spiracles colorless.

All legs, and abdomen are a very pale greenish yellow.

On the first segment immediately below the usual position of the cervical shield there is a large diamond shaped dark olive shield or scutellum. A similar shield occurs on the caudal segment, but is smaller.

Head, black.

Second instar: Length, extended, 3 mm. Color, pale greenish white. A broad magenta mid-dorsal band extends the length of the larva, except for the first segment. On the outer edges of this band three erect stout black hairs arise from each segment, their bases being formed as black papilliform points. The central hair of each group is longer than the others, and the ends of all hairs incline slightly backward.

On the first segment a few black hairs arise, and arch over the head. Two long stout hairs arise from the scutellum.

Laterally on the body there are three or four short black hairs, irregularly disposed, on each segment, and a few small black dots occur along the upper edge of the overlap.

Below the overlap there occur four black papillae on each segment, from which arise single straight black hairs of medium length. The upper and lower edges of the overlap are shaded with a narrow band of pale magenta. The overlap is slightly lighter than the body.

Subdorsally there occurs a broad longitudinal pale magenta band.

Spiracles, invisible. Legs, dark brown. Prolegs and abdomen, pale greenish white.

The scutellum is black, and the dark olive patch on the caudal segment still persists.

In some examples a more general shade of magenta prevails.

This instar is illustrated on Plate 54, fig. A.

Third instar: Length, extended, 7 mm.

The larva now becomes slug shaped; the body color being yellowish green. A narrow mid-dorsal band of magenta is present. The lateral surface bears three indistinct longitudinal narrow
PLATE 54
Larva of Heodes xanthoides.
A. Lateral aspect of larva in second instar, enlarged x 15.
B. Lateral aspect of mature larva enlarged x 3.
C. Cervical shield of mature larva, highly magnified.
D. Two segments of the extreme color form of mature larva shown in lateral aspect, x 3.
Reproduced from painting by Comm. Charles M. Dammers

PLATE 55
Mature larva of Heodes xanthoides.
Dorsal aspect, enlarged x 3.
Photo by Menke, retouched by Comstock

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magenta bands. Overlap, pale magenta. Spiracles, soiled white, with brown rims. Abdomen covered with colorless hairs, the other hairs on the body being arranged as in the previous instar.

Head, and cervical shield, dark olive.

Fourth instar: Similar to the third, except than in some examples only the mid-dorsal magenta band persists, the remainder of the body being pale green.

Mature larva: Length, extended, 25 mm.

There is now great variation in the color, ranging from examples resembling the fourth instar, through apple green with a slightly darker mid-dorsal band, to examples that are distinctly yellowish green, shading to yellow along the edges of the mid-dorsal magenta band. A still more extreme form is dark orange, with three longitudinal bars of magenta shading to green along their edges, and a mid-dorsal band of magenta. In all examples the abdomen is greenish white, and the legs pinkish green, with pale brown points; the prolegs are greenish white, with orange hairs on the claspers; spiracles, soiled white, with brown rims; head, soiled yellow, with brown mouth parts.

The cervical shield is green, with slight mauve shading around its margin. It is bisected by a narrow bluish-white bar, and the surface is marked by a few white points. This characteristic feature of the larva is illustrated in fig. C of Plate 54.

The entire larva, except the head, is covered with short red-brown hairs, arising from brown points. The body surface is liberally sprinkled with small white punctae. The mature larva is shown on Plate 54, fig. B, and the extreme color variation mentioned above is illustrated by two typical segments, on the same plate, fig. D.

PLATE 56
Pupa of Heodes xanthoides, enlarged x 3½.
Photo by Menke, retouched by Comstock

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The dorsal aspect of the mature larva is picture on Plate 55.

The first larva went into pupation March 31, 1935, forming a loosely woven silk cocoon on the floor of the breeding cage, into which it incorporated particles of soil. This cocoon formation by a Lycaenid is a most unusual feature, and the first of its kind encountered in our breeding of diurnals.

Pupa: Length, 15 mm.

Thorax and body, pink-buff, with the wing-cases slightly paler. Some examples show a darker coloration.

The entire pupal surface is spotted and blotched with irregular black markings. Spiracles, soiled yellow.

The head, thorax and body are thickly covered with very short colorless pile, of so fine a character as to be indistinguishable without a lens. This pile is thicker and longer over the anterior part of the thorax and immediately adjacent to the spiracles.

Imagos began emerging April 30, 1935.

The pupa is illustrated on Plate 56.

Xanthoides is single brooded, the winter being passed in the ovum.

An Ichneumon was recovered from our hatch, but the species has not been determined.

This life history now completes all of the “coppers” occurring in southern California, with the single exception of Heodes heteronca clara Hy. Edw. Since the latter is only a race of heteronca, the metamorphosis of which was published by F. X. Williams, in Entom. News, XXI. p. 37, it is reasonable to assume that the early stages of the race clara will not vary from the parent species.

The only California “copper” whose life story is entirely unknown is Heodes nivalis Bdv. Much remains to be learned concerning H. cupreus, rubidus, mariposa and editha.

These are problems that should not be difficult of solution for our northern California contemporaries.
Everes amyntula Bdv.

The habits of this larva were discussed in a most fascinating manner by W. G. Wright, in Papilio, Vol. IV, p. 126, 1884. He has, however, given no notes on the larva or pupa, and several points in the habits of the fall brood are left in question. Furthermore, his paper carries no illustrations. Our contribution will therefore supplement his work with a minimum amount of repetition.

Eggs and larva were taken in quantity on June 1, 1932, at Riverside, Calif.

Egg: Echinoid, of the characteristic Lycaenid form. Color, pale green. They are laid singly on the flowers or young seed pods [exceptionally, on the stem, W. G. R.], of Astragalus.

Mature larva: Length, extended, 17 mm.

The color is highly variable, ranging from a greenish-straw with pink and maroon markings, through a yellowish-green with pale mauve markings, to a solid green, with darker mid-dorsal line. The shape is of the usual slug form. Our description will apply to the greenish-straw variety.

Body color, pale greenish-straw. A narrow mid-dorsal band of maroon-red runs the length of the larva, becoming greenish on the second to fourth segments.

Diagonally across each segment except the first, are three narrow bands, the center one being maroon. The sub-dorsal and sub-stigmatal bands are pink. The overlap (infrastigmatal fold) is also pink.

Spiracles, brown. Abdomen concolorous with body.

The entire surface of the body is sprinkled with minute black punctae of various sizes.

The body is covered with a fine straw-colored pile.

Legs, greenish-straw, with brown points. Prolegs, greenish straw, with brown hairs on claspers.

Head black; very small, and retractile into the first segment.

The larvae went into hibernation in late June, 1932. At that time they were not fully matured. In March of 1933 they were placed on the first Astragalus blooms, and began feeding immediately. Pupation took place on the foodplant, the pupa being supported by a silk button for the cremaster, and a girdle over the middle.

Pupa: length 11 mm.

Ground color, pale soiled buff, varying in some examples to olive-grey, and a few nearly olive-white.

The head, thorax and wing cases are slightly lighter than the body. A dark brown mid-dorsal band, broken at the segmental joints, extends from the top of the head to the cremaster.

Laterally on the body there is a line of quadrate dark brown blotches (one to a segment), which are heaviest anteriorly, and obsolescent on the last two caudal segments.

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PLATE 57
Larva and pupa of *Everes amyntula*.
A. Mature larva, lateral aspect, enlarged x 3½.
B. Pupa, lateral aspect, enlarged x 3½.
C. Two segments of mature larva, dorsal aspect, enlarged x 3½.

Reproduced from painting by Comm. Charles M. Dammers

PLATE 58
Pupa of *Everes amyntula*, showing ventral, lateral and dorsal aspects, enlarged x 3½.

Photo by Menke, retouched by Comstock

The body is sparingly sprinkled with olive-brown points. These are absent over the nervules on the wing cases, and hence give this area a striped appearance. Spiracles, cream-pink.

Cremaster, light, with numerous minute yellow hooks.

The head, thorax and body are sparingly covered with long white hairs, many of which end in dark points.

The pupa is illustrated on Plate 57, fig. B, and also on Plate 58.
Pygarctia murina Stretch

A large number of eggs of this species were secured from a female, taken by Mr. C. Henne, at Mexican Wells, San Bernardino County, Calif., on September 5, 1934. On September 10 numbers of mature larvae were found in the same locality, feeding on a small erect red-stemmed Euphorbia.

The eggs were laid in a group on the side of the collecting cage.

Egg: Spherical; smooth, with a flattened base. Color, yellowish-white. Eggs laid September 5, hatched September 14. The young larvae were given Philibertia, which they accepted, but later were transferred to Euphorbia.

Larva, first instar: Length, extended, 1.5 mm. Color, soiled yellow. The future tufts are represented by single very long dark brown hairs. Head, yellowish-brown. There is a pale brown bar crossing the top of the first segment.

Larva, second instar: Length, 6.5 mm. Body color, soiled yellow, with a darker mid-dorsal shading. Subdorsally there occurs a translucent white band, and a similar band occurs below the spiracles.

The upper two rows of hair tufts are composed of three or four dark brown hairs and a single white hair. All other tufts are made up of a few soiled white hairs, those on the second, third and eleventh segments being very long.

Head, soiled orange,

In the successive instars the larva gradually assumes the color of the mature phase which is described below.

Mature larva: Length, extended, 22 mm.

This larva is of the characteristic "wooly bear" type. The body color varies from a purplish-brown to a blue-gray. There is a narrow lemon-white sub-dorsal longitudinal band. A wide yellow band also occurs inferior to the spiracles.

There are twelve tufts of hair on each segment, arising from the usual tubercles. The size, and placement of these, is clearly brought out in the illustration of the mature larva on Plate 59, fig. A.

The pair of mid-dorsal tufts on the fourth to eleventh segments are composed of a dense brush of long soft hairs, with a few soiled white hairs on their outer edges.

The next lateral pair of tufts (one on each side) are composed of erect buff hairs. The next latero-inferior pair are composed of a few stiff buff hairs. The remaining tufts are made up of stiff white hairs.

Around the base of the third pair of tufts is a large soiled orange raised area.

From the uppermost tufts of the first, second, third, ninth, eleventh, and caudal segments arise a few very long hairs, which are mixed black and white.

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PLATE 59
Larva and pupa of *Pygaretia marina*, enlarged x 3.
A. Mature larva, lateral aspect. B. Pupa, lateral aspect.
Reproduced from painting by Comm. Charles M. Dammers

Spiracles, white with black rims. Legs, soiled orange. Prolegs, soiled orange with paler ends; the claspers flesh colored, and bearing hairs of the same color.

Abdominal surface, soiled white.

Head: Dark orange, covered with hair of the same color.

Ocelli and mouth parts, brown.

Pupation occurred in October, 1934, in a silken cocoon, formed in the debris on the surface of the soil.

Pupa: Length, 11 mm. Color, a uniform bright chestnut. Stout, oval, the cephalic end somewhat squared, and the caudal end bluntly rounded. Thickest through the fourth abdominal segment. The surface is heavily punctate. The thorax bears a low keel-shaped ridge, placed mid-dorsally. There are no setae or vibrissae.

The pupa is illustrated on Plate 59, fig. B, and also on Plate 60.

PLATE 60
Pupa of *Pygaretia marina*, enlarged approximately 2½ times, showing ventral, lateral and dorsal aspects.
Photo by Menke, retouched by Comstock

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Lathosea dammersi McD.

This species was recently named\(^1\) by Dr. J. McDunnough, from material furnished by the junior author. The moth has not heretofore been seen in any of our local collections, probably due to the fact that it does not come to light, and is on the wing in December and January, when collectors are not in the field.

The larvae were taken on March 8, 1931, in the Gavilan Hills, Riverside Co., Calif., feeding on *Ericameria palmeri* Gray. They were subsequently taken at several points on the Mojave Desert, notably, near Palmdale, and in the Kramer Hills. A still earlier collection is on record from the upper end of the Cajon Pass on May 17, 1929, where they were feeding on *Stenotopsis linearifolius* (D. C.).

They were again taken on Mary Street, Riverside, in late February, 1934, feeding on *Gutierrezia sarothrae* Britt, none being found on *Ericameria* growing in proximity. A visit to the Gavilan Hills at the same time disclosed exactly the reverse condition, the two plants being found in association, but the larvae occurring only on the *Ericameria*. An illustration of a paratype of the imago is shown on Plate 61.

![Lathosea dammersi paratype](Plate 61)

PLATE 61

*Lathosea dammersi*, paratype.

No. 3979, Riverside, Cal., Jan. 22, 1935. Figure slightly enlarged, the specimen measuring 41.5 mm.

Mature larva; extended length, 45 mm. Ground color, blue gray, marked with large and small punctae, and lines of black, disposed as shown on Plate 62, fig. A, and also on Plate 63. A yellow interrupted mid-dorsal band having two expanded patches to each segment, is a prominent feature. There are also two lateral longitudinal yellow bands, interrupted by black at the segmental junctures and across the centers of the segments.

The overlap is white, with a lemon yellow patch at each segmental center.

Spiracles indistinguishable. Abdomen, green, spotted with black, and with a white area at each segmental center.

Legs, prolegs, and anal prolegs green, spotted with black.

Head, pale blue-gray, heavily marked with black, as shown on Plate 63. Ocelli and mouth parts, black.

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\(^1\) Canadian Ent. LXVII, p. 135, June, 1935.
PLATE 62
Larva and pupa of *Lathosea dammersi*, enlarged approximately 1 1/2.
A. Matura larva, lateral aspect.  B. Pupa, lateral aspect.
C. Two segments of larva, dorsal aspect.
Reproduced from painting by Comm. Charles M. Dammers

PLATE 63
Larva of *Lathosea dammersi*, enlarged x 1 1/2.
Upper figure, head of larva, highly magnified.
Drawing by J. A. Comstock
Middle figure, larva, dorsal aspect.
Lower figure, larva, lateral aspect.
Photo by Menke
There is considerable variation in the larva. Some have a suppression of the mid-dorsal band. Others show an increase in the black markings, and the yellow spots and lines are replaced with orange.

The earlier instars (except possibly the first) are similar in coloration and pattern to the mature.

Pupation takes place under the soil in late March, in a distinctive cocoon, the soil being formed in the shape of a hat with the brim turned up. This is illustrated on Plate 64.

Pupa: Length, 20 mm. Color, a uniform light chestnut, shading to green at the segmental joints. The surface bears a polished surface. The form is adequately pictured on Plate 62, fig. B.

The larvae are heavily parasitized in their earlier instars by an Ichneumon.

The recorded foodplants, thus far noted, are:

- *Stenotopsis linearifolius* (D. C).
- *Acamptopappus sphaerocephalus* Gray.
- *Ericameria palmeri* Hall.
- *Ericameria pinatifolia* (Gray).
- *Gutierrezia sarothrae* Britt.

**PLATE 64**

Cocoon of *Lothosea dammersi*, natural size.

Reproduced from painting by Comm.
Charles M. Dammers

**Phasiane orillata** Wlk.

This geometrid moth comes to light abundantly in suburban areas of southern California. The larva feeds on Guadalupe Cypress, an introduced ornamental tree. In the wild state it probably occurs on *Juniperus*, as the species is common in the juniper belt.

Larvae in all instars were collected at Riverside, Calif., Dec. 23, 1934. The earlier instars were so similar to the last that only the mature larva is here described.

Mature larva: Length, extended, 29 mm., the form being of the usual cylindrical measuring-worm type.

The ground color is a dark blue-green which gives an admirable camouflage on the plant.

There is a mid-dorsal longitudinal lemon-white line, with a similar line paralleling it on each side.

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Subdorsally each segment is crossed longitudinally by a lemon-white band, broken in the center of the segment, and enlarging to a sub-quadrate patch at the fore end.

Below each spiracle occurs a raised brown lobular protrusion, inferior to which is a lemon-white area.

The abdomen is dark green, striped longitudinally with lemon-white bands.

Body sparingly indented with longitudinal discontinuous creases. Spiracles, buff, with black rims.

Legs, pale green, with pale brown points. Prolegs pale green with bronze hooks on the claspers.

Head, pale green, blotched with irregular pale brown markings, and sparingly covered with pale brown setae.

Mouth parts, pink. Ocelli, black.

Each typical body segment bears twelve brown setae arising from small brown nodules. The arrangement of these is illustrated on Plate 65.

The first larva pupated December 25, 1934. Pupation occurred under the soul in a light silk bag or webbing.

Pupa: Length, 12.5 mm. Color, uniform dark olive-brown, with the caudal segment carmine. Spiracles, pale chestnut. Body and thorax finely punctate. A few colorless hairs occur over the anterior surface of the thorax. The form of the chrysalis is shown in the illustration, Plate 65, fig. D.

The first imago emerged February 16, 1935. The species is evidently at least double brooded, as captures are recorded for the spring and fall months.

PLATE 65
Larva and pupa of Phasiane orillata, enlarged x 3.
A. Larva, lateral aspect.
B. Head, facial aspect.
C. Two segments of larva, dorsal aspect.
D. Pupa, lateral aspect.

Reproduced from painting by Comm. Charles M. Dammers
NEW HOST RECORDS OF THE LINGUATULID, KIRICEPHALUS COARCTATUS (DIESING) IN THE UNITED STATES

By Howard R. Hill

Zoologist, Los Angeles Museum, from the Zoological Laboratory of the University of Southern California

With the exception of one species (Linguatula serrata Froehlich, which lives in the nasal passages of the dog), all members of the endoparasitic family Linguatulidae live as adults within or near the lungs of flesh-eating reptiles. The genus Kiricephalus of this worm-like family is easily recognized by the characteristic features of the group which consist of a club-shaped body with globular head and an elongate abdomen of uniform thickness which is devoid of stigmata or "skin pores." Three species of the genus are known, all from snakes; K. tortus (Shipley) from New Britain, K. pattoni (Stephens) from Southern Asia, and K. coarctatus (Diesing) which occurs in various hosts in North, South and Central America.

K. coarctatus has been reported most frequently from the indigo snake (Drymarchon corais couperi Holbrook) which ranges from Florida to Texas and Northern Mexico. The writer has received over fifty specimens from Silver Springs, Florida, taken from indigo snakes captured in the vicinity. Additional material as noted below, would seem to indicate that the species is widely distributed and that infection may be expected in many other snakes especially in the Southern States. New hosts of this linguatulid are here recorded for the first time. Supplementary notes with regard to the range of host, the number and sex of the parasites obtained, the position in the host and the source of material are also given.

NEW HOSTS OF KIRICEPHALUS COARCTATUS (Diesing)

Host, Green Garter Snake, Thamnophis s. sirtalis L.
Host range, Eastern and Southern States.
Number and sex of parasites, one female.
Source, Philadelphia Zoological Gardens.

Host, Common Water Snake, Natrix s. sipedon (L.).
Host range, Eastern and Southern States.
Position in host, lung.
Number and sex of parasites, one male.
Source, Philadelphia Zoological Gardens.

Host, Brown Water Snake, Natrix taxispilota (Holbrook).
Host range, Southeastern States.
Position in host, lung.
Number and sex of parasites, one male and one female.
Source, Philadelphia Zoological Gardens.
Host, Woodhouse's Water Snake, *Natrix sipedon transversa* (Hallowell).
Host range, Texas, Oklahoma, Arkansas.
Position in host, lung.
Number and sex of parasites, two males and one female.
Source, Philadelphia Zoological Gardens.

Host, Red-bellied Water Snake, *Natrix sipedon erythrogaster* ( Förster).
Host range, Eastern and Southern States.
Position in host, under tongue and protruding from anterior end of body.
Number and sex of parasites, three females.
Source, Toledo Zoo.

Host, Rattlesnake, *Crotalus* sp.?
Number and sex of parasites, one immature female.

Host, Virginia Opossum, *Didelphis virginiana* Kerr.
Host range, Eastern, Central and Southern States.
Position in host, nasal cavity.
Number and sex of parasites, one female.
Source, Ames, Iowa.

The female specimen from the opossum measured 114 mm. in length and possessed sixty annulations or abdominal segments. For several reasons, this record is of exceptional interest. It is the first time that an adult linguatulid has ever been obtained from an opossum. Furthermore, it is the first record of *K. coarctatus* in this mammal which has been known to harbor the larval form of another linguatulid, *Porocephalus clavatus* (Wyman).
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To be used when it is desired to leave real estate to the Academy.

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ON THE IDENTITY AND TYPE LOCALITY OF EUPHYDRYAS EDITHA (LEP. RHOP.)*

By J. McDunnough

The recent receipt of a good number of Euphydryas forms in the editha group has led me to check up rather carefully on the identity of the parent form editha Bdv. and its so-called type locality, as given by Gunder in his Revision of the genus (1929, Pan Pacific Ent. VI, 1-8, Pls. I-XVI). On one of his maps (Pl. 15) it is noted that editha is "typical in Kern Co." but with this statement I must emphatically disagree, and would venture the suggestion that the type-localities for editha Bdv. and rubicunda Hy. Edw. have been transposed and that typical editha should be looked for in Mariposa Co. and the adjacent regions, whilst the race in Kern Co. is more nearly approached to rubicunda than to anything else.

An excellent colored figure of the type male of editha (to which in case of any doubt the name should be restricted) is given by Oberthur (1914, Et. Lep. Comp. IX (2) Pl. CCLIX, fig. 2171) and this figure has been reproduced by Comstock in his Butterflies of California (Pl. XXXIV, fig. 1). Particular attention is called to the fact that on the primaries the row of small sub-marginal spots is depicted as being decidedly ruddy, a character found in the small series from Mariposa before me, but certainly not present in Kern Co. specimens, which show a much more prominent row of pale yellowish spots. This ruddy suffusion on the subterminal spots seems to be an important character in editha races from the central and northern portions of the Sierras; it is found in aurilacus Gund., but in this race the suffusion has gone a step farther and is found on the secondaries as well as on the primaries. A further argument in favor of the region north of the Yosemite being selected as the type locality for editha is found in Boisduval's introductory remarks (page 6) to his 1869 paper on the Lepidoptera of California; from these it seems fairly evident that during the first two years of his collecting in California (i.e. the years 1850 and 1851) Lorquin, the collector who supplied Boisduval with the material for his 1852 paper, did not reach southern California in his travels but confined his attention to the placer mining regions more or less due east of San Francisco, termed by Boisduval the "Juba mountains."

* Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.
With regard to *rubicunda* Hy. Edw. a similar difficulty exists in determining the exact type locality. The original description simply states "Sierra Nevadas" and is in addition useless as a means of racial differentiation. Typical *rubicunda* was first figured in the Barnes and McDunnough "Contributions" Vol. III, 88, Pl. X, fig. 3 and specimens from Tulare cited as topotypical; the actual type was shown in Gunder's revision (Pl. X); in both these figures the pale color of the submarginal spots on primaries is evident. Through the kindness of Mr. F. Watson of the American Museum of Natural History I have obtained the following data on the type specimens. Mr. Watson writes that "the series consists of four males and one female and they seem to me to be all the same thing." A male and a female bear bordered labels with the name "*Melitaea var. rubicunda* Hy. Edw. Type" and the sex, in Hy. Edwards' handwriting; in addition the male bears a small white printed label, "Sier. Nev. Cal." and the usual round disk with the number 7154. The female has the words "Knight Val." written above the printed "California" locality, as well as the same number, 7154. In case of doubt the above-mentioned male should be selected as holotype. Two other male specimens have "Havilah" and "Knight Val." respectively, written above the printed "California" label, the former also with the number 7154. The last specimen has "Mendocino Co." written on the locality label which would seem to indicate some mix-up in localities with *baroni*; its correctness should be regarded as doubtful. The number "7154" is an original catalogue number of little value as the entry under this number reads "*Melitaea quino var. rubicunda* Hy. Edw. Cal. Colo. etc. H. E. etc." and was evidently applied to a very mixed lot. I have no means of ascertaining where Knight Valley is located, but Havilah was one of Hy. Edwards' favorite collecting spots in Kern Co. and bears out the above contention.

It might be further noted that in the Canadian National Collection are four male specimens which evidently came originally from the Hy. Edwards collection either direct or through W. H. Edwards; one of these, besides the name label in Hy. Edwards' writing and the numbered disk 7154, also bears the locality label "Havilah, California" and agrees excellently with the published figures. It would seem therefore fairly well established that the type locality for *rubicunda* is considerably more southern than was recorded by Gunder.

*Ottawa, Ont.*
INTERRELATIONSHIP OF ANTHOCHARIS CETHURA F. & F. AND A. PIMA EDW. (LEPID. RHOPAL.)

By Charles N. Rudkin

In a fairly long series of *Anthocharis cethura* F. & F. from the Antelope Valley and Victor Valley regions of the Mojave Desert of California there will usually be found a few examples more or less tinted with yellow. The tint varies from a very pale lemon color in the cell region of the primaries or secondaries, or both, to a clear bright yellow over all portions of the wings not black or orange, except the extreme costal edge of the fore wing, which remains white in all specimens I have been able to examine. These yellow specimens, which, since the appearance of Dr. J. A. Comstock’s “Butterflies of California,” have been identified with *A. caliente* Wright, form about 2 percent or less of the population.

There is a colony of yellow Anthocharis in the Providence Mountains of San Bernardino County, about 150 miles almost due east from the Antelope Valley colony just mentioned. A very considerable number of specimens taken from this colony in the spring of 1935 by several Southern California collectors does not include any white specimens, although the intensity of the yellow tint varies to a considerable extent.

In yellow tint, in form and extent of the black pattern of the wing tips, and in the tendency of the orange spot to invade the cell beyond the black discal bar, the specimens from the Providence Mountains are almost exactly intermediate between the yellow examples taken with *A. cethura* and typical *Anthocharis pima* Edwards, which appears to be perfectly constant from the left bank of the Colorado River to its type locality in Pima County, Arizona.

Wright, in describing *Anthocharis caliente*, gives the type locality as “in the Colorado Desert of California, far to the west of Yuma, in a locality difficult of access.” His type, taken in 1889, was still a unique at the time the description was published (1905). This writer knows of no comparable specimens from a locality which could be construed to be covered by Wright’s vague indication. The Mojave Desert colonies (Antelope Valley, Victor Valley and Providence Mountains) lie about 140 miles north of an east-west line through Yuma. Colonies of *cethura* do exist, however, in the San Bernardino, San Jacinto and Laguna Mountains, and the species extends over into Baja California.
Wright’s specimen, a female, illustrated in “The Butterflies of the West Coast,” Plate VIII, fig. 70, can be almost exactly matched by female specimens from the Antelope Valley colony, although specimens can be found there which show a considerably greater extent and brighter tint of the yellow color.

The figure will serve to illustrate the closeness of the intergradation from typical *A. cethura*, through *caliente* and the Providence Mountains race to typical *pima*. Specimens numbers 1, 2 and 3 were taken in the neighborhood of Little Rock, Los Angeles County, numbers 4 and 5 near the Bonanza King Mine in the Providence Mountains, and number 6 at Tucson, Pima County, Arizona. The above numbers refer to Plate 1.

The series of intergrades here presented would seem to establish the fact that *A. cethura* and *A. pima* represent the extremes of geographical variation of a single species, to be classed under the prior name *cethura* F. & F., with *pima* Edw. as a race or sub-species.

*A. caliente* Wright was probably named from a yellow specimen from a southern colony of *A. cethura*, and it occurs regularly as a rare form in such colonies, at least along the edge of the desert. The existence in mid-desert of a race which is indistinguishable in series from a series of the variant form might perhaps warrant racial standing for the name.

In the strictest meaning of the word “race” any group having a distinctive genetic constitution should be entitled to a name as a race. Since the Providence Mountains race possesses such a distinctive genetic constitution, different from that of the *cethura* colonies which contain both white and yellow forms, it would appear to deserve a racial name other than *caliente*. However, names are necessarily based upon morphological differences and depend upon the establishment of individual type specimens. This being the case it is impracticable to attempt to apply a name to the race located in the Providence Mountains. It is largely a matter of taste whether the 100 percent yellow race is included as *A. cethura cethura* form *caliente* or as *A. cethura pima* form *caliente*. 
PLATE 1

Male specimens showing gradation from No. 1, *Anthocharis cethura cethura* F. & F., to No. 6, *Anthocharis cethura pima* Edw.
METAMORPHOSIS OF STRYMON LEDA EDW.
(LEPID. RHOPAL.)

By John A. Comstock and Charles M. Dammers

Freshly emerged examples of the Leda Hair-streak have been taken from time to time in Southern California. W. S. Wright reported its capture in 1907 by George Field at Jacumba, although he erroneously recorded it as Callicistema ines Edw.

Fordyce Grinnell secured a series on Black Mountain in the Santa Rosa range at an altitude of 3500 feet. His record, published in Psyche, XVI. 92, 1909 repeats the error in determination. His notes on the association of the species with Juniper have led many of our lepidopterists astray in supposing this to be the larval foodplant.

The junior author captured several gravid females while collecting in the San Felipe wash, San Diego Co., Calif., from which a number of eggs were secured. These were deposited (in captivity) on the young flowers of Honey Mesquite, Prosopis juliflora, v. glandulosa Ckll. The species may possibly have other foodplants, as freshly emerged specimens have been taken near Riverside, where no mesquite occurs. A capture is also recorded from Forest Home, San Bernardino County.

In the San Felipe district both Honey- and Screw-bean mesquite occur.

Egg. Echinoid: .5 mm. diameter at base and approximately .25 mm. high. Color, pale green, with white reticulations and small nodules arising from the junctures. See Plate 2.

The eggs are difficult to find as they simulate the color and texture of the mesquite blossoms. They are laid singly. Egg laid June 24, 1935, hatched July 1.

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1 Journal N. Y. Ent. Soc., XVI. 162, 1908.
LARVA.

First instar. Body, pale yellow. Head dull yellow. Four longitudinal rows of long curved white hairs occur, there being one hair to a segment in each row. Measurements were not taken on account of the exceedingly small size.

Second instar. July 7. Color and general appearance as in the previous phase, but with the addition of a mid-dorsal and lateral broad band of pale orange.


Fourth and final instar. July 16. Length, extended, 16 mm. Body apple green, sparingly covered with short thick chestnut hairs, those on the top of the center of each segment being much longer.

Sub-dorsally, on the second to ninth segments there is a yellowish white ridge which continues inferiorly to the line of the spiracles. In some examples this ridge has a reddish blotch on each side at its highest point.

The infra-stigmatal fold is yellowish-white and in some examples has a reddish suffusion on its upper side at the center of each segment.

Spiracles, pale brown, with lighter rims. Abdomen, pale apple green, sparingly covered with white hairs. At the center of each segment on a line half way between the infrastigmatal fold and the line of the top of the legs, a raised yellowish-white band. Legs and prolegs, pale apple green.

PLATE 3

Mature larva and pupa of Strymon leda enlarged approximately x 4.

A. Lateral view of larva.
B. Dorsal view of two typical segments of larva.
C. Lateral view of pupa.

Reproduced from painting by Comm. C. M. Dammers
Head pale olive-green with brown mouth parts.

The cervical shield is pale magenta, bisected by a narrow lighter band. The mature larva is illustrated on Plate 3. The larvae feed solely on the flowers.

Pupation took place from July 20 on. Several examples pupated on the floor of the breeding cage. Others attached themselves to the stems of the foodplant by the usual silk button and girdle.

Pupa. Length, 9 mm. Robust; the thorax and abdomen well arched. Ventral surface relatively flat.

Prothorax, thorax and wing cases pale olive-brown, heavily blotched with black. Abdominal portions, chestnut, with a mid-dorsal and lateral band of black stippling. Spiracles, soiled white. Ventral surface, pale olive.

Except for the wing cases and a portion of the venter, the entire pupal surface is covered with short stout soiled white hairs. See Plate 3, fig. C.

Imagos emerged from the 3rd to 6th of August, 1936. There are three broods a year, the third brood probably overwintering in the pupal state. Their breeding ground in the San Felipe wash was visited when the last brood was on the wing and it was found that the mesquite had put forth a new set of blooms, so it may be assumed that the life cycle is exactly similar for this brood except for the overwintering of the chrysalis.

The correct placement of *Strymon ledum* Edw., and *S. ines* Edw., was adequately dealt with by Drs. Barnes and McDunnough in Entom. News, Vol. XXIII, 49, 1912. All of the California examples that we have thus far examined are of the parent form *leda*.

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1912—Barnes, W., and McDunnough, J., Ent. News, XXIII, 49.
1912—Barnes, W., and McDunnough, J., Ent. News, XXIII, 49.
1931—Holland, W. J., Butterfly Book, 240.
CALIFORNIA MICROLEPIDOPTERA VIII
By H. H. Keifer

The last installment of this series was issued in the Monthly Bulletin of the Department of Agriculture, State of California, Vol. 24, Nos. 4-5-6, p. 195, June 25, 1935. It becomes necessary to correct an error in the illustrations of the larval metathoracic leg in this last publication. At or near the apex of the tarsus and surrounding the claw are four setae, two interior and two exterior. With the exception of certain Blastobasidae the interior setae so far seen are both short although somewhat variable in their distance apart and in their position in relation to the claw. The two exterior setae have been found to be consistently near the base of the claw but are quite variable in shape and relative length. Thus in the three illustrations previously published, the posterior seta of this outer pair should have been represented as distinctly longer than the anterior one. In the case of Aristotelia and “Borkhausenia” this outer posterior seta is rather sickle-shaped but tapers regularly. In Anarsia the outer posterior seta is also incurved but broad and blade-like, or oblanceolate. The outer anterior seta of Aristotelia spp. is not as short in comparison to the posterior one of this pair as in other Gelechiids examined. These outer setae on Pyramidobela are approximately as in “Borkhausenia.”

The Agonopteryx species here described has a different structure on the metapod, and other thoracic legs. The outer apical tarsal setae on larvae of four species of this genus before me are both of equal length and blade-like. Larvae of Stenoma and Sciotostoma exhibit this same type of structure except these setae are broader than in Agonopteryx.

The Eucordylea larva in this respect fits in with Anarsia, Gelechia spp. (species referred thereto), non-gall-forming Gnirimoschema, Tephusa, Xenolechia, Exoteleia and other Gelechiids. In all of these the outer anterior seta is short and slender, whereas the outer rear seta is long, broadened and oblanceolate.

Not only is the outer rear seta longer and lanceolate in Holocera, but the rear inferior seta is also longer.

The Gelechiidae are sharply differentiated from all Tortricidace and Olethreutidae so far examined by the fact that in these latter families the outer tarsal setae are long and equal, though varying in thickness.
OECOPHORIDAE

AGONOPTERYX CLARKEI Keifer, new species
(See Plate 4; Plate 7, fig. 6)

Expanse 18-20 mm. General color luteus. Second joint of palpi lightly sprinkled fuscous on outer side and in brush; terminal joint darker with blackish ill-defined annulus below middle and broader darker one below tip. Head somewhat infuscated and rough above. Antennae with scape fuscous above and funicle evenly fuscous covered except for darker narrow annuli at each segment base, this marking obscured below. Thorax slightly infuscated and a tuft on either side of apex. Forewings with scales throughout lightly but unevenly infuscated below tip, and with sparse black irration, the effect being a rather uniformly dull luteus wing with faint lighter and darker blotches here and there. Costa with dark spots or short dashes along entire length, irregularly placed, part of them strongly reproduced beneath. Dorsal base clear luteus and edged outwardly by a transverse dark dash which turns abruptly above plica and parallels costa, soon fading. A dull dark blotch well within costa at about one-half. Sigmata practically obsolete: first discal a pair of obscure black dots and associated lighter area at one-third, one dot obliquely inward above the other; second discal a slight lighter spot with a black scale or two above at nearly two-thirds. Cilia fuscous with scale-tips light, producing about three concentric arcs of luteus around outer margins. Hindwing light luteus, somewhat infuscated, darker apically, the cilia lined first lighter then darker at base; apical area below irrorated fuscous. Abdomen about the same as hindwings above, brighter below with a blackish longitudinal line on each side; the male with a ventral tuft on the anterior edge of the eighth segment. Legs, luteus, irrorated and infuscated fuscous, the hind legs lighter. Male genitalia with harpes typical of the genus, the finger-like process from near the middle of the sacculus reaching almost to the costa; uncus produced ventrally and posteriorly as a pair of appressed somewhat curved plates, heavily pilose with a considerable tuft of hair from between the plates; gnathos produced ventrally, ending in a spined cone; aedoeagus short, bent ventrally, tapering. Female genitalia with apex of ovipositor sclerotinized and set with many spine-like setae; signum a flat arrow-head-like plate with longitudinal rows of spines pointing away from central line.

Type, male, collected in the Placerville District, California, at Missouri Flat, as larva on Artemisia vulgaris variety, May 28, 1935, by the writer, the adult emerging June 27. Allotype, female, with same data, the adult emerging June 21. Four paratypes with same data except two were collected as larvae on June 10. Two paratypes from Bellingham, Washington, collected by J. F. Gates Clarke, bearing the dates September 1, 1935, and January 14, 1924. Mr. Clarke, for whom this species is named, kindly
determined it as new for me and pointed out that the structure of the ovipositor sets this apart from nearly all others he has studied. I have, however, five specimens placed in my hands by Mr. Clarke, from Aweme, Man., collected by Criddle, that have approximately the same ovipositor structure as the type material of *clarkei*, but may represent another species. These Aweme specimens bear the name *argillacea* Wlsm. and *arnicella* Wlsm. One of the paratypes was determined as *argillacea*.

The pupa, which is about 13 mm. long is a deep clear brown. The integument is approximately smooth except for the abdomen which is finely scobinate in part. The antennae apically diverge, following for a short distance the wing margin and exposing the tips of the hind legs. The abdomen has three flexible sutures making the fifth, sixth and seventh abdominal segments movable; the structure being such that there is in effect a lateral condyle in each suture and the segments can only be flexed dorsally or ventrally. Cremaster absent.

The larva is about 15 to 17 mm. long when grown, with light green body. The head is luteus with blackish blotches. The shield is as the head with the dark area a band from the posterior center extending to and enveloping the whole side. Tubercles body color. Some accessory setae on the caudal prolegs with two or three above the lower setal series. Crochets triordinal, on central prolegs in complete circle 48-52, caudal prolegs 43-45. Described from one larva taken June 10, 1935.

There are several structural features on both pupa and larva which are of note, especially in relation to the next described species. On the larval head setae *A* and *O* are on a line posterior to ocellus I; seta *O* is short and obliquely above *G*; the mandibles have three large teeth followed by nine small teeth. The body skin is finely spinulate. On the meso- and metathorax setae 1a and 1b are on separate tubercles; the legs are not spinulate and the outer apical tarsal setae are of equal length and blade-like. The abdomen shows no setae missing and bears the usual thin seta (seta III) on the ninth segment; the caudal prolegs have accessory setae associated with the lower or "b" series; one or two small setae are found above the line of this series (in this connection see the figures of the *Pyramidobela* larva). The setae on the back of the caudal prolegs are on separate tubercles and well spaced.

This larva belongs to the "light" tubercle group and is structurally characterized by the mandible and the number and position of the caudal proleg accessory setae. Another "light" tubercle larva (Plate 7, fig. 4) from willow has but few of the small mandibular teeth and has more accessory hairs on the caudal proleg, these hairs ascending further up the leg. The larva of *Agonopteryx psoraliella* Wlsm. (Plate 7, fig. 5) represents the "dark" tubercle group in which the tubercles are prominently dark fuscos, the body more contrastingly pigmented and with apparently heavier skin spinules.
ETHMIIDAE

Genus Pyramidobela Braun


_Pyramidobela_ Braun; Meyrick, Exotic Microlep., Vol. 3, p. 144, 1928 (referred to the Hyponomeutidae along with _Ethmia_).

_Pyramidobela_ Braun; Fletcher, Mem. Dept. Agr., India Ent. Series, Vol. 11, June, 1929 (Hyponomeutidae).

I am indebted to Miss Braun for the statement of the above synonymy and also for specimens of the two genotypes. There is not a great deal of difference in the appearance of the three species of _Pyramidobela_ herein treated, and the male genitalia illustrate this further. _P. quinquecristata_ is brown with a dark longitudinal streak and dark shadings. The new species is very similarly marked to this but in a series of sixty-eight examples all are uniformly gray-brown in ground color. _P. argyrtodes_ is somewhat lighter, being rather light infuscated ochreous, the veins tending to be more definitely lined fuscous. In addition there is another species, _tetraphyla_ Meyrick from Real del Monte, Mexico.

There is what I take to be a _corema_ on the midline at the posterior edge of the male anterior sternal plate of each species examined.

**Pyramidobela quinquecristata** Braun

(Plate 7, fig. 1)


The type locality of this species is Two Medicine Lake, Glacier National Park, Montana. The food plant is _Penstemon confertus_ Dougl, on which larvae were collected by Miss Braun during late July, 1920. The infestation was localized. In the harpes of the male genitalia, note that the costal margin is projected and curved down to near the end of sacculus, is blunt from the standpoint of comparison, and the recurved projection from the center of the costa is broadly rounded distally. The palpi are as described for the new species, which follows, but there would seem to be more scales on the upper rear expansion of the second joint, making it appear larger.
Pyramidobela argyrtodes Meyr.

(Plate 7, fig. 2)


Type locality, Alpine, Texas; April and May; host unknown. The costa of the harpes in this species is curved down and extended beyond the end of sacculus, with its end attenuate but rounded, and the recurved projection sharp pointed. The expanded scales of the second joint of the palpi appear largely worn away on the specimen at hand.

Pyramidobela angelarum Keifer, new species

(Plate 5; Plate 7, figs. 3a, 3b)

Expanse 16-21 mm. Palpi dull gray-brown; basal joint blackish outwardly; second joint whitish on posterior half with black irroration in expanded portion, blackish outwardly at base, a more or less complete annulus of black irroration at one-third, another at two-thirds fading to the rear in the black irroration of the upper posterior tuft, another band, faint, just below apex, the apical scales strongly tipped white; apical joint lighter with a black annulus at middle and tip black. Head rough, whitish, dark fuscous irroration; antennae dull gray-brown, basal joint blackish on anterior edge, shaft alternate lighter and darker annuli. Forewings dull gray-brown giving a rather even ashen effect; there is considerable fuscous irroration especially on the dorsal side of the fold; costal edge, and more narrowly the dorsal edge, irrorated dark and blackish fuscous. First three tufts at point of a triangle, half-way between costa and plica at one-fourth, in plica at about one-third and at center of wing beyond one-third, respectively; the first small, black; plical moderate size, black, outer part luteus; the third mostly luteus and same size as plical. A faint blackish band from costa before first tuft obliquely to dark area between tufts. Last two tufts at two-thirds, the upper black, very small, the lower the largest of all, mostly luteus, in center of wing. Faint, often absent central longitudinal dark streak from third tuft to tufts at end of cell. Faint dark streaks tending to follow the veins on the apical area. Scales at cilia base blackish, tending to form spots along apical margins. Cilia gray-brown, white-tipped, two or three white and one dark line around apex. Hindwings gray, the cilia somewhat ochreous basally and with several faint transverse longitudinal lines. Abdomen whitish-gray, irrorated fuscous below. Thorax
below rather white, legs gray with darker shades and annuli. Male genitalia with uncus broad, depressed, hood-like; gnathos absent; harpes broad with costa projecting out into a somewhat down-curved setiferous rather sharp spine-like structure; from the center of the costa is a recurved thin narrow process ending in an enlarged rounded tip; the sacculus consisting mainly of a setiferous plate, ending almost below the end of the costal projection in a short spine; aedoeagus recurved at base and rather long, obliquely truncated and pointed distally. Female genitalia with medium length ovipositor and the whole base of the bursa copulatrix sclerotinized.

Type, male, collected in Los Angeles during the first part of April, 1935, as a larva on Buddleia (davidii?), the adult emerging May 27, 1935. Allotype, female, same data but adult emerging May 25, 1935. Thirty-eight paratypes are on hand from larvae collected in Los Angeles, April and July 6, 1935, the latter by V. E. Williams; Santa Ana on June 5, 1935, by C. E. Norland; and Santa Paula, June 4, 1935, by E. L. Smith; all from the same host. The species breeds continuously throughout the year on its host, and larvae were recently received from Los Angeles that had been collected October 21, 1935, and adult appearing November 26. This species was first called to my attention in 1934 by Mr. V. E. Williams of the Los Angeles Agricultural Commissioner’s Office, who submitted specimens. Mr. Busck, who determined them as a new species at that time, states that he had previously received examples of this insect from Commander C. M. Dammers. The insect has a subtropical aspect and has surely moved into Southern California recently in company with many other pests now established there.

Pupa about 7 mm. long, light orange-brown; integument strongly setiferous, these setae tending to be strong along the vein ridges on the wings. Abdomen curved ventrally, with three flexible sutures making segments five, six and seven movable. These flexible sutures are of the lateral condyle type described for Agonopteryx clarkei, the dorsal flexures with opposed pairs of tooth rows on the edge. Apex of abdomen with a contiguous pair of central lobes just behind the genital pore; no cremaster but hooked hairs.

Larval length 12-14 mm. when full grown. Body yellow-green, dorsum very lightly infused a dull brown shade, body tubercles dark fuscous, moderate in size and dorsally surrounded by light or whitish areas; hairs moderate in length, fuscous; skin finely spinulate. Head piceus, lighter areas near posterior edges above on each side of foramen. Shield piceus, rest of prothorax purplish. Suranal plate lightly infuscated. Central crochets in complete biordinal circle, 30-32; caudal crochets 18-20. Prepupal larva with bright pink coloration on dorsal half. The larva
rolls, skeletonizes, and shreds leaves, and eats into terminal buds of various Buddleias. Several larvae were examined.

The morphological features of this interesting genus show many points worthy of note. The second joint of the adult palpi is expanded with scales, coming out in front to a sharp edge, broadly truncate apically, and roughened near apex above. The terminal joint is shorter than the second, and slender. All Ethmias seen have palpi which are slender throughout. Ethmia and Pyramidobela lack pecten on the antennal scape. The wings of Pyramidobela are narrower than those of the Ethmias examined, but there seem to be no other striking differences except in the cubital veins which originate back of the discal cell angle in Pyramidobela. The veination of Agonopteryx is fundamentally similar to these. The aedoeagus of the male genitalia of Pyramidobela has a peculiar basal structure, as illustrated. This basally recurved aedoeagus is a characteristic of Ethmia, Borkhausenia, and others. A few Ethmias have an uncus very similar to Pyramidobela. The male genitalia of Hyponomeuta are not at all like anything here discussed.

There seems no reason why we should not consider the lateral condyles on the pupal abdomen of Pyramidobela as homologous with the same structures on the pupa of Agonopteryx clarkei, of Ethmia albitogata (Plate 7, fig. 7), of Setiostoma and other members of the Gelechioidae. The Ethmia pupa has but two flexible sutures, as illustrated, suggesting Pyramidobela to be nearer the Oecophoridae. If we consider the pupa as the most conservative phase of these moths, this abdominal articulation becomes significant taxonomically. (The Borkhausenia pupa appears to lack these lateral condyles and the larva possesses no accessory setae on the anal proleg.) Ethmia has setiferous pupal prolegs projecting forward from the venter of the ninth segment which give the pupa a peculiar backward and forward motion when it is disturbed. The pupa of Setiostoma has rudimentary prolegs with recurved spines on the eighth segment. Pyramidobela lacks pupal prolegs. A complete analysis of Ethmia and Setiostoma is now in preparation.

The head of the Pyramidobela larva is as illustrated. On the meso- and metathorax note that seta Ia and Ib are on a compound tubercle as in Ethmia, Anacampsis and Holcocera. Abdominal segment nine possesses all seta. Note particularly the position of seta I on A9 which is on the same tubercle as and dorsad to seta II as in Ethmia. On Borkhausenia, Endrosis and Holcocera seta I is still on the same tubercle with II but lateral to II. Seta III is of the type common to many Gelechioids. The anal prolegs have the most interesting feature on the larva, namely, a considerable number of accessory setae which obscure the usual upper and lower primary series of setae. These acces-
sory setae are found on the front, outer side and back of each leg. On most Gelechioid larvae examined that have accessory setae on the anal prolegs, these extra setae are confined to the lower series of primary setae, and are only on the side, or side and front.

The larvae of *Ethmia arctostaphylella* and *Ethmia discostrigella* have been examined. Both of these have the well-known accessory setae associated with seta VII on segment A9, which suggests a correlation with the apically setiferous prolegs of the pupa. Otherwise *arctostaphylella* possesses only accessory setae in the lower series of the anal proleg, a character common to many Gelechioids. The other *Ethmia* larva, presumably *discostrigella*, is more interesting. The anal proleg has setae similar to *Pyramidobela* but also possesses accessory setae on the other prolegs, in series VII on segments A1 and A2, and on the thoracic coxae.

GELECHIIDAE

**Eucordylea gallicola** Busck  
(Plate 7, fig. 9)


Mr. Busck has determined moths for me as this species, the moths being taken in the Sacramento vicinity, thus extending the range of this species, originally described from Colorado. One adult emerged from willow taken at Oroville in 1927.

On May 24, 1933, a larva was beaten from Sacramento pussywillow, *Salix lasiolepis* Bentham, that subsequently produced an adult of this species. Length 8 mm. Head yellowish-brown. Body whitish, dorsum with pale pink lines and spots. Tubercles small, fuscous. Anal fork present, the central prongs crossed.

**Eucordylea huntella** Keifer, new species  
(Plate 6)

Expanse 14-15 mm. Palpi white; first joint blackish; second joint over-laid blackish on outer and anterior side leaving base, middle annulus and tip, white; terminal joint with base black, and two black annuli, one just below middle, the other just below tip. Head white, fuscous irrorated on sides of face and above. Antennae white, scape black above and funicle with black annuli. Thorax and patagia white, fuscous irrorated, a pair of black spots behind head and slight black scale tuft on each side just before apex. Forewing white, evenly irrorated
light fuscous; small black tuft at fold base; costal base dark
with black streak from radial stem base obliquely out to dark
costal spot at one-third, this streak usually twice interrupted;
three pairs of small black and white tufts: first pair at about
one-fifth on either side of fold, the upper very small and nearer
base; second pair at just beyond one-third, one in disc, the other
in fold, the upper nearer apex; third pair at end of disc, fairly
well centered and connected by white, the upper the farther out.
A faint outwardly angulate narrow fascia from costa to tornus.
Seven or eight black dots along apical margins at base of cilia
with one at apex. Cilia whitish basally along outer margins and
tornus, elsewhere with light gray irroration along costa and
around apex, with a dark line around apex. Hindwings light
gray; the cilia lighter. Abdomen white or yellow-white, slightly
grayish; a subventral fuscous line. Legs yellow-white with black
or dark fuscous markings. Male with less black on outer side
of second joint of palpi than female; expansive tuft of white hair
on upper side of second joint of the male palpi though the female
has a tendency in this direction; basal two-thirds of male anten
tagellum noticeably thickened and more uniformly gray, though
annulate; yellow hair-pencil from dorsal base of male hindwings.
Male genitalia with uncus broad, slightly bilobed, gnathos a
slender hook, tegumen assymmetrical but lacking lateral projec
tions, harpes assymmetrical with left harpe moderately long and
slender, annellus and aedoeagus as figured, dorsal genital cover
a broad blunt lobe. Female genitalia as figured.

Type, male, collected May 21, 1935, as larva, by H. A. Hunt,
and the writer, on Rhododendron occidentale Gray, on the mid-
dle fork of the Mokelumne River the West Point district, Cala-
veras County, the adult appearing June 2, 1935. Fifty-six desig
nated paratypes are from the same host and locality. The species
is named for Mr. Hunt who discovered the larvae.

This species is very similar to E. mackiei Keifer, described
from Manzanita berries. The new species is larger, the second
palpal joint is lighter, the forewings are lighter and lack the cen
tral longitudinal black streak possessed by mackiei. The lobe
over the male genitalia of mackiei (Plate 7, fig. 8) is more
pointed. Otherwise the two species are very similar, showing a
common origin. Mr. Busek kindly compared the new species
with elucidella Barnes and Busek, and finds it structurally distinct.

In placing mackiei and huntella in Eucordylea, the original
definition of the genus is broadened and almost merged with the
majority of species now referred to Recurvaria. The species
atrupictella Dietz (genotype of Eucordylea) (Plate 7, figs. 10a,
10b), gallicola Busck, and elucidella B, & B, are structurally sim
ilar, with a strong upward projecting tuft from the second palpal
joint; the male genitalia have lateral projections from the tegu
men and the left harpe is short (male genitalia of elucidella not
seen). As will be noted, the new species and its associate are distinct from the genotype of Eucordylea in these regards. For discussion of the genotype of Recurvaria and its relation to the bulk of North American species now referred thereto, see Busck, Proc. Ent. Soc. Wash., Vol. 31, p. 15, Jan. 1929.

The pupa of huntella is 5-6 mm. long and is brown with glabrous integument. Abdomen tending to be curved dorsally with hindlegs reaching to the end of the fifth segment and the maxillae separating the midlegs. There are three partly flexible sutures on the abdomen. This pupa is similar to other Recurvaria pupae examined and to the pupa of E. gallicola. On the other hand the pupae of "Recurvaria" francisca Keifer and ceanothiella Braun differ in having the midlegs meet below the maxillae, a very unusual and distinct development which is likely the structure found in the genotype of Tosca Heinrich.

Larva of huntella approximately 10 mm. long when grown. Head brown over-laid very dark brown. Shield dark brown, also suranal plate. Body red or purplish-red; tubercles medium size to small, fuscous; skin finely spinulate. Crochets on central prolegs plus or minus twenty-eight, in a complete biordinal circle weaker outwardly; rear crochets about twenty in a complete biordinal series. This larva reminds one of the Peach Twig borer, Anarsia.

The structure of the larval head parts is illustrated; note the anterior position of seta A₉. The thoracic legs are spinulate especially on the tarsi, and the outer posterior apical seta is curved and broadly blade-like. Seta VI on segment A₉ is either on the same tubercle with IV and V or separated. Accessory setae only on anal prolegs in the "b" series; setae VIIac and VIIbc, on the interior rear of these legs are approximate. There is no anal fork as possessed by gallicola. Three larvae of huntella were examined.

This larva bores into and destroys the flower buds of its host Azalea. A few larvae were found in leaf buds, and one in a folded leaf. The infestation at the type locality had destroyed nearly all of the Azalea flowers for a hundred yards along the river below the road, which was as far as we investigated the species.

Aristotelia eldorada Keifer, new species

(Plate 7, figs. 11a, 11b)

Expanse 11-12 mm. Second joint of palpi white with three broad blackish annuli and tip black; third joint black with white
annulus above base, white scales at about one-half, and front edge lined white. Head dark grayish-black, slightly brown behind. Antennae black with some white scales toward base and along front side. Thorax chestnut-brown, patagia with some blackish scales. Ground color of forewings chestnut-brown with pinkish reflections, darker on costal one-half, costal edge broadly infuscated or blackish and dorsal edge slightly infuscated. Pinkish spot at fold base. Silvery line from pink spot along fold a short ways and thence obliquely toward dorsal edge ending well before edge. White and silvery oblique fascia from costal one-fifth, ending before reaching dorsal one-fourth, white only on inner costal side of fold and edged black along white. Short oblique silvery streak at about costal one-third. First section of black central longitudinal streak between first and second fasciae, straight on costal side but broadened to fold below. Second fascia silver and white, from costal one-half, obliquely outward to black streak which it interrupts by two white intrusions, thence obliquely inward and fading as silver on dorsum, edged white on inner part interrupting black longitudinal line. Third fascia from costal cilia beginning obliquely inward to tornus, silver except white spot at black line interruption. Black line from central fascia narrow and pointing to apex where it fades. Cilia dark fuscous with pinkish and whitish spots and scales around apical margins in their bases; a white spot just below apex of wing; slightly darker lines in apical cilia. Hindwings fuscous. Wings below a leaden color with elongate hairs from male frenulum hook. Abdomen leaden color above, below whitish especially along mid-ventrum and at segment apices, with sub-ventral fuscous line. Legs dark fuscous with white annuli; three annuli on fore tarsi; posterior tibiae with two prominent and one faint white band, and apex white. Male genitalia compact, uncus broad basally, narrowing to apical point; gnathos a hook-shaped structure; harpes surpassing uncus, rather straight; structures surrounding aedeagus fused centrally with two posterior setiferous lobes; aedoeagus sinuate, attenuate, bulbous basally and with some sclerotization in the connective tissue below. Female genitalia figured.

Type, male, collected by the writer near Deer Creek El Dorado County (Shingle Springs area), April 24, 1935, as larva on Adenostoma fasciculatum H. & A., the adult emerging May 16, 1935. Allotype, female with same data, the adult emerging May 22, 1935. Twenty-five designated paratypes are from this area, part of the adults reared as above. This species is near adenostomae Keifer and has practically the same genital structure, but is colored quite differently and shows a different life history. Larvae of adenostomae appear in May and June after the flight of the new species has passed. Moreover, larvae of adenostomae are not or rarely found in the area inhabited by eldorada, being consistently lower in habitat. The adult of adenostoma is much blacker than eldorada and the coastal form
lacks silver streaks. Adults of *adenostomae* have been reared in numbers from typically colored larvae taken at Ione, Amador County, June 16, 1933, at not over 500 feet elevation, these adults however, possessing silver scales on the forewings. Larvae and adults of *eldorada* have never been met with below 1,200 feet elevation, and one adult was taken at Chiles, Napa County. This latter record shows the species to occur at higher elevations in the Coast Range.

Larva of *eldorada* about 8 mm. long when full grown. Head sordid yellow-green, fuscous mottled behind. Body greenish, dorsal one-half over-laid with fuscous brown, this area sparsely irrorated with white which faintly indicates six longitudinal lines. A white full-length line just below spiracles, broken centrally on meso- and metathorax. Fuscous brown marks just above thoracic legs. Shield reddish anteriorly and suranal plate slightly darker than body color. Hairs white, on very small tubercles. Two pronged anal-fork present. Central proleg crochets 16-22; anal proleg crochets 22-27. Described from one larva.

The larva feed among the young leaves, and before pupating, on the blossom buds of *Adenostoma*. In areas where adults were extremely common during the latter part of April, 1934, few larvae could be found in 1935. For that matter, I have never succeeded in collecting larvae in numbers, whereas adults have always been observed as plentiful during the flight.

**Gelechia langei** Keifer, new species

(Plate 7, fig. 12)

Expanse 20 mm. Palpi white; first joint orange; second joint orange on outer side at base, fading toward tip; third joint slightly orange toward base. Head white. Antenna white, basal joint over-laid fuscous-orange above, remainder alternate fuscous and white annuli, the white somewhat obscure below. Thorax and patagia white infused orange except at thorax tip. Forewings bright orange-yellow and white with rough scaling, smoother apically. Dorsal base white, the color extending almost to costal edge, white somewhat oblique band at one-fourth from just within costa to over fold; broad transverse white band at one-half similarly enclosed; antapical white fascia at three-fourths, slightly inwardly oblique, running clear across wing; outer apical edge narrowly white at base of cilia; cilia very light yellow. Hindwings light fuscous-yellowish, the cilia light yellow. Uncus of male genital hood-shaped; gnathos recurved, hook-like; harpes curved ventrally and tapering to a fine point; aedeagus slender, moderately long with narrow anterior projection.
Type, male, reared from *Pinus ponderosa* Dougl., May 15, 1935, the larva collected near Placerville, California, by Mr. W. H. Lange, and bearing a Hopkins U. S. No. 21, 182 N. One paratype in the writer's collection taken near Dutch Flat, Placer County, May 11, 1934, by Mrs. Eleanor Fourness. This species may be recognized by the striking coloration and the rough scaling. It is similar in color to the Olethreutid, *Petrova subiniana* (Kearf.), which also is a pine feeder. Both species have evidently been influenced in color by similar environment. The new species is named for the collector.

The type and allotype of *Agonopteryx clarkei* are presented to Mr. Clarke who is revising the genus. The type of *Gelechia langei* is in the U. S. National Museum since it is government property. The other types and allotypes have been placed in the California Academy of Sciences. Paratypes as far as possible distributed as usual and to Dr. J. A. Comstock for the Los Angeles Museum.

*Sacramento, California*
PLATE 4

AGONOPTERYX CLARKII, NEW SPECIES

Fig. 1. Adult head, left side.
Fig. 2. Female genitalia.
Fig. 3. Male genitalia.
Fig. 4. Wings.
Fig. 5a. Pupa, ventral view.
Fig. 5b. Pupal abdomen, left side.
Fig. 5c. Pupal abdomen, dorsum.
Fig. 6a. Larval head, front.
Fig. 6b. Larval labrum.
Fig. 6c. Larval head, left side; I—first ocellus; A3—third anterior seta; O2—second ocellar seta; O3—third ocellar seta.
Fig. 6d. Larval head, suboral structures and left epicranium; O3—as above; G1—genal seta.
Fig. 6e. Larval mandible.
Figs. 7a, 7b, 7c. Left subdorsal view of larval thorax, first three and last four abdominal segments, respectively; 1a, 1b—setae on dorsum of metathorax.
Figs. 8a, 8b, 8c. Left subventral view of same segments.
Fig. 9. Larval metapod.
Fig. 10. Left anal proleg, anterior side; VIIpa—anterior puncture in group seven.
Fig. 11. Left proleg of third abdominal segment.
Fig. 12. Upper view of last two abdominal segments.
Fig. 13. Left side of last two abdominal segments; III—third seta on segment A9; VIIpl—lateral puncture on anal proleg.
PLATE 5
Pyramidobela angelarum, new species

Fig. 1. Adult head, left side.
Fig. 2. Male genitalia.
Fig. 3. Female terminalia, left side.
Fig. 4. Wings.
Fig. 5a. Pupa, ventral view.
Fig. 5b. Pupa abdomen, left side.
Fig. 5c. Pupal abdomen, dorsum.
Fig. 6a. Larval head, frontal view.
Fig. 6b. Same, labrum.
Fig. 6c. Same, left side; $A_3$—third seta of anterior series; $G_1$—small genal seta; $O_2$—second ocellar seta; $O_3$—third ocellar seta.
Fig. 6d. Same, suboral structures and left side of head.
Fig. 6e. Same, mandible.
Figs. 7a, 7b, 7c. Left subdorsal view of larva with 4th, 5th and 6th abdominal segments missing; 1a, 1b—setae.
Figs. 8a, 8b, 8c. Subventral view of same.
Fig. 9. Larval metapod, rear.
Fig. 10. Front of left anal proleg.
Fig. 11. Left proleg of segment $A_3$.
Fig. 12. Left side of last two abdominal segments; I, II and III setae.
Fig. 13. Last two larval segments from upper rear.
PLATE 6

EUCORDYLEA HUNTELLA, NEW SPECIES

Fig. 1. Wings.
Fig. 2. Left side of adult head.
Fig. 3a. Male genitalia, uncus, tegumen and harpes.
Fig. 3b. Male genitalia, aedeagus and associated structures.
Fig. 3c. Male terminalia, dorsal covering lobe of eighth segment.
Fig. 4a. Left side of female abdomen minus ovipositor and third, fourth, and fifth segments.
Fig. 4b. Ventral diagram of female terminalia.
Fig. 4c. Female signum.
Fig. 5. Pupa.
Fig. 6a. Larval head, anterior diagram of frons and epicrania.
Fig. 6b. Larval epicranium, left side; $A_3$—third anterior epicranial seta; $O_2$—second ocellar seta.
Fig. 6c. Larval suboral structures with epicranium to right.
Fig. 6d. Larval mandible.
Figs. 7a, 7b, 7c. Left subdorsal view of larva, minus last three proleg segments; 1a and 1b—dorsal setae on metathorax.
Figs. 8a, 8b, 8c. Same, left subventral view.
Fig. 9. Larval metapod, rear aspect.
Fig. 10. Left anal proleg, anterior view; VIIpa—anterior puncture.
Fig. 11. Left proleg from third abdominal segment.
Fig. 12. Left side of last two larval abdominal segments: III and VI—setae on ninth abdominal segment; VIIpl—lateral puncture.
Fig. 13. Larval abdomen, upper rear view of last three segments.
Fig. 1. *Pyramidobela quinquecristata* (Braun), male genitalia.

Fig. 2. *Pyramidobela argyrtodes* (Meyr.), male genitalia.

Fig. 3a. *Pyramidobela angulata* ventral side of female terminalia.

Fig. 3b. Same, anterior sternal plate of female.

Fig. 4. *Agonopteryx* sp., larval mandible.

Fig. 5. *Agonopteryx psoraliella* Wlsm., larval mandible.

Fig. 6. *Agonopteryx clarkei*, anterior sternal plate of adult.

Fig. 7. *Ethmia albitogata* Wlsm., pupal abdomen; subventral and subdorsal views, respectively.

Fig. 8. *Eucordylea mackiei* Keifer, male genitalia (See Figs. 3a, 3b and 3c, Plate III).

Fig. 9. *Eucordylea gallicola* Busck, male genitalia.

Fig. 10a. *Eucordylea atrupictella* Dietz, male genitalia.

Fig. 10b. Same, left side of male head.

Fig. 11a. *Aristotelia eldorada*, male genitalia with aedoeagus separated to right.

Fig. 11b. Same, left side of female abdomen with segments 3, 4 and 5 omitted.

Fig. 12. *Gelechia langei*, left side of male genitalia.
NEW SCOLYTIDAE (COLEOPTERA) OF SOUTHERN CALIFORNIA WITH A KEY TO THE SPECIES OF PSEUDOTHYSANOES BLACKMAN

By C. R. Bruck

When the author described the species Renocis penincillatus Br.¹ he said that the species was not of economic importance. Since that time it has been the writer’s misfortune to see many acres of valuable watershed of the San Gabriel Mountains destroyed by fire. This fire resulted in loss of life and great property damage by the floods caused by the following rains.

The killing of shrubs and bushes, the chief vegetation of the Southern California foothills, by insects undoubtedly increases the fire hazard. The author while making an intensive study of the bark beetles in this type of growth found several new species which are made known in this paper.

In making the key to the species of Pseudothysanoes Blackman the author, due to the lack of certain species, had to copy, adverbum, from Dr. Blackman’s² key of this genus.

Acknowledgments for assistance afforded in making this study are due to Mr. A. J. Barton, Assistant Forester and Fire Warden, Los Angeles County Department of Forestry, for the determinations of the host plants; Dr. John Comstock and Prof. L. J. Muchmore of the Los Angeles Museum for their cooperation; Mr. Chas. S. Cressaty of Los Angeles who made it possible for the writer to accomplish the field work; and to Mr. A. T. McClay for the long series of species presented.

KEY TO SPECIES³

1. Declivital interspaces subequally elevated with a single row of spatulate bristles ........................................ 2

Third and ninth declivital interspaces elevated and ornamented with a double row of spatulate bristles .................. 7

2. Sutures of antennal club arcuate; pronotum of the males distinctly subtriangular in outline ........................................ 3

Sutures of antennal club transverse; pronotum of the males faintly subtriangular in outline ................................. 6

¹ Canadian Entomologist, Vol. 65.
² Bulletin New York State College of Forestry, Sept., 1928.
3. Sutures of antennal club uniformly curved; elytral bristles fine and faintly conspicuous ............................................. 4

First suture of antennal club broadly curved, second narrowly curved; elytral bristles broadly spatulate and conspicuous ................................................................. 5

4. First and second sutures of antennal club subangulate; anterior margin of the pronotum widely margined in the males and armed with four asperities; anterior pronotal slope armed with few small sharp asperities; elytral striae faintly impressed ....................... hopkinsi Blkm.

First and second sutures of antennal club obliquely arcuate; anterior margin of the pronotum narrowly margined in the males and armed with two to four asperities; first elytral stria distinctly impressed, others not impressed ........................ bartoni n. sp.

5. “Pronotum⁴ with anterior area more strongly asperate; elytral declivity of males more convex, with summit well behind the middle of elytra; strial punctures moderately coarse (Eastern)” ......................................... drakei Blkm.

“Pronotum⁵ with anterior area less strongly asperate; elytral declivity of the males more oblique, with the summit near the middle of the elytra; strial punctures coarser (Eastern)” ........................................ rigidus (Lec.)

6. Anterior margin of the pronotum armed with two asperities; elytral declivity deeply sulcate ........................................ sulcatus n. sp.

Anterior margin of the pronotum armed with six asperities; elytral declivity uniformly rounded .................................. phorodendri Blkm.

7. Third declivital interspace more strongly elevated than the ninth, first ornamented with but a single row of scale-like bristles ...................................................... 8

Third and ninth declivital interspaces subequally elevated, first ornamented with a double row of scale-like bristles .... 9

8. “Anterior⁶ margin of the pronotum scarcely serrate in the males, not serrate in the females; elytra more narrowly rounded behind, ornamented with narrower spatulate bristles; smaller (Eastern)” ........................................... lecontei Blkm.

“Anterior⁷ margin of pronotum moderately serrate in the males, weakly serrate in the females; elytra not so narrowly rounded behind, ornamented with wider spatulate bristles; larger” ........................................... sedulus Blkm.

9. Front of head of male plano-concave below; anterior margin of pronotum with from four to eight asperities; stria punctures of elytra rather fine; first and second declivital interspaces not granulate above .......................... gambetti Blkm.

Front of head of male convex below; anterior margin of pronotum with seven asperities; stria punctures rather coarse; first and second declivital interspaces coarsely granulate above .......................... barberi Blkm.

**Pseodothysanoes bartoni N. Sp.**

Length 1-1.5 mm. Front of male convex between the eyes, densely, closely, finely granulate punctate, very opaque, sparsely clothed fovea behind epistomal margin; sutures of antennal club obliquely arcuate. Pronotum slightly wider than long, 0.9:0.7, subtringular in shape, very sparsely clothed with short coarse hairs, constricted near anterior margin, impressed dorsally from the constriction to behind the summit; anterior margin narrowly margined, armed medially with from two to four small, sharp asperities; anterior slope armed with numerous small sharp asperities; posterior slope densely, closely, finely granulate; sides more glabrous, faintly sparsely punctate. First elytral striae impressed, more deeply on the declivity, punctures small, separated by more than their own diameter; interspaces smooth and flat, faintly rugose on the disk, clothed with a single row of short spatulate hairs interspaced with a few longer ones; declivity with no distinctive differences of the elytra.

The female differs from the male by having frontal fovea deeper, larger, extending to between the eyes; pronotum without asperities on anterior margin and less distinctly subtringular.

This species is closely related to *P. hopkinsi* Blkm, but is readily separated by having but two to four asperities on the anterior pronotal margin, numerous asperities on the anterior pronotal slope, and by the lack of vestiture of the elytral striae.

The author took a very long series of this species from dead and dying twigs of *Malvastrumthurberi* at Saddle Peak, Santa Monica Mts., Calif., XII-16, 1933. Mr. A. T. McClay took a long series of this species from the same host plant at Pacoima, Calif.

The holotype and allotype will be retained in the author's collection; one pair of paratypes will be sent to Dr. E. C. Van Dyke at the University of California to be deposited in his collection at the California Academy of Sciences; one pair will be sent to Dr. J. M. Swaine to be deposited in the collection at the Canadian National Museum; one pair will be deposited in the collection of the Los Angeles Museum; and ten pairs will be retained in the author's collection.
PSEUDOTHYSANOE*S SULCATU*S N. Sp.

Length 1.25-1.75 mm. Front of male shallowly impressed; impression flat, granulate punctate, moderately clothed with short hairs, densely fringed with long hairs; antennal scape clavate, sparsely clothed with long hairs, club slightly longer than the funicle, septate, sutures transverse. Pronotum slightly wider than long, 0.9:0.7, slightly subtriangular in shape, moderately densely clothed with short, thick, scale-like hairs on anterior slope becoming finer and more sparse on the sides and posterior slope; sides and posterior slope densely, closely, finely granulate, opaque; summit closely, densely serrate; on the anterior slope the serrations are less dense, larger, and more acute than on the summit; anterior margin with two small, acute median teeth. Elytral striae marked only by a row of very widely spaced, very short, very indistinct hairs; interspaces marked only by a row of very widely spaced, short, scale-like hairs; elytral surface opaque, densely, closely, finely granulate; first and second declivital interspaces impressed at summit forming a deep sulcus; posterior half of declivital face flat, vestiture and markings same as on the elytra.

Front of female deeply concave; concavity densely clothed with short coarse hairs; vestiture of antennal scape longer and denser than in the male; serrations on anterior slope of pronotum coarser but more sparse, summit coarsely granulate but not serrated; elytral striae very faintly, very indistinctly impressed.

This species is readily separated from any of the others of this genus by the sulcus formed by the first and second declivital interspaces being deeply impressed.

The author collected a long series of this species from dead and dying twigs of Ceanothus integerrimus on Mt. Wilson, Calif, and from C. divaricatus on Henniger Flats, Mt. Wilson, Calif.

The holotype and allotype will be retained in the author's collection; one pair of paratypes will be sent to Dr. E. C. Van Dyke at the University of California to be deposited in his collection at the California Academy of Sciences; one pair will be sent to Dr. J. M. Swaine to be deposited in the collection of the Canadian National Museum; one pair will be deposited in the collection of the Los Angeles Museum; and ten pairs will be retained in the author's collection. All type material is designated from specimens taken on Ceanothus integerrimus.

PHLEOSINUS GRANULATUS N. Sp.

Length 1.5-2 mm. Front of male densely, minutely granulate except on the deep concavity between the eyes; concavity glabrous, very sparsely punctate with moderate punctures,
fringed with numerous short hairs; antennal club longer than funicle and scape combined, 1.25:1.00, first and second segments of antennal club subequal, first suture subarculate, second slightly obliquely arcuate, third segment as long as the first and second combined and divided medially by a strongly oblique row of short hairs and with a faint row at the apex. Pronotum wider than long, 5.00:3.5; sides strongly arcuate, slightly constricted behind the anterior margin, constriction very faintly impressed on the dorsum; very densely, minutely granulate on the disk and sides, glabrous on the anterior half which is densely moderately punctate; sparsely clothed with short erect hairs. Elytra with striae half as wide as the interspaces, shallowly impressed, less distinct on the sides; striae densely, closely, finely granulate obliterating the strial punctures; interspaces plano-convex, densely, closely, finely granulate with a distinct row of small, widely spaced granules, sparsely clothed with short hairs; declivity sparsely clothed with short hairs, declivital face densely, minutely granulate punctate, very densely, closely, finely granulate at the summit and apex; first and third interspaces slightly elevated, more distinctly on the summit, serrations very sparse, moderately large, and acute at the summit, a single moderately large tooth on the declivital face, and one large one at the apex, second and fourth interspaces with very small granular serrations, widely spaced, the entire length of the interspace. Mesasternum precipitous.

The female differs from the male by having the front plano-convex, naked, densely, minutely granulate punctate. Elytral interspaces are less opaque on the disk, declivital serrations are smaller, less acute, and more numerous, the declivital interspaces are more densely pubescent.

*P. granulatus* is distinguished from *P. swainei* Br., by the very dense, close granules of the elytra and pronotum and by having small granular serrations on the second and fourth declivital interspaces. It is readily separated from *P. russus* Sw. by having the pronotal sides strongly arcuate and by having a row granular-like elevations on the elytral interspaces.

This species was taken in long series from under the bark of dead and dying twigs and branches of *Cupressus forbesi* in Santa Ana Canyon, Orange Co., Calif., XII-10-1933 by the author.

The holotype, allotype, and ten pairs of paratypes are retained in the author's collection; one pair will be sent to Dr. E. C. Van Dyke at the University of California to be deposited in his collection at the California Academy of Sciences; one pair will be sent to Dr. J. M. Swaine to be deposited in the collection at the Canadian National Museum; and one pair will be deposited in the collection at the Los Angeles Museum.
Pseudocryphalus maclayi N. Sp.

Length 2 mm. Front densely finely granulate, densely, very minutely, shallowly punctate, moderately densely clothed with short coarse hairs, longer hairs on the epistomal margin, distinctly impressed between the eyes; lateral borders of the impression clothed with short, narrow, very coarse, brown, tooth-like hairs and armed medially on each side with a prominent, coarse, granule-like tooth; epistomal margin armed with a small median granule and clothed with long hairs; antennal club short and stout, sparsely clothed with short stiff hairs. Pronotum wider than long, 1.4:0.9, densely clothed with short brown and white scales hiding the pronotal surface; scales forming pattern of white with a light brown arrow head-shaped median spot on the disk and a lateral dark brown spot, the anterior border of which has two prominent teeth, one acute, the other rounded and shorter; the posterior border is armed with three equally prominent, subacute teeth; sides strongly arcuate, strongly impressed behind the anterior margin; anterior margin broadly rounded, fringed with recurved short, broad, scale-like hairs. Elytra densely clothed with short, brown and white scales forming brown and white bands across the elytra, the anterior band is brown and narrow, becoming very narrow laterally, the third band is as wide as the white second band, the posterior margin attains the summit of the declivity; striae distinctly impressed with moderate, deep punctures separated by less than their own diameter from which arises a very fine, very short, very inconspicuous hair; interspaces plano-convex, armed with a single median row of upright, very broad, brown, spatulate hairs; declivity steep, clothed with white scales on the declivital face surrounded by brown scales; first and second interspaces flat, finely granulate, minutely punctate, vestiture when present is of white, short scales but unarmed with the broad spatulate hairs of the elytra; strial punctures small, shallow, separated by several times their own diameter.

Frontal variations are that the tooth-like hairs are shorter and less numerous in some specimens; the vestiture laterally of the impression is often sparse or lacking. On the declivity the striae often do not attain the posterior margin. These may be sexual differences but due to the intergradation of the extremes the writer does not find them constant enough to name them as definite sexual characters.

This species is readily separated from P. brittaini Sw. and P. cridellei Sw. by the more dense vestiture of the elytra; characters of the elytral declivity; and by the serrations on the lateral brown spots of the pronotum.

This species was described from 352 specimens collected by Mr. A. T. McClay; six were taken by beating Encelia californica in Westwood Hills, Calif., one on V-1-1935, one on V-
11-1935, and one on VI-28-1935; two were dug out from under the bark-like epidermal layer of the same host, same locality on XII-25-1935, twenty more on XII-30-1935; 324 specimens were taken by Mr. McClay and the author at the same locality from the same host plant on 1-26-1936.

The holotype will be retained in the author's collection with twenty-five paratypes; one paratype will be sent to Dr. E. C. Van Dyke at the University of California to be deposited in his collection at the California Academy of Sciences; one will be sent to Dr. J. M. Swaine to be deposited in the collection at the Canadian National Museum; one will be deposited in the collection at the Los Angeles Museum, and twenty-five will be sent to Mr. McClay.

**Carphoborus cressatyi N. Sp.**

Length 1.5-3 mm. Front of male plano-convex, slightly impressed behind the epistomal margin, entire front moderately clothed with moderately long scale-like hairs; armed with a medial granular-like tubercle between the eyes; epistomal margin fringed with sparse long hairs; cephalic portion minutely granulate punctate; sutures of antennal club strongly, obliquely arcuate, tip of club rounded to conform with sutures. Pronotum wider than long, 1.3:1.0, very densely, minutely punctate, densely clothed with very short scale-like hairs; sides distinctly subparallel on posterior two-thirds, strongly narrowly anteriorly and distinctly constricted behind the anterior margin; very densely, finely punctate, punctures deeper on the posterior two-thirds than on the anterior third; densely clothed with very short scale-like hairs. Elytral striae distinctly impressed with large, deep, closely placed punctures; interspaces plano-convex, densely, finely, closely punctate, densely clothed with very short scale-like hairs, wider than the striae except on the declivity where the first is as wide as the striae, the second narrower, and the third wider; first and third declival interspaces very sparsely armed with acute tubercles, slightly longer than the scale-like hairs.

The female differs from the male by having the front deeply impressed between the eyes; impression densely, finely granulate-punctate, and densely fringed with long hairs; serrations of the declival interspaces larger and more numerous than in the males.

This species according to the key to species of this genus by Bruck comes in the group with *C. simplex* Lec. *C. vandykei* Br. but is readily separated from *C. simplex* Lec. by the sutures of the antennal club being strongly obliquely arcuate and is separated from *C. vandykei* Br. by having the second elytral interspace distinct the entire declival length.

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*Key to Species of Genus Carphoborus Eichhoff, Can. Ent., May, 1933.*

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The holotype, allotype, and ten pairs of paratypes are retained in the author's collection; one pair of paratypes will be sent to Dr. E. C. Van Dyke to be deposited in his collection at the California Academy of Sciences; one pair to Dr. J. M. Swaine to be deposited in the collection at the Canadian National Museum; and one pair of paratypes will be deposited in the Los Angeles Museum.

C. cressatyi was taken under the bark of dead and dying twigs and branches of *Pseudotsuga macrocarpa* in long series by the author at Arroyo Seco, Los Angeles Co., Calif., XII-25-1933.

**Pseudohylesinus serratus** N. Sp.

Length 3-3.5 mm. Front slightly longer than wide, densely, coarsely granulate punctate, very shallowly and narrowly impressed behind the epistomal margin, very sparsely clothed with indistinct hairs; epistomal area divided by a short, low, indistinct carina; epistomal margin sparsely clothed with short hairs; beak wider than between the eyes, wider than long; vortex densely, closely, finely, shallowly granulate punctate. Pronotum wider than long, 1.7:1.1, densely closely, moderately, prominently granulate punctate on the disk, granules more prominent on the sides, less prominent and fewer on the anterior third with the punctures larger and shallower; densely clothed with short, broad, white and brown scales interspersed with short stiff bristles, white scales more abundant on the sides; a longitudinal stripe of white scales extends anteriorly from the base to the dorsal impression; sides subparallel, convergent for over half the length, then suddenly strongly constricted; constriction extending across the dorsum; anterior margin broadly rounded, fringed with a row of short, stiff, widely spaced, coarse, upright hairs. Elytral striae as deep as wide, punctures small, deep, separated by at least two times their diameter; interspaces convex, densely clothed with short, broad scale-like hairs obliterating the surface, scales brown and yellow forming patchy patterns of brown and yellow spots variable in size, pattern, and dominance in color; the immature specimens have more yellow than brown whereas the more mature specimens have more brown which is more dominant, the interspaces are armed with a single row of prominent, very widely spaced granules; alternate interspaces of the declivity distinctly elevated and armed with prominent, widely spaced serrations, those of the seventh and ninth interspaces larger than those of the first, third, and fifth; in a few of the specimens the first and third interspaces are more indistinct; this may be a sexual character; the second declivital interspace is increasingly narrowed apically until it is obsolete midway of the declivital face.

This species is closely related to *P. nebulosus* Lec, but is readily separated by the subparallel sides of the pronotum and
by the distinct serrations on the declivital interspaces and by the alternately elevated interspaces.

*P. serratus* was taken from dead limbs and trunk of *Pseudotsuga macrocarpa* at West Fork San Gabriel Canyon, Los Angeles Co., Calif., XII-29-1934 by Mr. Roy Kessinger of Alhambra, Calif.

A series of fourteen specimens were examined, seven of which were immature, lighter in color. The holotype and ten paratypes are retained in the author's collection; one paratype will be sent to Dr. E. C. Van Dyke at the University of California to be deposited in his collection at the California Academy of Sciences, one will be sent to Dr. J. M. Swaine to be deposited in the Canadian National Museum, and one will be deposited in the Los Angeles Museum.

A SYNOPTIC REVISION OF THE SUBFAMILY HYLESININAE (SCOLYTIDAE-COLEOPTERA) OF WESTERN NORTH AMERICA NORTH OF MEXICO

By C. R. Bruck

The only extensive work on the family Scolytidae of North America was published in 1918 by Swaine, and dealt with Canadian Bark Beetles (Swaine, 1918). That publication included only the more northern members of the family. Due to the lack of complete keys and descriptions, workers have encountered much difficulty in studying our western and southern members of this group of destructive forest insects. Because of work

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1 This paper was originally written as a thesis for M. S. degree at the University of California in 1932. The author has revised and brought the original paper up to date for this publication. Due to the great length the paper will appear in six installments.
being done by others on certain genera of this family, the writer has restricted his investigations to the subfamily, Hylesininae.

The subfamily Hylesininae contains some of the most destructive and important species in the family. Practically all forest trees of the west are attacked by some member of this group, not all of which are of primary importance. The subfamily Eccoptogastrinae has but one important genus in western North America, *Scolytus* Geoff., which attacks firs, true firs and Douglas firs. In the subfamily Hylesininae there is only one genus, *Pseudohylesinus* Sw., that attacks the firs and is of secondary importance. On pine trees the genus *Dendroctonus* Er. of the same subfamily is by far the most important, economically, in western North America. On cupressine trees the genus *Phloeocinus* Chap. is the most important of all the bark beetles. There is only one species of the subfamily that is of any importance to the orchards. *Leperisinus californicus* Sw. attacks the olive tree in southern California although its native host is like that of *Renocis* Csy., *Chaetophloenus* Lec., and other genera which attack shrubs and undergrowth of the forest such as Mountain mahogany, Mountain lilac, and sumac. One genus *Hylastinus* Bedel, which attacks the roots of clovers and *Pseudocyphalus* Sw. on *Encelia* are the only members of the entire subfamily known to work on a perennial plant. All of the other species work between the bark and the cambium layer in either the larval stage, adult, or both, of trees or shrubs. Some members of this group, such as *Phloeocinus cristatus* Lec., do much damage by feeding on the twigs of cypress, causing a pruning back.

In one of the genera it was found advisable to consider certain species as synonyms. This was only done after a careful study of long series from many trees, and from several localities in the west, and after communication with various forest and systematic entomologists.

The completeness and thoroughness of this paper was made possible by the helpful criticisms of Professors W. B. Herms, E. C. Van Dyke, E. O. Essig, and S. B. Freeborn of the Division of Entomology and Parasitology of the University of California. I am indebted to the California Academy of Sciences for the use of its collection, to Dr. J. M. Miller of the U. S. D. A. Bureau of Entomology for the use of the department’s collection and much field information accumulated by workers associated with him. I am also indebted to Dr. J. M. Swaine of the Canadian Entomological Branch and Dr. W. J. Chamberlain of Oregon State College of Agriculture for the loan of material from their collections. Mr. J. N. Knull of Mont Alto, Pa., has been most helpful in building up my collection as well as Mr. A. T. McClay of Los Angeles, and Dr. Burke of Palo Alto, Calif.
Key to the Subfamilies

1. The anterior tibiae produced into a prominent process at the outer apical angle (Pl. 13, fig. 1) .......... Eccoptogasterinae
   The anterior tibiae not produced at the outer apical angle (Pls. 13, 14, figs. 3, 1) ........................................... 2

2. The head visible from above; the pronotum at most only slightly roughened in front (Pl. 11, fig. 5) .......... Hylesininae
   The head subglobose, concealed from above by the pronotum; the pronotum usually distinctly strongly roughened in front (Pl. 11, fig. 4) .......................................................... 3

3. The anterior tibiae with the sides nearly parallel, not widened distally (Pl. 13, fig. 3); the antennal funicle 5 or 6 segmented, usually 6 segmented; the first two visible segments of the abdomen subequal and each as long as the last three united (Pl. 15, fig. 4) ................................................ Micracininae
   The anterior tibiae widened distally and serrate on the outer margin (Pl. 14, fig. 1); the antennal funicle less than six segments ........................................................ Ipinae

Key to the Genera

1. The antennal funicle of 2 or 3 segments (Pl. 9, figs. 1, 4); very small species ................................................. 2
   The antennal funicle of more than 3 segments; species of moderate large size ...................................................... 3

2. The antennal funicle of 2 segments, club with the sutures only at the extreme apex (Pl. 9, fig. 4) .......... Crypturgus Er.
   The antennal funicle of three segments; club segmented Pl. 9, fig. 1) ................................................... Dolurgus Eich.

3. The third foretarsal segment cylindric, not widened (Pl. 13, fig. 4) ................................................................. 4
   The third foretarsal segment distinctly widened and emarginate or bilobed (Pl. 13, fig. 5) ........................................ 7

4. Eyes divided (Pl. 11, fig. 5), antennal club unsegmented, scape much longer than funicle (Pl. 9, fig. 9) .... Polygraphus Er.
   Eyes not divided (Pl. 11, fig. 7); club segmented, scape stout, but little longer than funicle (Pl. 9, figs. 2, 3, 10) ............ 5

5. Eyes deeply narrowly emarginate; antennal scape slightly longer than funicle (Pl. 9, figs. 2, 3, 10) ....... Carphoborus Eich.
   Eyes feebly sinuate in front, hardly emarginate; antennal scape shorter than the funicle (Pl. 9, fig. 8) ............... 6

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6. Anterior coxae in contact with the head beneath, sternum before them obsolete; tibiae margined with short stout teeth (Pl. 13, fig. 5) .................................................. Renocis Csy.

Anterior coxae separated from the head by a very short prosternum; the tibiae margined with long slender teeth on the outside (Pl. 13, fig. 7) .................. Pseudocryphalus Sw.

7. Antennal club unsegmented; funicle attached to side of club (Pl. 9, fig. 11) ........................................... Chramesus Lee.

Antennal club segmented; funicle attached to end of club ... 8

8. Antennal club loosely segmented, segments produced on one side, sublamellate (Pl. 9, fig. 12) ........ Phthorophloeus Rey

Antennal club connate, segments equal sided (Pl. 9, fig. 13) ....................................................... 9

9. Antennal funicle less than seven-segmented ............... 10

Antennal club seven-segmented .................................. 14

10. Antennal funicle five-segmented .................................. 11

Antennal funicle six-segmented (Pl. 10, fig. 7) ..................

................................................................. Tomicus Latr.2

11. Fore coxae very narrowly separated, practically contiguous (Pl. 12, fig. 1); metepimeron visible in part, variably distinct; epistomal process basal and well developed; antennal club flattened; thickened at the base, as wide or usually wider than long (Pl. 9, fig. 13) .................. Dendroctonus Eich.

Forecoxae moderately or narrowly separated (Pl. 12, figs. 2, 6); metepimeron covered by the elytra; antennal club much longer than wide (Pl. 9, figs. 5, 6, 7); front without basal epistomal process ................................................................. 12

12. Antennal funicle with the outer segments distinctly broader (Pl. 9, figs. 5, 6, 7); club elongate, pubescent, compressed with three more or less strongly oblique sutures; eyes deeply emarginate; forecoxae moderately distant (Pl.13, fig. 2); pro-

sternum moderately short; alternate interspaces of the de-

clivity usually serrate or granulate, more strongly in the male; metasternum wide ......................... Phloeosinus Chap.

Antennal funicle with the outer segments hardly widened (Pl. 10, fig. 1); club compressed; densely clothed with coarse erect hairs on upper surface .................................. 13

2 This genus is not represented in the fauna west of the Rocky Mountains.
13. Declivity with a few serrations on the strongly elevated third interspace; antennal club obtuse at the tip (Pl. 10, fig. 1); forecoxae contiguous (Pl. 12, fig. 3); prosternum very short in front of the coxae .......... Chaetophloeus Lec.

Declivity without serrations; antennal club narrowly rounded at the tip; forecoxae moderately separated; prosternum moderately long in front of the coxae .......... Xylechinus Chap.$^3$

14. Forecoxae rather widely separated (Pl. 12, fig. 4) .......... 15

Forecoxae somewhat narrowly separated (Pl. 12, fig. 6) .... 20

15. Venter of abdomen bent upwards behind; elytra gradually depressed behind without a steep declivity (Pl. 15, fig. 1) .... 16

Venter of abdomen normal not bent upwards behind; elytra with the declivity distinct and abrupt (Pl. 15, fig. 2) .......... 17

16. Antennal club very strongly compressed (Pl. 10, fig. 2); clothed above with scales .................................. Leperisinus Reit.

Antennal club slightly compressed (Pl. 10, fig. 10); vestiture above consisting of hairs .................................. Dendrosinus Chap.$^4$

17. Antennal club hardly flattened, subconical, with the first segment almost as long as the second and third united (Pl. 10, fig. 3); episterna scaly .................................. Scierns Lec.

Antennal club distinctly but not strongly compressed, first segment much shorter than the second and third united .... 18

18. Antennal club with the first suture alone strongly chitinized, distinct; first and second segments each longer than the third and fourth united (Pl. 10, fig. 4); ligula widened distally and truncate at the tip; the distance from the front of the eyes to the base of the mandibles is much greater than the width of the eyes; meso- and metepisterna scaly .......... Hylastinus Bedel

Antennal club with the first two sutures strongly chitinized and distinct, the two apical segments together longer than the second; ligula rounded at the tip; the distance between the eyes and the base of the mandibles hardly greater than the width of the eyes, which are narrow and elongate, passing the base of the mandibles on the ventral side of the head .......... 19

19. Front shining, smooth, very sparsely clothed with hairs; pronotum strongly wider than long; segments of the club

---

$^3$ This genus is not represented in the fauna west of the Rocky Mountains.

$^4$ This genus is not represented in the fauna west of the Rocky Mountains.
distinctly subdivided by a constriction and a row of hairs, third and fourth segments very rapidly narrowed, tip pointed; segments of the funicle more strongly widened distally (Pl. 10, fig. 6); meso- and metepisternum scaly; ninth elytral interspace strongly carinate; scutellum oblique.............................................. *Alniphagus* Sw.

Front opaque, closely granulate-punctate, densely clothed with short hairs; pronotum slightly wider than long; segments of the club not subdivided, third and fourth segments gradually narrowed, tip rounded, segments of funicle not much widened distally (Pl. 10, fig. 8); metepisternum not scaly; scutellum not depressed ..................... *Hylurgopinus* Sw. 5

20. Elytra with the bases very strongly arcuate, slightly elevated and finely serrulate; first, second, and fifth ventral segments subequal in length (Pl. 14, fig. 5); ligula wide, from a convex chitinized base, narrowed distally; antennal hairs stout and plumose; metasternum somewhat inflated (Pl. 12, fig. 6) ........

................................................................. *Pseudohylesinus* Sw.

Elytral bases at most but moderately arcuate and not regularly serrulate; first and fifth ventral segments subequal in length and longer than the others (Pl. 14, fig. 4); ligula slender, from a box-like, strongly chitinized basal inflation .......................... 21

21. Third tarsal segment much widened and bilobed (Pl. 13, fig. 6); mesosternum protuberant in front (Pl. 12, fig. 5); bases of elytra usually rounded (Pl. 14, fig. 2) ........... *Hylurgops* Lec.

Third tarsal segment but little widened and emarginate (Pl. 13, fig. 2); mesosternum not protuberant (Pl. 12, fig. 7); base of elytra nearly straight (Pl. 14, fig. 3) .............. *Hylastes* Er.

5 This genus is not represented in the fauna west of the Rocky Mountains.
PLATE 8

_Hylurgops rugipennis_ (Mann.)

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Term</th>
<th>Abbreviation</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abd</td>
<td>Abdomen</td>
<td>Md</td>
<td>Mandible</td>
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<tr>
<td>C</td>
<td>Coxa</td>
<td>Mesepm</td>
<td>Mesepimeron</td>
</tr>
<tr>
<td>CC</td>
<td>Coxaal cavity</td>
<td>Mesepst</td>
<td>Mesepisternum</td>
</tr>
<tr>
<td>Cl</td>
<td>Club</td>
<td>Mstepst</td>
<td>Metepisternum</td>
</tr>
<tr>
<td>E</td>
<td>Eye</td>
<td>MSt</td>
<td>Mesosternum</td>
</tr>
<tr>
<td>El</td>
<td>Elytron</td>
<td>MStP</td>
<td>Mesosternum process</td>
</tr>
<tr>
<td>F</td>
<td>Femur</td>
<td>Ped</td>
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<td>Fun</td>
<td>Funicle</td>
<td>PSt</td>
<td>Prosternum</td>
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<tr>
<td>GS</td>
<td>Gular suture</td>
<td>Sc</td>
<td>Scape</td>
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<tr>
<td>Lab</td>
<td>Labrum</td>
<td>Tr</td>
<td>Trochanter</td>
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<tr>
<td>Max</td>
<td>Maxilla</td>
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PLATE 9

ANTENNAE

Carphoborus
  radiata Sw. .................................. 2
  simplex Lee. .................................. 3
  vandykei Bruck ................................ 10
Chramesus dentatus Schffr. ............ 11
Crypturgus borealis Sw. .................. 4
Dendroctonus brevicomis Lee. .......... 13
Dolurgus pumilus (Mann.) ............... 1
Phloeosinus
  hoppingi Sw. .............................. 7
  rubicundulus Sw. .......................... 6
  variolatus Bruck .......................... 5
Phthorophloeus frontalis (Oliv.) ....... 12
Polygraphus rufipennis (Kby.) .......... 9
Renocis heterodoxus Csy. ................ 8
ANTENNAE (Cont.)

fig.

Alniphagus aspericollis (Lec.) .................. 6
Chaetophloeus hystrix Lec. ...................... 1
Dendrosinus bourreriae Sz.¹ ..................... 10
Hylastes longicollis Sw. ......................... 9
Hylastinus obscurus (Marsh) ..................... 4
Hylurgopinus rufipes (Eich.) .................... 8
Hylurgops lecontei Sw. ........................... 11
Leperisinus californicus Sw. ..................... 2
Pseudohylesinus sericeus (Mann.) ............... 5
Scierus annectans Sw. ............................. 3
Tomicus piniperda (L.) ............................ 7

PRONOTUM AND EYES

Pronotum

<table>
<thead>
<tr>
<th>Species</th>
<th>Fig.</th>
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<tbody>
<tr>
<td>Ips integer (Eich.)</td>
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<tr>
<td>Pseudohylesinus</td>
<td></td>
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<tr>
<td>granulatus (Lec.)</td>
<td>1</td>
</tr>
<tr>
<td>obesus Sw.</td>
<td>2</td>
</tr>
<tr>
<td>sericeus (Mann.)</td>
<td>3</td>
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<tr>
<td>Renocis penicillatus Bruck</td>
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Eyes

<table>
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<th>Species</th>
<th>Fig.</th>
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<tbody>
<tr>
<td>Carphoborus vandykei Bruck</td>
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</tr>
<tr>
<td>Polygraphus rufipennis (Kby.)</td>
<td>6</td>
</tr>
</tbody>
</table>
ANTERIOR COXAE AND MESOSTERNUM PROCESS

Anterior coxae
- Chaetophloeus hystrix Lec. .......... 3
- Dendroctonus brevicomis Lec. .......... 1
- Leperisinus californicus Sw. .......... 4
- Phloeosinus cupressus Hopk. .......... 2
- Pseudohylesinus sericeus (Mann.) .... 6

Mesosternum process
- Hylastes macer Lec. ................. 7
- Hylurgops lecontei Sw. ............... 5
- Pseudohylesinus sericeus (Mann.) .... 6
PLATE 13

TARSI AND TIBIAE

Tarsi

<table>
<thead>
<tr>
<th>Species</th>
<th>Fig.</th>
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<tbody>
<tr>
<td>Hylastes macer Lee</td>
<td>2</td>
</tr>
<tr>
<td>Hylurgops lecontei Sw.</td>
<td>6</td>
</tr>
<tr>
<td>Polygraphus rugipennis (Kby.)</td>
<td>4</td>
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</tbody>
</table>

Tibiae

<table>
<thead>
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<th>Species</th>
<th>Fig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micracis hirtellum Lec.</td>
<td>3</td>
</tr>
<tr>
<td>Pseudocryphalus brittaini Sw.</td>
<td>7</td>
</tr>
<tr>
<td>Renocis heterodoxus Csy.</td>
<td>5</td>
</tr>
<tr>
<td>Scolytus unispinosus Lec.</td>
<td>1</td>
</tr>
</tbody>
</table>
PLATE 14

ABDOMEN, ELYTRAL BASE AND TIBIA

Abdomen

Hylurgops lecontei Sw. .................. 4
Pseudohylesinus sericeus (Mann.) .... 5

Elytral base

Hylaster macer Lec. ......................... 3
Hylorgops lecontei Sw. .................... 2

Tibiae

Ips integer (Eich.) ....................... 1
ABDOMEN

Abdomen

Leperisinus californicus Sw. .............. 1
Micracis hirtellum Lec. .............. 4
Monarthrum scutellare (Lec.) ........ 3
Scierus pubescens Sw. .............. 2
THE STATUS OF PHYLLOPHAGA LANCEOLATA (SAY) (COLEOPTERA: SCARABAEIDAE)

By Jack C. von Bloeker, Jr.
University of California

Melolontha lanceolata was described by Thomas Say in 1824 and later was designated as the type of Tostegoptera by Emile Blanchard (1850), who based the new genus upon the female being apterous and having a short metasternum destitute of villosity. Burmeister (1855) retained the genus, but it was rejected in favor of Lachnosterna Hope by Lacordaire and Leconte as based upon insufficient characters. Later Leconte changed his views in this regard and revived the genus only to have it returned to synonymy by Dr. George H. Horn (1887). Lachnosterna was in turn rejected in favor of Phyllophaga Harris by Dr. R. D. Glasco (1916) on valid grounds of convention and priority.

The present writer is engaged in making studies which, it is hoped, will ultimately lead to a complete revision of the genus Phyllophaga. In assembling specimens for preliminary studies it was found that the material identified heretofore as Phyllophaga lanceolata was composite and included not one, but three species and one variety. As but one of these appears to be named, descriptions of the unnamed forms are presented below.

Dr. E. C. Van Dyke, of the University of California, suggested that the writer direct particular attention to the nature of the wings of the specimens, when making the necessary dissections to obtain the genitalia. This was done, the right wing of each specimen being removed, relaxed, and mounted on a glass slide. The result of this phase of the investigation, together with certain other unique characters of the specimens has convinced the writer of the need for the designation of a subgeneric name for the lanceolata group. Blanchard’s name Tostegoptera, based upon the characters mentioned above, is the oldest available name for such subgeneric designation and is the one herein adopted, though the characters described by him are not, strictly speaking, accurate. In the first place, the females are not apterous in a true sense of the word, for wings are present, though degenerate and incapable of supporting the body in flight. Secondly, the short metasternum of the female is not destitute of villosity. In all the species described in the present study, lanceolata included, it was found that there are three types of hairs, or modifications of hairs, present on the body. On the dorsal surface of the insects there is a more or less dense vestiture.
of small, flat, lanceolate hair-like scales, a unique feature among the *Phyllophaga* species; in the male the ventral surface of the thorax is heavily clothed with long hairs and the venter of the abdomen is clothed with modified hairs which are shorter, thicker and more bluntly pointed than those of the thorax and lie flat to the abdomen with their apices pointing posteriorly; in the female the ventral surface of the first and second thoracic segments are clothed with hairs of the same nature as those in the male, whereas the metasternum and abdomen have the same type of vestiture as the male abdomen. A further character, separating this group from the remaining species of the genus and one that was remarked upon by Say in his original description of *lanceolata*, is the presence of compressed tubercles on the venter of the male. In addition there is a remarkable dimorphism of form between the sexes, the male being oblongate, the female gibbous. In other respects *lanceolata* is a typical *Phyllophaga*.

**Subgenus Tostegoptera** Blanchard.

Above with small, appressed, lanceolate hair-like scales; sexes dimorphic: male robust oblongate; wings well-developed for flight; venter of thorax densely clothed with long hairs; venter of abdomen with vestiture of short, stout, blunt hairs; second, third and fourth ventral abdominal segments each with a median compressed tubercle, or denticle; female robust gibbous; wings degenerate, approximately one-third the size of the male wings and incapable of supporting the body in flight; venter of prothorax and mesothorax densely clothed with long hairs; venter of metathorax and abdomen with vestiture of short, stout, blunt hairs; denticles absent; antennae 10-segmented; spurs of hind tibiae movable; tooth of claw subbasal.

**Type species:** *Phyllophaga lanceolata* (Say).

**Range:** Arizona, New Mexico, Texas, Colorado, Arkansas, Missouri, Kansas, South Dakota, Wisconsin, Iowa, Nebraska, Oklahoma, and probably also northern Mexico.

**DESCRIPTION OF SPECIES**

*Phyllophaga lanceolata lanceolata* (Say).

*Melolontha lanceolata* Say, 1824.

*Tostegoptera lanceolata* Blanchard, 1850; Leconte, 1860.

*Lachnosterna lanceolata* Leconte, 1856; Horn, 1887.

*Phyllophaga lanceolata* Glascow, 1916.

**General Form:** Male robust oblongate, rounded dorsally, tapering slightly posteriorly, sides nearly parallel; female robust
gibbous, broadest across posterior two-thirds point of elytra, tapering gradually anteriorly, rounded posteriorly (pear-shaped).

Characters: Antennae 10-segmented, club equal to length of stem; clypeus widely reflexed and densely punctate, scales very small, anterior margin acutely sinuate; head finely punctate as in clypeus; occiput less densely punctate, glabrous, shining; frons clothed with fine, lanceolate hair-like scales, excepting a distinct narrow, median longitudinal glabrous line; pronotum short and broad, sides convergent in anterior half, parallel basal half, side margins finely and evenly but not deeply crenate, surface rugosely punctate, punctures larger and deeper than on head, clothed lightly with short lanceolate scales, a narrow, smooth, shining, glabrous median line not reaching anterior margin; elytra alutaceous, sparsely clothed with grayish yellow scales; sutural costae distinct; remaining costae obsolete but distinctly glabrous; mesosternum finely, not densely, punctate; ventral surface of male thorax and ventral surface of pro- and mesothorax of female clothed with long, silky yellowish hairs; abdomen coarsely punctate, nearly glabrous medially; venter of male abdomen and venter of metathorax and abdomen of female with vestiture of short, thick, bluntly pointed hairs; second, third, and fourth ventral abdominal segments gibbous, each with a distinct median denticle in the male; penultimate suddenly transversely depressed and narrowly emarginate at middle of posterior margin in the male; terminal vaguely depressed medially; pygidium longer than broad, sparsely punctate and more or less sparsely clothed with minute lanceolate scales; spurs of hind tibiae narrow, tapered, nearly acute, gently curved; lower spur movable, three-fourths length of upper; tooth of claw subbasal, acutely recurved, small male, larger female.

Measurements: Male—Length 16.0 mm., width 9.0 mm., length of wing 17.5 mm., greatest width of wing 6.75 mm. Female—Length 18.0 mm., width 10.5 mm., length of wing 5.25 mm., greatest width of wing 1.75 mm.

Specimens Examined: Thirty-five, as follows—Texas: Alpine 3, Austin 2, Marathon 1, no definite locality 4; Oklahoma: Oklahoma City 4; Nebraska: Mitchell 1; Colorado: Fort Collins 6; New Mexico: Santa Fe Cañon 4; South Dakota: no definite locality 4; Wisconsin: no definite locality 1.

Remarks: The original series of specimens from which this species was described came from Missouri and Arkansas. Specimens have also been recorded from Iowa (Annual Report of the Iowa State Agricultural College, Ames, Iowa, 1932), and from the following localities in Nebraska: South Bend, Lincoln, West Point, Brown Co., Thomas Co., Alliance, North Platte, Ogallala, McCook, Hitchcock Co., Imperial, Mitchell, and Sioux Co. (R. W. Dawson, University Studies, University of Nebraska, Vol. XXII, Nos. 3-4, p. 217, July-October, 1922).
Phyllophaga lanceolata arizonae subsp. nov.

Holotype male (No. 4111, Mus. Calif. Acad. Sci., Ent.) from Arizona (no definite locality), and allotype female (No. 4112, Mus. C. A. S., Ent.) from southern Arizona, collected by a Mr. Dietz, July 25, 1925.

General Form: Male robust oblongate, broader in relation to length than P. l. lanceolata; female less gibbous and more ventricose than lanceolata, sides more nearly parallel, ovate, broadest across middle third of elytra, more gradually tapering posteriorly.

Characters: Antennae 10-segmented, club longer than stem; clypeus narrowly reflexed, coarsely and densely punctate, scales absent male, hair-like female, not sinuate at middle of anterior margin; head coarsely punctate as in clypeus; occiput smooth, glabrous, shining; frons sparsely clothed laterally with fine lanceolate scales, median line absent; pronotum length as in lanceolata, but actually and relatively narrower, sides convergent in anterior third, posterior two-thirds slightly concave, side margins finely, evenly and narrowly crenate, surface coarsely punctate as on head, clothed lightly with minute scales, a median smooth, shining, glabrous line, relatively broader but shorter than in lanceolata, extends from posterior margin to middle; elytra alutaceous, sparsely clothed with grayish or yellowish scales; sutural costae distinct, lightly clothed with lanceolate scales; remaining costae even more obsolescent than in lanceolata; mesosternum finely and densely punctate; ventral surface of male thorax and ventral surface of pro- and mesothorax of female densely clothed with yellowish hairs which are shorter and coarser than in lanceolata; ventral surface of abdomen in both sexes and metasternum of female sparsely but uniformly clothed with short, blunt yellowish hairs, except in mid-region of penultimate and all of terminal glabrous; second, third and fourth segments gibbous, third and fourth each with a distinct median denticle, denticle of second indistinct or wanting male, denticles absent female; penultimate sharply depressed transversely and deeply emarginated at center of posterior margin male; terminal slightly depressed medially; pygidium as broad as long, upper half sparsely punctate and lightly clothed with small lanceolate scales, lower portion more or less smooth, glabrous, shining; spurs of hind tibiae slender, conical, nearly straight, lower movable, seven-eighths length of upper; tooth of claw subbasal, strong, right-angled, equal in both sexes.

Measurements: Male—Length 13.5 mm., width 9.0 mm., length of wing 16.0 mm., greatest width of wing 6.5 mm. Female—Length 16.0 mm., width 9.5 mm., length of wing 4.5 mm., greatest width of wing 2.0 mm.

Specimens Examined: Six, all from Arizona (no definite locality).
Remarks: The degeneracy of the denticle of the second ventral segment of the male abdomen, the ovulate shape of the female, and the smaller size of both sexes readily distinguish this race from typical lanceolata. The four paratypes, all males, are deposited in the following collections: One in the collection of Mr. E. R. Leach, one in the collection of Mr. M. A. Cazier, and two in the writer's collection.

**Phyllophaga grisiana sp. nov.**


General Form: Male robust oblongate, flattened dorsally, more gradually tapering posteriorly than *P. l. arizonae*; female robust ovulate, broadest across middle of elytra, slightly flattened dorsally, gently tapering posteriorly.

Characters: Antennae 10-segmented, club shorter than stem; clypeus feebly reflexed, very minutely punctate, scales hair-like, more abundant female, anterior margin broadly sinuate at middle; head punctate as in clypeus; occiput less deeply punctate, glabrous, shining; frons sparingly clothed with lanceolate scales, densely so female, median line indistinct or absent; pronotum shorter and narrower than in lanceolata, sides convergent in anterior half but less sharply so, in basal half distinctly concave, side margins finely, evenly, and deeply crenate, surface very minutely punctate as in head and densely clothed with fine, grayish lanceolate scales, median longitudinal line indistinct male, pronounced and reaching anterior margin female; elytra actually alutaceous, but cincereous in appearance due to dense vestiture of minute ashy-gray scales; sutural costae distinct though heavily clothed with scales; remaining costae indistinct male, broad and nearly glabrous but not reaching posterior margin female; mesosternum finely and closely punctate; ventral surface of male thorax and ventral surface of pro- and mesothorax of female densely clothed with coarse, ashy-gray hairs; ventral surface of abdomen and metasternum of female uniformly minutely punctate and more or less densely clothed with short, blunt, cincereous hairs; second, third and fourth ventral abdominal segments gibbous, second with a low median posterior ridge, third and fourth each with a median denticle, ridge and denticles absent in female; penultimate with median longitudinal depression and posterior margin with a broad, shallow emargination male; terminal slightly depressed medially; pygidium broader than long, minutely and moderately punctate throughout, sparsely clothed with ashy-gray scales; spurs of hind tibiae long, slender, pointed, straight for basal two-thirds, slightly curved apical one-third, lower movable,
approximating length of upper; tooth of claw sub-basal, strong, slightly recurved, long male, shorter and stouter female.

Measurements: Male—Length 14.5 mm., width 8.75 mm., length of wing 17.0 mm., greatest width of wing 6.25 mm. Female—Length 15.0 mm., width 8.0 mm., length of wing 5.0 mm., greatest width of wing 2.25 mm.

Specimens Examined: Eleven, as follows—Texas: Fort Sam Houston 5, Higgins 6.

Remarks: The dense vestiture of cinereous scales covering the surface of the beetle readily distinguishes it from related forms. The nine designated paratypes, all males, are deposited as follows: One in the collection of Mr. E. R. Leach, two in the collection of Mr. M. A. Cazier, and the remainder in the writer’s collection.

Phyllophaga cazieri sp. nov.


General Form: Male robust oblongate, flattened dorsally for anterior two-thirds of elytra, slightly tapering posteriorly; female robust subglobose, rounded dorsally, broadest at, or just posterior to, middle of elytra.

Characters: Antennae 10-segmented, club greater in length than stem; clypeus vaguely reflexed male, more distinctly reflexed female, finely punctate, lanceolate scales longest and most hair-like of any known species of the subgenus, sparse male, dense female; very slightly sinuate at middle of anterior margin; head punctate as in clypeus; occiput also punctate and clothed with lanceolate scales laterally, feebly shining; frons clothed with scales, very densely so female, median longitudinal line indistinct or absent; pronotum short and robust, sides convexly convergent in anterior half, slightly concave in basal half, side margins distinctly and evenly crenate, surface finely punctate as in head, densely clothed with fine, golden-yellow lanceolate scales, median longitudinal line smooth, shining, glabrous, extremely narrow, not quite reaching anterior margin; elytra alutaceous, rather densely clothed with golden-yellow scales; suture costae distinct, sparsely clothed with scales; remaining costae distinct in anterior half, becoming gradually indistinct until completely obliterated in posterior one-fourth due to increasing vestiture of scales posteriorly; mesosternum rugosely punctate; ventral surface of male thorax and ventral surface of pro- and mesothorax of female densely clothed with long, coarse, golden-yellow hairs; ventral
surface of abdomen in both sexes and metasternum of female finely punctate and more or less densely clothed with short, blunt, golden-yellow hairs, except for glabrous median longitudinal line of abdomen and entirely naked terminal segment; second, third and fourth ventral abdominal segments gibbous, second with a low median ridge not reaching posterior margin, third and fourth each with a well-defined median denticle in male, ridge and denticles absent in female; penultimate with shallow transverse depression and sharp median U-shaped emargination in posterior margin male; terminal with vague emargination of posterior margin male; pygidium nearly as broad as long, coarsely, not deeply, punctate, more or less densely clothed with golden-yellow lanceolate scales; spurs of hind tibiae short, stout basally, acutely curved, lower movable, greater than one-half length of upper and more acutely curved; tooth of claw subbasal, thin, nearly right-angled, longer in female than in male.

Measurements: Male—Length 16.0 mm., width 8.0 mm., length of wing 16.75 mm., greatest width of wing 5.75 mm. Female—Length 16.3 mm., width 10.5 mm., length of wing 6.0 mm., greatest width of wing 2.25 mm.

Specimens Examined: Fourteen, all from Reno Co., Kansas.

Remarks: The dense vestiture of golden-yellow scales and the globosity of the female readily distinguish this species. I take pleasure in naming the form in honor of Mr. Mont A. Cazier, of the University of California, Berkeley, who aided me in securing the loan of a number of specimens of Tostegoptera for use in connection with the present study. The twelve designated paratypes, four males and eight females, are deposited as follows: One male and one female in the collection of Mr. M. A. Cazier, one male and one female in the collection of Mr. E. R. Leach, and the remainder in the writer’s collection.

ACKNOWLEDGMENT

It is a pleasure to acknowledge assistance with the studies in connection with this paper. Dr. E. C. Van Dyke generously gave of his time to make many valuable suggestions and criticisms and made available the specimens in the University of California collection and many references from his private library. Mr. E. P. Van Duzee made available the specimens in the California Academy of Sciences, and Mr. E. R. Leach, of Piedmont, California, and Mr. M. A. Cazier made generous loans of specimens from their private collections.

Opportunity is taken at this time to place a standing request for the loan of Phyllophaga material from other collectors, for use in connection with future studies on this genus by the writer,
in the hope that thereby the forthcoming review may be as complete as possible. Specimens and data may be sent to the writer at 203 Agricultural Hall, University of California, Berkeley, California, in care of Dr. E. C. Van Dyke. All criticisms and material from other workers which will contribute to the completeness of the revision will be welcome and gratefully acknowledged.

BIBLIOGRAPHY


EXPLANATION OF PLATE 16

The lettered figures have the same meaning throughout:
a, en face view of oedagus; b, lateral view of oedagus; c, dorsal view of oedagus.

Fig. 1. Phyllophaga lanceolata lanceolata (Say), plesio-
type male.

Fig. 2. Phyllophaga lanceolata arizonae von Bloeker, holotype male.

Fig. 3. Phyllophaga grisiana von Bloeker, holotype male.

Fig. 4. Phyllophaga cazieri von Bloeker, holotype male.
Dimorphism of wings in the subgenus *Tostegoptera* Blanchard.

Fig. 1. Right wing of male x 4.

Fig. 2. Right wing of female x 4.
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MARINE PLEISTOCENE MOLLUSKS FROM OAXACA, MEXICO

By ROBERT H. PALMER and LEO GEORGE HERTLEIN

During the course of geological work in southern Mexico in April and May, 1924, the senior author made a collection of fossils found on elevated beaches along the coast of Oaxaca. The field work and collecting are the results of the senior author’s work, while the preparation of the manuscript is mostly the work of the junior author. Three papers dealing with this general area have been published.¹

The writers wish to acknowledge the kind assistance received from Mr. A. M. Strong of Los Angeles and Mrs. I. S. Oldroyd of Stanford University, in the identification of certain of the species. They wish especially to acknowledge the kindness of Dr. G. D. Hanna of the California Academy of Sciences for criticism of the manuscript, the line drawings, and photography of most of the specimens which have been illustrated in this paper.

The coast of Oaxaca is a series of alternating depressions and elevations. The occurrence of the Pleistocene has been summarized by Palmer in the paper dealing with the corals, as follows:

“Along the Oaxaca coast the Pleistocene occurs as a low cliff of loosely consolidated beach material. It extends along the coast in patches for some twenty-eight miles. In some places it is on the beach and in others it is inland about a mile and a half. Its elevation varies from low tide level to fifty feet or more. No reefs have been found in this exposure although there are abundant coral remains which include such reef-forming genera as Porites and Pocillopora.”

The formation is made up mostly of a soft gray or buff sandstone, although locally it is hard and flinty. The name Colotepec formation is here proposed for this Pleistocene formation. The type locality is along the Pacific coast of Oaxaca, about 16 kilometers west of the mouth of the Río Colotepec. The thickness of the formation is about 15 meters and the beds lie upon granite of Cretaceous age. No sedimentary beds of Tertiary age are known along the coast of Oaxaca.

The excellent preservation of the fossils and lack of cross-bedding indicate quiet deposition of the Pleistocene beds in contrast to the present day wave-buffeted strand. Some of the specimens still retain traces of the color markings.

Most of the collection was made from elevated beaches from five to sixteen meters above sea-level, at Loc. 1299 (C. A. S.), on the Oaxaca coast about 16 kilometers west of the mouth of the Rio Colotepec.

The original collection was divided into four parts. One each was given to Leland Stanford Junior University, University of California, California Academy of Sciences and the private collection of Palmer. Some of the species in the collection at Leland Stanford Junior University have been recorded by Grant and Gale.²

The type of the species described in this paper as well as the specimens illustrated but not representing new species, are in the type collection of the California Academy of Sciences.

The following faunal list contains the names of species collected by Palmer from the Pleistocene of Oaxaca, in the collections of the California Academy of Sciences as well as those of Stanford University.

**Faunal List from the Upper Pleistocene of Oaxaca, Mexico**

**Anthozoa**
- Oculina sp.
- Pocillopora palmata Palmer ("Pleistocene near Escondido Bay, Oaxaca, Mexico")
- Porites panamensis Verrill.

**Echinodermata**
- Encope micropora L. Agassiz.

**Pelecypoda**
- Anomalocardia subimbricata Sowerby
- Amphichaea kindermannii Philippi
- Antigona multicostata Sowerby
- Arca formosa Sowerby
- Arca gordita Lowe
- Arca gradata Broderip & Sowerby
- Arca mutabilis Sowerby
- Arca pacifica Sowerby
- Arca reeviana d'Orbigny
- Botula cf. cinnamomea Chemnitz
- Cardium asperum Sowerby
- Cardium consors Broderip & Sowerby
- Cardium planicostatum Sowerby
- Chama echinata Broderip

Chama frondosa Broderip
Chione cf. succincta Valenciennes
Chione undatella Valenciennes
Codakia distinguenda Tryon
Divaricella eburnea Reeve
Donax punctatostriata Hanley
Dosinia ponderosa Gray
Glans affinis Sowerby
Glycymeris delesseritii Reeve
Lima tetrica Gould
Modiolus capax Conrad
Mytilus edulis Linnaeus [? or M. pedroanus Conrad]
Macrocallista aurantiaca Sowerby
Macrocallista squalida Sowerby
Ostrea fisheri Dall
Ostrea iridescens Gray
Pecten circularis Sowerby
Pecten subnodosus Sowerby
Pinctada mazatlanica Hanley
Pitar concinna Sowerby
Pitar lupanaria Lesson
Pitar vulnerata Broderip
Pseudochama exogyra Conrad
Spondylus crassisquama Lamarck
Tellina cf. rubescens Hanley
Tivela byronensis Gray
Tivela hians Philippi
Venericardia cuvieri Broderip
Venericardia flammea Michelin
Venerupis foliata Deshayes

Gastropoda
Acanthina cingulata Lamarck
Acanthina muricata Broderip
Anachis cf. costellata Sowerby
Anachis rugosa Sowerby
Architectonica granulata Lamarck
Bullus aspersus A. Adams
Calyptraea mamillaris Broderip
Cantharus elegans Gray
Cantharus sanguinolentus Duclos
Cassis coarctata Gray
Conus brunneus Gray
Conus fergusoni Sowerby
Conus gladiator Broderip
Conus lucidus Mawe
Conus mahogani Reeve (cited by Grant & Gale, 1931)
Conus princeps lineolatus Valenciennes
Conus princeps regius Chemnitz
Conus purpurascens Broderip
Conus regularis Sowerby
Crepidula aculeata Gmelin
Crepidula lessonii Broderip
Crucibulum imbricatum Sowerby
Crucibulum spinosum Sowerby
Cypraea arabicula Lamarck
Diodora inaequalis Sowerby
Diodora panamensis Sowerby³
Enacta barnesii Gray
Erato scabriuscula Gray
Fasciolaria granosa Broderip
Harpa crenata Swainson
Hipponix barbatus Sowerby
Latirus concentricus Reeve
Malea ringens Swainson
Mazatlania fulgurata Philippi
Melongena patula broderip & Sowerby
Mitra belcheri Hinds⁴
Mitra lens Wood
Morum tuberculosum Sowerby
Murex brassica Lamarck
Murex princeps Broderip
Murex radix Gmelin
Natica catenata Philippi
Natica intemerata Philippi
Oliva angulata Lamarck
Oliva kaleontina Duclos
Oliva spicata Bolten
Oliva testacea Lamarck
Olivella gracilis Broderip & Sowerby
Olivella porteri Dall
Patella mexicana Broderip & Sowerby
Polinices crickmayi Palmer & Hertlein, n. sp.
Pyrene fuscata Sowerby
Pyrene strombiiformis major Sowerby
Strombina lanceolata Sowerby
Strombina pulcherrima Sowerby
Surcula olivacea Sowerby
Tegula mariana Dall

³ This specimen has been compared with a large series of Diodora panamensis Sowerby by Mr. A. M. Strong and it is his opinion that the specimen falls within the range of variation of Sowerby's species.

Tegula cf. rubroflammulata Koch
Terebra strigata Sowerby
Thais biserialis Blainville
Thais triangularis Blainville
Trivia pustulata Lamarck
Trivia radians Gray
Colubraria soverbiani Reeve
Turritella tigrina Kiener
Turritella gonostoma Valenciennes var. [with strong spiral ridges]
Vasum caestus Broderip
Vitularia salebrosa King

Cirripedia
Balanus tintinnabulum peninsularis Pilsbry

This fauna is decidedly tropical in character and all the species are known Recent. The majority of the species in the faunal list are now found in the waters of the Pacific Ocean adjacent to Oaxaca. A few of the species have not been reported north of Panama in their Recent range.

This suggests an indication of the northward migration during the warm Upper Pleistocene, well known along the west coast of Lower California and Upper California. The similarity of certain species to those of the Recent and fossil Caribbean forms is an interesting feature of the fauna.

In previous papers by Palmer, this fauna was considered to be of Upper Pleistocene age, and with this conclusion the present writers are in agreement. It appears that the Colotepec Upper Pleistocene formation of Oaxaca should be correlated with the Upper Pleistocene of the Tres Marias Islands,5 the Gulf of California region, Magdalena Bay,6 San Quintin Bay,7 and the Upper San Pedro formation of San Pedro,8 California and San Diego, California. These may be considered not as the same but as approximately equivalent formations.


NOTES AND DESCRIPTIONS OF SPECIES

**Arca gordita** Lowe
Plate 19, figures 1 and 4


Specimens of this species from the Pleistocene of Oaxaca, Mexico, measure 61 mm, in length.

*Arca gordita* Lowe is near to *Arca golfoyaquensis* Maury, but differs in the fewer ribs, 30 rather than 38, and in that the beaks are less anteriorly placed than in Maury’s species. Other species of this group are *Arca golfoyaquensis* var. *medioamericana* Olsson, and *A. henekeni* Maury, all from the Caribbean Miocene.

**Lima tetrica** Gould


---


*Arca Henckeni* Maury, Olsson, Bull. Amer. Paleo., vol. 9, no. 29, 1922, p. 358 [186], pl. 24 [27], figs. 18, 14, “Gatun Stage; Water Cay,” Costa Rica, Miocene.
Lima tetrlica is narrower and more compressed than Lima lima Linnaeus\(^{12}\) and the posterior and ventral margins are less broadly rounded.

The Recent range has been given by Dall as Lower California to Panama, Galapagos and Juan Fernandez Islands.

**Amphichaena Philippi**


**Amphichaena kindermannii Philippi**

Plate 18, figures A, B. C.; plate 19, figures 5, 6, 7, 8, 9, 10

*Amphichaena kindermannii* Philippi, Archiv. für Naturgeschichte, 1847, p. 63, Tab. 3, fig. 7. “Habitat litus Oceani Pacifici ad oppidum Mexicanum Mazatlan.”

*Psammobia kindermannii* Philippi, Giebel, Naturgeschichte des Thierreichs, Bd. 5, 1864, p. 146. “mit drei Schloszzähnen in der einen Klappe unter Amphichaena.”


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*Radula, Pecten testa oralis, ...* [etc.], Chemnitz, Syst. Conch.-Cab., vol. 7, 1784, p. 349, pl. 68, fig. 651. “Franqueber.”


71
Philippi and Dall have well described the characters of this interesting shell. The general shape is that of *Tagelus divisus*, but the texture and solidity and internal marginal grooving resemble *Donax*. The smooth surface shows suppressed radial sculpture which on weathered specimens is much more pronounced. There are two cardinals on the right and three on the left valve. Several specimens are present in the collection from the Oaxaca Pleistocene.

Recent specimens of the species were collected by the junior author at Loc. 27223 (C. A. S.), Mazatlan, Sinaloa, Mexico; at Loc. 27217 (C. A. S.), Tenacatita Bay, Jalisco, Mexico; and a fine series of specimens was secured at Loc. 27230 (C. A. S.), Petatlan Bay, Guerrero, Mexico.

*A. View of the interior of right valve, plesiotype No. 6954 (C. A. S. Type Coll.); length of valve 32.4 mm.*

*B. View showing details of hinge of valve shown in figure A.*

*C. View of hinge of left valve, plesiotype No. 6955 (C. A. S. Type Coll.).*
CHAMA FRONDOSA Broderip


The specimens referred to Chama frondosa from the Pliocene of Oaxaca, have in most cases lost the exterior ornamentation of lamellae and spines as well as the color. Recent shells of this species in the collection have frondose laminae, and each lamella is somewhat of the shape of a broad fan-shaped leaf, which is radiately plaited on the upper surface and of saffron color, tinged with purple.

Due to loss of lamellae and color it seems best to refer our specimens to C. frondosa Broderip. Perhaps they might equally well be included with the form listed as Chama purpurascens Conrad which was given as a synonym of C. frondosa by Tryon,13 or they might be listed under Chama frondosa var. b. Broderip,14 later named Chama frondosa var. mexicana Carpenter.

PITAR (HYSTEROCONCHA) LUPANARIA Lesson


Cytherea dione Linnaeus, Giegel, Naturgeschichte des Thierreichs, Bd. 5, 1864, p. 149, figs. 351, 352. "tropischen Westküste Südamerikas." [Not Cytherea dione Linnaeus.]

Dione luponaria Lesson, Römer, Monographie Molluskengattung Venus, Linné, vol. 1, 1868, pl. 130, pl. 34, fig. 2; pl. 35, fig. 1 (exspinata). "America centralis in Oceano pacifico (Salango, Tumbez, Payta (Peru), San Blas, Mazatlan, Reallejos)."

Cytherea (Dione) luponaria Deshayes, Tryon, Struct. and Syst. Conch., vol. 3, 1884, p. 178, pl. 113, fig. 23. "Mazatlán." Recent.


This species is an analogue of the Antillean P. dione Linnaeus15 and has been regarded as a variety of that species by some authors. It is easily recognizable by the violet spots at the base of the spines. This species was figured by Delessert16 and the locality given was China, but Römer has pointed out that the species is definitely known only along the Pacific coast of North America.

According to Römer, Dione exspinata17 Reeve is considered as a synonym of P. luponaria and Dall has regarded Reeve's species as only a mutation.

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Dione dione Linné, Römer, Monographie Molluskengattung Venus, Linné, 1868, p. 129, Taf. 34, fig. 1. "Mare Antillarum."

16 Cytherea semilamellosa Gaudichaud, B. Delessert, Reeueil Coq, décrivées par Lamarck et non encore figurées, 1841, pl. 19, fig. 2. "rapportée des mers de China par M. Gaudichaud."

Cytherea Semi-Lamellosa Lesson, Chenu, Illust. Conchyl., Cytherea, 1843, pl. 9, figs. 9a, 9b, 9c (the date of this plate is 1843 according to Sherborn, see Proc. Malacol. Soc. London, vol. 9, pt. 4, 1911, pp. 264-267).

Dione semilamellosa Gaudichaud, Reeve, Conch. Icon., vol. 14, 1863, Dione, pl. 6, figs. 20a, 20b, 20c. "Central America."

17 Dione exspinata Reeve, Conch. Icon., vol. 14, 1863, Dione, pl. 6, fig. 24 for fig. 23 [see errata]. "Central America."
Murex brassica Lamarck


Murex (Polylex) brassica Lamarck, Mörch, Malakozool, Blätter, Bd. 7, 1861, p. 100. “Realejo.”


An excellent specimen of this handsome species is present in the Academy’s collection from the Oaxaca Pleistocene.

Vitularia Swainson

Vitulina Swainson, Treatise on Malacology, 1840, p. 64. “. . . and is represented by the Murex vitulinus of authors.”


The type of this genus is Murex vitulinus Lamarck by monotypy. According to Kobelt8 and Tryon,9 Murex vitulinus Lamarck10 is a synonym of Murex miliaris Gmelin.21

8 Kobelt, W., Illustrierte Conchyliaenbucb, Bd. 1, Lief. 1, 1876, p. 36.
In *Vitularia miliaris* Gmelin the ribs are more prominent and rounded, the form is shorter and there is not as strong development of lamellae as in *V. salebrosa*. According to Tryon\(^22\) the *Murex vitulinus* Lamarck figured by Kiener\(^23\) and the *M. purpura* of Reeve\(^24\) can be referred to *Vitularia miliaris* Gmelin.

It is interesting to note that Swainson used both *Vitulina* and *Vitularia* in the original volume where the genus was proposed. Since the name *Vitularia* is so well established in the literature, that spelling is used in the present paper.

Iredale\(^25\) has pointed out the resemblance of *Transtrafer longmani* Iredale, type of the genus *Transtrafer*, to *Vitularia vitulinus* Lamarck.

**Vitularia salebrosa** King


*Vitularia vitulinus* var., Gray, Zool. Beechey's Voyage, 1839, p. 108, pl. 33, figs. 4 and 6. [No locality cited.]


An excellent specimen showing the frilled ornamentation of this species is present in the collection at Stanford University.

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\(^{22}\)Tryon, G. W., Manual Conch., vol. 2, 1880, p. 133, pl. 35, figs. 393 and 397. “W. coast of Africa.”


Polinices crickmayi Palmer & Hertlein, New Species
Plate 19, figures 12 and 14

Shell ovate globose, medium thickness, spire very short, whorls flatly convex, smooth or with fine oblique striations; aperture long and ovate; columella nearly straight and with callus at upper part; narrowly arcuately umbilicate. Altitude 18.8 mm.; greatest diameter of body whorl 14.2 mm.

Holotype, No. 5615 (C. A. S. Type Collection) from Loc. 1299 (C. A. S.) Coast of Oaxaca, Mexico; R. H. Palmer, collector; Pleistocene. Also Paratype, No. 5616 (C. A. S. Type Collection from Galapagos Islands?; W. H. Ochsner, collector; Recent).

This species is close to Polinices gallapagosa Recluz\(^26\) but is distinguished by the longer aperture and lower spire. Furthermore, the figures of \textit{P. gallapagosa} given by Reeve and Sowerby show an angular carina or angulation on the body whorl bordering the umbilicus while on \textit{P. crickmayi} this area is rounded. The callus on \textit{P. crickmayi} is relatively somewhat larger than on the species described by Recluz.

Polinices \textit{otis} Broderip and Sowerby\(^27\) has a broader shell and larger umbilical area as well as a smaller funicle on the callus in comparison to \textit{P. crickmayi}.

Paratype No. 5616 is a Recent shell from the Galapagos Islands?; it was identified as Polinices \textit{fusca} Carpenter at the United States National Museum by Mrs. I. S. Oldroyd.

Polinices \textit{fusca} was listed by Carpenter\(^28\) but was first figured and described by Sowerby and attributed to Carpenter. The illustrations of \textit{P. fusca} given by Sowerby and Tryon apparently represent a species identical with \textit{P. otis} Broderip and


\textit{Mauna} (\textit{Natica}) \textit{otis} Broderip and Sowerby, Mösch, Malakozoologische Blätter, Bd. 7, 1861, p. 71. Central America.


According to Weinkauff\(^2\) there is a \textit{Natica fusca} Blainville.

The new species is named for Dr. Colin H. Crickmay, in recognition of his contributions to the geology and paleontology of Western North America.

\textbf{Polinices intemerata} Philippi

Plate 19, figure 3


\textit{Natica alabaster} Reeve, Conch. Icon., vol. 9, \textit{Natica}, 1856, pl. 9, figs. 33a, 33b. "Mazatlan."

\textit{Polinices uber} Valenciennes, var. \textit{intemerata} Philippi, Dall, Bull. Mus. Comp. Zool., vol. 43, no. 6, 1908, p. 334. "Gulf of Panama, in 182 fathoms, mud, temperature 54°.1 F." "Also at Mazatlan, Mexico, and living in Panama Bay, in 51 fathoms."

This species is represented in the collection by several specimens whose characters agree with the illustrations of \textit{Polinices intemerata} Philippi. This is a fairly globose form with a thick callus on the inner lip which becomes very thick at the top of the aperture. The umbilicus is moderately small and crescentic in shape.

\textbf{Natica catenata} Philippi

Plate 19, figures 2 and 11


The type locality of \textit{Natica catenata} was not given at the time of the original description but Carpenter\(^3\) and Tryon as well as others have recognized it as a west coast species. Reeve and Sowerby illustrated specimens which they indicated came from Sicily but Tryon pointed out that they had confused \textit{N.}


catenata with a related Mediterranean species, Natica marochiensis Gmelin.31

The specimens from the Pleistocene of Oaxaca fit the description and agree with the figures of Philippi’s species given by other authors. The specimens are identical with specimens of a Recent species from the west coast of North America referred to Natica catenata Philippi in the collections of the California Academy of Sciences.

The original reference to Natica grayi Philippi22 has not been available to us but that species was considered by Tryon to be a synonym of N. catenata. Our specimens resemble the figure of Natica depressa Gray23 and it is quite likely that Tryon was correct in placing this species in the synonymy of Natica catenata Philippi.

Natica unifasciata Lamarck34 has a slightly higher spire, proportionately smaller umbilicus and globose whors. In the Recent shells N. unifasciata is ornamented by a single narrow yellowish white band on the upper part of the whors, while the rest of the whorl is yellowish brown, chocolate or olivaceous and whitish towards the base.

According to the description, Natica (Cochlis) sceethra Dall,55 appears to differ from N. catenata only in color.

PLATE 19

Fig. 1. Arca gordita Lowe; true length of specimen 55 mm.; height 37.5 mm.; plesiotype, left valve, No. 5624 (C. A. S. Type Coll.) : Pleistocene.

Fig. 2. Natica catenata Philippi; greatest diameter of body whorl 11.5 mm.; plesiotype, No. 5618 (C. A. S. Type Coll.) : Pleistocene.

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32 R. A. Philippi, in Martini und Chemnitz, Conchylia-Cabinet, Bd. 2, Abt. 1, 1852, pl. 11, fig. 10.


Fig. 3. *Polinices intemerata* Philippi; true height of figured specimen 24.8 mm.; plesiotype, No. 5617 (C. A. S. Type Coll.): Pleistocene.

Fig. 4. *Area gordita* Lowe; same specimen as figure 1, interior view of shell.

Fig. 5. *Amphichaena kindermannii* Philippi; true length of figured specimen 37.2 mm.; plesiotype, right valve, No. 5636 (C. A. S. Type Coll.): Pleistocene.

Fig. 6. *Amphichaena kindermannii* Philippi; true length of figured specimen 35.8 mm.; plesiotype, left valve, No. 5637 (C. A. S. Type Coll.): Pleistocene.

Fig. 7. *Amphichaena kindermannii* Philippi; true length of figured specimen 38.3 mm.; plesiotype, left valve, No. 5638 (C. A. S. Type Coll.): Pleistocene.

Fig. 8. *Amphichaena kindermannii* Philippi; true length of figured specimen 43.5 mm.; plesiotype, right valve, No. 5639 (C. A. S. Type Coll.): Pleistocene.

Fig. 9. *Amphichaena kindermannii* Philippi; true length of figured specimen 32.4 mm.; plesiotype, left valve, No. 6954 (C. A. S. Type Coll.): from the same locality as specimen shown in figure 9.

Fig. 10. *Amphichaena kindermannii* Philippi; true length of figured specimen 32.4 mm.; plesiotype, right valve, No. 6955 (C. A. S. Type Coll.): from Loc. 27230 (C. A. S.), Petatlan Bay, about nine kilometers south of Zihuatanejo, Guerrero, Mexico: Recent.

Fig. 11. *Natica catenata* Philippi; true height of figured specimen 14.5 mm.; plesiotype, No. 5619 (C. A. S. Type Coll.): Pleistocene.

Fig. 12. *Polinices crickmayi* Palmer & Hertlein, new species; true height of figured specimen 18.8 mm.; holotype, No. 5615 (C. A. S. Type Coll.): Pleistocene.

Fig. 13. *Mazatlania fulgurata* Philippi; true length of figured specimen 10.8 mm.; plesiotype No. 5656 (C. A. S. Type Coll.) from Loc. 27223 (C. A. S.), Mazatlan, Sinaloa, Mexico: Recent. This species also occurs fossil in the Pleistocene of Oaxaca.

Fig. 14. *Polinices crickmayi* Palmer & Hertlein, new species; true height of figured specimen 27 mm.; paratype, No. 5616 (C. A. S. Type Coll.), from Galapagos Islands?; W. H. Ochsner, collector: Recent.

All the specimens illustrated on this plate except figures 9, 10, 13 and 14 are from Loc. 1299 (C. A. S.), Pacific Coast of Oaxaca, Mexico, about 16 kilometers west of the mouth of the Rio Colotepec, from elevated beaches from five to sixteen meters above sea level; R. H. Palmer, collector: Pleistocene.
AN ORDOVICIAN AULUROID FROM CALIFORNIA

By Fred B. Phleger, Jr.

During the fall of 1931 John H. Bradley, Jr., had the good fortune to find specimens of an auluroid in the shales of the Barrel Springs formation. Dr. Bradley has generously placed these specimens at the author's disposal. The rest of the Barrel Springs fauna is Middle Ordovician in age and has been described elsewhere.¹

Phylum Echinodermata
Class Stelleroidea
Subclass Auluroidea
Order Lysophiurae Gregory
Family Palaeophioridae Gregory
Genus Inyoaster gen. nov.

The rays are long and slender. The plates alternate with each other. The ambulacralia are considerably smaller than the adambulacralia and are subquadrate in form.

It is difficult to compare Inyoaster with other genera, inasmuch as detail of either surface is not preserved. Absence of all features of the actinal surface is especially regrettable. Palaeophuira Stürtz may be closely related to Inyoaster but differs in having rod-shaped ambulacralia which are very narrow. The plate arrangement of Inyoaster somewhat resembles that of Ptilonaster Hall, but Inyoaster is distinct from Hall's genus in lacking the marginal series of plates.

Genotype: Inyoaster bradleyi sp. nov.

INYOASTER BRADLEYI SP. NOV.

Plate 20, figs. 1, 2

One of the two specimens shows the shape of the central disk and the arrangement of the rays. It has been replaced by pyrite which is so badly altered that many details of structure have been obliterated. In the second specimen these is an excellent preservation of most of the water-vascular system in two of the rays. The radial water-vessel and its branches are exposed from the abactinal surface, and casts of the podial cavities are present. The ambulacralia and the adambulacralia are so poorly preserved that their shape on the abactinal surface is only suggested in most cases.

Although the shape of the actinal surfaces of the ambulacralia must be inferred, it does not seem probable that they are

boot-shaped. Thin spines are produced laterally from the ambulacralia. The interskeletal radial water-vessel proceeds in a sinuous course from the central disk to the end of the ray. Short water vessels branch off from each lateral apex of the main canal and enter the podial cavities, which are mound-shaped, with the summit of the mound upward.

Measurements:

- Length of the rays (average) .......... 26 mm.
- Width of the central disk ............. 16 mm.
- Width of a ray at the widest part ..... 4 mm.
- Width of a podial cavity ................ ¾ mm.

Horizon and locality: Barrel Springs formation, one-half mile east of Barrel Springs, Inyo Mountains, Calif.

The cotypes are Mus. Comp. Zool. Nos. 50 and 51.

The paratypes are Los Angeles Museum Nos. A-3158.1 and A-3158.2.

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PLATE 20

Fig. 1. Photograph of the most complete specimen of *Inyoaster bradleyi* Phleger, 1½ x natural size.

Fig. 2. Photograph of a portion of a ray of *Inyoaster bradleyi* Phleger, showing a cast of the water-vascular system. Approximately 3 x natural size.
NEW CALIFORNIAN OSMINAE (HYMEN.,
MEGACHILIDAE)

By Charles D. Michener
Pasadena, California

The present paper includes descriptions of a few of the many new bees of the subfamily Osmiinae found in this state. For the present types will be retained in the author's collection.

OSMIA CRENULATICORNIS n. sp.

Male: Length 8 mm.; blue green, the posterior margins of the tergites blue purple, narrowly edged apically with brown; legs black, the hind femora greenish, the other femora and the tibiae with a faint greenish tinge; apical tarsal joints reddish; hind metatarsus wider apically than basally; tegulae dark brown, greenish anteriorly; flagellum black, brown beneath, crenulate; wings quite clear, the basal vein distad to transverse median, the second abscissa of cubital vein longer than fourth; head and thorax finely and closely punctate, the scutellum with a polished median streak; tergites with numerous piliferous punctures except on the apical margins; margin of sixth tergite unnotched, slightly sinuate at sides; seventh tergite with a median notch; posterior margin of second sternite with a sharp, slightly raised median angle; pubescence of head and thorax white, that of clypeus erect; pubescence of abdomen very sparse and short. Perhaps worn, that of first tergite pale, that of tergites two to five dark fuscous or blackish, pale on posterior margins of tergites; pubescence of sixth tergite pale.


This is an aberrant Acanthosmioides. The crenulate antennae, erect hair of clypeus, and the form of the genitalia all show this relationship, although there is no distinct process on the second sternite. It will be noted that there is an inconspicuous raised point on the apical margin of the second sternite. This could be described as a dorso-ventrally compressed process, closely appressed to the base of the third sternite. In O. wyomingensis Mich. this process is also appressed to the abdomen, but in this case it is high and thick.

OSMIA CLAREMONTENSIS n. sp.

Male: Length 5½ to 6½ mm.; agrees with O. nemoris Sandh. but smaller; apical margin of third sternite with a deep notch, margined with orange hairs; basal vein a little more distinctly distad to transverse median; legs more distinctly green; eyes more strongly converging below.
Holotype and two paratypes: Claremont, Calif. (Baker). The holotype is in Prof. Cockerell's collection.

I give a key to some species of this group. *O. abdominalis* Mich. is related but the abdomen is long and parallel sided.

Third sternite entire or hardly emarginate posteriorly, but with some orange hairs in the middle of apical margin ..............

.............................................................. *nemoris* Sandh.

Apical margin of third sternite deeply emarginate:

Tegulae brassy black ........................................ *albiventris* Cress.

Tegulae brownish, the anterior half green .. *claremontensis* Mich.

The presence or absence of a small notch on the sixth tergite is of no value as a specific character in this group, as in both *nemoris* and *claremontensis* this notch may or may not be present.

I have not seen the male of *O. albiventris*. The specimens of *O. nemoris* which I have seen are two paratypes from Olympia, Wash. (length 7-8 mm.; legs black with a strong greenish tinge).

**Osmia punctata n. sp.**

Female: Length nearly 9 mm.; dark blue, rather robust with large head, the pubescence, including the scopa, white; abdomen with inconspicuous pale hair bands; posterior half of sixth tergite covered by dense white hair; mandibles and antennae black, the former broad; legs black, the femora blue, the pubescence of under sides of tarsi ferruginous; tegulae shining black posteriorly, blue on anterior half; punctation of entire body very coarse and not very dense; punctures close, however, on face, comparatively fine on sides of face near antennae, and coarsest on vertex, scutum, and scutellum, the latter without an impunctate streak; enclosure of propodeum rather shiny, the upper margin narrowly roughened and dull, the lower margin with some large punctures; abdomen with punctures about the size of those on cheeks, though a little sparser; tergites without impunctate margins, though punctures on posterior edges of tergites are finer than elsewhere; wings nearly clear, the basal vein a little distad to the transverse median, the second abscissa of cubital vein twice as long as fourth.

Holotype: Coachella, Calif., April 20, 1934 (collector unknown).

This is a desert species, closely related to *O. subfasciata* Cress. and *O. botitena* Ckll. from Texas. The three form a distinct little group, known by the coarse punctation, and may be separated thus:

Top of head and thorax green, the punctures smaller and about as close as they can be except in center of scutum ..............

.............................................................. *botitena* Ckll.
Top of head and thorax blue; punctures coarser, distinctly separated on large area in center of scutum.

Flagellum black; head large; form robust; punctures a little coarser; transfacial line longer than facial ....

................. punctata Mich.

Flagellum brown beneath; head normal; form more slender; transfacial line about equal to facial ....

................. subfasciata Cress.

Osmia marginata n. sp.

Female: Length nearly 9 mm.; dull green; mandibles black, tridentate; clypeus normal, the apical margin black; antennae black, the under side of flagellum strongly reddish brown; tegulae, except anteriorly where they are green, dark brown; legs black, the distal joints of the tarsi faintly rufescent; scutum black except for a rather narrow green margin all the way around which is broadest anteriorly in the middle; pleura black below; eyes convergent below; punctuation of head and thorax very close throughout, coarsest on clypeus; scutellum more coarsely punctate than rest of thorax, without a shiny streak; enclosure of propodeum dull, the upper margin narrowly roughened; wings dusky brown, the basal vein meeting the transverse median, the second abscissa of the cubital vein not quite twice as long as fourth; abdomen rather finely punctate, the punctures rather numerous; posterior margins of tergites punctate, but the punctures finer and sparser than elsewhere; tergites, especially posteriorly, lineolate as well as punctate; pubescence white except for the black scopa, rather pale fuscous hair on clypeus, and ferruginous to fuscous hair of under side of metatarsi.

Holotype: Ten miles east of Mecca, Calif., April 14, 1935 (Michener).

This is another desert species. It runs to O. seclusa Sandh. in the Sandhouse key to Western species.* It differs from O. seclusa by tridentate mandibles, from O. cocrulescens (Linn.) by smaller size, dull area of propodeum, and closer punctures of head and thorax, and from O. hesperella Ckll. by black areas, punctate margins of tergites, etc.

Osmia latisulcata n. sp.

Female: Length about 10 mm.; dark green, the green color rather faint, the legs, mandibles, tegulae, antennae, and anterior margin of clypeus black; mandibles four toothed; anterior margin of clypeus with a broad emargination, bounded by a sharp angle

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on each side; middle of emargination with a slender tooth, some-
what concealed by long fuscous hairs originating from the edge
of the clypeus; face rather broad; eyes slightly converging below;
head not large and subquadrate; punctures of vertex, scutum,
and scutellum very coarse and not very close; scutellum without
an impunctate streak; face, cheeks, and pleura with punctures
finer than those of dorsum; lower half of enclosure of propodeum
polished and shiny, upper half dull and rough; face of propodeum
below enclosure with a large, broad, black pit; base of first ter-
gite with a broad concavity (though not so broad or so deep as
in Ashmeadiella), bounded by the usual faint carina; abdomen
strongly punctured, without impunctate margins on the tergites;
pubescence of head and thorax mixed black and white, except for
the posterior face of propodeum, where there is no black; pub-
escence of legs mostly pale, but black internixed on femora; hair
of first tergite white, a little fuscous intermixed basally; hair of
second tergite mixed black and white, of third tergite mostly
black, of fourth and fifth tergites mixed, and of sixth tergite
white; tergites two to five with inconspicuous apical bands of
white hair; scopa black; wings slightly brownish, the apices
clearer; basal vein a little distad to transverse median; second
abscissa of cubital vein longer than fourth.

Holotype: Altadena, Calif., May 2, 1936, on Lotus scoparius
(Michener, Coll.).

This is a remarkable species. It differs from O. rostrata
Sandh. by the emarginate clypeus and from O. nelsoni Ckll. by
the different sort of clypeus.

**Osmia tokopahensis n. sp.**

Female: Length 10 mm.; dark blue, the scutum, vertex, and
front blackish in most lights, the narrow impunctate hind mar-
gins of tergites concolorous posteriorly, slightly bluer on anterior
tergites; legs black with metallic femora; antennae and mandi-
bles black, the teeth of the latter low and rounded (probably
worn); tegulae black, blue in front; clypeus normal, the anterior
margin black; face rather broad, the eyes converging below; head
and thorax finely and closely punctured, the scutellum with a not
too well formed polished streak; enclosure of propodeum dull,
slightly roughened above; wings dusky, the basal vein basad to
transverse median, the second abscissa of cubital vein a little
more than twice as long as fourth; abdomen finely but not very
sparsely punctate, the impunctate margins of tergites very nar-
row; pubescence white with black hairs mixed in on face, vertex,
lower parts of cheeks, and on last three tergites; fore and middle
tibiae with some blackish hair; scopa black; pubescence of man-
dibles and lower edge of clypeus dark, coppery in certain lights;
brushes under margin of clypeus ferruginous.
Holotype: Tokopah Valley, Sequoia National Park, Calif., August 24, 1933, on Linanthus montanus (Michener, Coll.).

Runs to O. clarescens Ckll. in the Sandhouse table of Western species. It differs from that species by the entirely pale hair of thorax, etc. O. tokopahensis is apparently near to O. densa Cress., differing by the finely punctured clypeus, etc. (In the species commonly determined as O. densa the clypeus and lower sides of face are much more coarsely punctate than rest of head.)

Osmia mixta n. sp.

Female: Length 9 mm.; rather dull blue, the hind margins of the tergites concolorous; legs, antennae, and mandibles black, the latter tridentate; tegulae black with a slight brownish spot, and perhaps very faintly metallic at extreme anterior tips; eyes distinctly converging below; clypeus rather bulging, the anterior margin a little produced downward, black, and slightly emarginate; face and cheeks finely and closely punctate; vertex, scutum, and scutellum coarsely punctate, the latter without an impunctate streak; pleura not as coarsely or deeply punctured as top of thorax; area of propodeum dull, only slightly roughened above; abdomen with abundant ordinary piliferous punctures, the impunctate margins of the tergites not wide; head with black pubescence, short and inconspicuous on upper part of cheeks, with a good deal of white intermixed on cheeks, and less on vertex, on sides of face, and between antennae; brushes beneath clypeal margin ferruginous; thorax with white pubescence with a little dark intermixed on pleura (especially above), and a very little on propodeum; scutum and scutellum, especially the latter, with many black hairs among the white; wings dusky brown, the basal veining meeting the transverse median, the second abscissa of cubital vein about twice as long as fourth; pubescence of legs mostly black; pubescence of abdomen black with a good deal of white on first tergite and a little white at the posterior edges of tergites two to five, especially two to four, and especially laterally; scopa black.

Holotype: Altadena, Calif., June 11, 1933, on Lotus scoparius (Michener, Coll.).

Runs best to 25 in the Sandhouse key to Western species. Unless the pleura are carefully examined, the dark hairs are not seen. In color this species resembles O. clarescens Ckll., from which it differs by black legs, etc. It differs from O. sedula Sandh, by tridentate mandibles; from O. pentstemonis Ckll. and O. perbrevis Mich. by shorter hairs of face, etc.; from O. caulicolca Ckll. by larger size; from O. albolateralis Ckll. by presence of black hair on scutum; from O. phaceliae Ckll. by bluer color, more abundant black hair on scutellum, etc. The punctures of the scutum are about the same size as in O. coloradensis Cress., coarser than in any of the species just mentioned.
Osmia potentillae H. sp.

Female: Length hardly 7 mm.; slender, dark blue green, the hind margins of the tergites concolorous (or a very little more bluish); lower part of face bluer, the center of scutum blackish in some lights; mandibles black, tridentate; antennae black, the flagellum sometimes faintly brownish beneath; tegulae greenish anteriorly and on outer side, otherwise black with a large brown spot in the middle; legs black; eyes converging below; face rather long; punctuation of head and thorax fine and fairly dense, a little coarser and sparser on pleura; scutellum with a suggestion of an impunctate median streak; enclosure of propodeum dull; clypeus with a pair of orange brushes below the margin; head with black hair, mixed with shorter white hair on sides of face and to a very slight extent on vertex, and replaced by white on cheeks; mandibles with ferruginous hair; hair of thorax white, intermixed with longer black hairs on scutum and especially on scutellum; hair of pleura very short and sparse; hair of legs black, reddish in some lights under sides of tarsi; abdomen finely and sparsely punctate, especially anteriorly, the impunctate margins of the tergites almost wanting, especially laterally; hair of abdomen short and black, practically wanting on disk of second tergite, mostly replaced by white on first tergite and by dark fuscous on second tergite, intermixed with some white on sides of abdomen and on sixth tergite; posterior margins of third to fifth tergites with white hairs, forming narrow bands, most conspicuous on fourth and fifth tergites; scopa black; wings dark brownish, the basal vein basad to transverse median, the second abscissa of cubital vein considerably longer than fourth.


In the keys this species runs persistently to O. phaceliae Ckll. Both O. phaceliae and O. caudicola Ckll. are larger and more robust, with clearer wings. The small size and slender form suggest O. pentstemonis Ckll. and O. hypoleucha Ckll., but these species have metallic legs, long bristles on the face, and less pale hair on abdomen. The legs of O. phaceliae Ckll. are black, not obscurly metallic as stated in the Sandhouse table.
Osma sequoiae n. sp.

Female: Length nearly 8 mm.; dark greenish blue, the hind margins of the tergites very slightly more bluish, the lower part of face blue, tending to purplish; apex of clypeus normal, black; legs black except for the rufescent clawjoints of tarsi and the distinctly metallic fore and hind femora; antennae and mandibles black, the latter tridentate; tegulae dark brownish black, the anterior third bluish; eyes converging below; face rather narrow; punctuation of head and thorax fine and dense; clypeus, especially upper part, more coarsely punctate than rest of head; enclosure of propodeum rather shiny below, duller medially and laterally, dull and roughened above; vertex and dorsum of thorax black in many lights; scutellum with a narrow median polished, though not entirely impunctate, streak; wings dusky brown, the basal vein basad to transverse median, the second abscissa of cubital vein a little longer than fourth; abdomen rather distinctly punctate, the first tergite and the posterior ones rather closely so, the second and third tergites polished and less closely so; impunctate margin of first tergite nearly wanting; head, except cheeks, with rather long black hair; cheeks with shorter white hair; vertex posteriorly, sides of face, and area between antennae with some short white hairs among the black; hair of pleura black, but that of propodeum abundant and white; scutellum with some long black hairs (few in the holotype) and some shorter white hairs; scutum with a little black hair, and some white intermixed at sides; large tuft of hair behind wing bases white; scopa black; hair of legs black; pubescence of abdomen black except for first tergite, where it is white, and last tergite, where there are some gray hairs in one paratype.


Runs to O. cyanosoma Ckll. in the Sandhouse key to Western species. It differs from that species by the black tibiae and shorter and less abundant hair. O. sequoiae lacks the bristles on the face found in the group of O. penstemonis Ckll. O. sequoiae differs from O. grindeliae Ckll., pikei Ckll., malina Ckll., nanula Ckll., and tristella Ckll., by the metallic femora.

Osma integra nigrigena n. subsp.

Male: Length over 12 mm.; agrees with the description of O. integra Cress. but hair of cheeks (except at upper ends) black; hair of fore legs beyond femora not mixed with pale; hair of second tergite black at sides; first tergite with some black intermixed at sides. Differs further from a New Mexico specimen by the black (not reddish) small joints of tarsi. In a Colorado specimen there is a little black hair intermixed at sides of second tergite.
Female: Length nearly 12 mm.; robust, dark blue, the dorsum of thorax greenish, the legs, antennae, mandibles, and tegulae black; clypeus partly black, not modified; head and thorax finely and closely punctate, the punctures of scutum so close as to leave no shiny ground between; enclosure of propodeum smooth and strongly shiny below, dullish laterally, and a narrow basal band (widened in the middle) dull and slightly roughened; abdomen rather finely punctate, the smooth apical margins of the tergites of moderate width; wings dusky, the basal vein meeting the transverse median; mandibles broad, four toothed, the outer tooth long and broad; pubescence of head black, mixed with ochraceous on vertex; pubescence of thorax black except for the dorsum, where it is entirely ochraceous; hair of first tergite ochraceous except laterally; hair of second tergite ochraceous medially, black laterally; black hairs present basally and apically in the median portion; rest of abdomen all black haired, except for some pale hairs on sixth tergite; scopa black; pubescence of legs black, somewhat fuscous on tarsi.

Holotype male: La Crescenta, Cali., May 5, 1934. Allotype female: same locality, April 28, 1934, both on Salvia mellifera (Nichener, Coll.).

This is probably a distinct Californian subspecies, as Cockrell in 1912 (Proc. U. S. N. M.) said "at Claremont, California, Baker has taken a variety of the male with the hair of cheeks (except above) and of anterior legs black." The female seems related to O. novomexicana Ckll., but differs by smaller size, black hair between bases of antennae, paler hair of scutellum, etc. Mr. P. H. Timberlake considers O. novomexicana the female of O. integra.

**Osmia femorata n. sp.**

Female: Length about 5½ mm.; a robust black form; facial line shorter than transfacial; eyes quite strongly converging almost to their lower ends; apical margin of clypeus broadly rounded, with a shallow notch in the middle; antennae black; mandibles black, with a broad red band just before the teeth; legs black, the hind femora and areas on inner sides of hind tibiae red; vertex and scutum somewhat shining, with rather small close punctures, sparser on center of scutum; posterior face of propodeum polished and impunctate, the extreme sides of upper part with a few longitudinal striae; front medianly a little more finely punctate than near eye margins or than vertex; wings nearly clear, the second submarginal cell short, the second recurrent vein nearly meeting second transverse cubital, the basal vein distal to transverse median; tegulae dull reddish testaceous; abdomen black, shining, with rather small punctures, widely separated on dorsum of first three tergites; concavity of first tergite bounded
by a fine carina, but without a median sulcus; face covered with white pubescence, most conspicuous on sides of face, dull and rather grayish on clypeus and around antennae; cheeks, pleura, scutellum, edges of scutum, and sides of propodeum with fairly copious white pubescence; tergites one to five with white bands, the first widened at the sides; sixth tergite with much white pubescence near base; scopa white.

Holotype: ten miles east of Borego Valley, Calif., emerged June 15, 1933, from a mud nest of a *Pseudomasaris* found on a rock (Michener). This was not an old nest, as the *Pseudomasaris* (one of the smaller species) pupae were alive, although they died just before the emerging time.

This is a very distinct species. The form of the margin of the clypeus and the red hind femora distinguish this species at once from all previously described forms. *O. timberlakei* Ckll. has all the femora red.

**Proteriades tristis** n. sp.

Female: Black, with red on the first segment of abdomen; length 7 mm.; eyes convergent below; mandibles tridentate, with a broad red band just before the teeth; apex of clypeus broadly rounded, hardly showing any angles; antennae black; entire head and top of thorax finely punctate, the face more finely and closely punctate than vertex and scutum; tegulae rufotestaceous; wings brownish, the veins and stigma black; legs black, the claw joints of tarsi brownish; abdomen black, the first tergite dark red at the sides and on posterior margin; pubescence rather sparse, whitish, forming abdominal bands and abundant between the bands on last few tergites, rather abundant on sides of thorax, scutellum, and sides of face; hair on under sides of tarsi orange brown.

Holotype: Eagle Rock Hills, Los Angeles Co., Calif., June 30, 1933 (Michener). Paratype: La Crescenta, Calif., on *Cryptatanthe*, May 5, 1935 (Michener). The latter specimen has most of the face covered with pale hair and has a little red at extreme sides of second tergite.

Differs from *P. evansi* and *semirubra* by the slightly convergent inner orbits.

**Proteriades evansi** n. sp.

Female: Length a little over 7 mm.; form very robust; head large; eyes divergent below; clypeus low, the apex medianly not farther downward than at sides where it approaches the eye margin; anterior margin of clypeus with two broad shallow emarginations, leaving a short median truncation; anterior lateral corners of clypeus each with a small shining tubercle or raised area; mandibles tridentate, broad, but not widened in the middle
as in *P. semirubra*; anterior margin of clypeus with a very long fringe of pale hairs; wings brownish, the second abscissa of cubital vein longer than fourth; body black, the first tergite except base medially and lateral parts of second tergite red; tegulae reddish testaceous; flagellum dusky brown beneath; legs black; punctures rather fine and close, a little coarser on clypeus (except for a small impunctate area on upper edge) and a little finer on abdomen; pubescence rather abundant, whitish, forming abdominal bands and abundant between the bands on apical tergites; scopa slightly yellowish.

Holotype: Loyds (Sierra Nevada Mountains), Tulare Co., Calif., August 3, 1935 (Evans).

Easily distinguished from the other species by the form of clypeus. This species is named for Mr. Willis A. Evans of Pasadena.

**Titusella clypeata n. sp.**

Female: Length a little over 6 mm.; black; eyes slightly divergent below; mandibles broad, four toothed, with rufescent hairs distally; antennae black; clypeus shiny, convex, nearly impunctate and hairless except laterally, and with the distal edge, except for a narrow space in the middle, undulate and produced forward; rest of head and dorsum of thorax moderately punctate; tegulae and legs black; wings nearly clear, the veins and stigma black, the second submarginal cell hardly longer than the first on the cubital side; abdomen rather finely punctate, more closely so behind; pubescence pale, forming distinct narrow abdominal bands, and abundant between the bands on the posterior segments; present also on the sides of the thorax, pronotum, around the edges of the scutum and scutellum, and to a lesser extent on the face and elsewhere; hair on under side of tarsi orange brown; scopa whitish; first joint of labial palpi a little shorter than second.

Holotype: Eagle Rock Hills, Los Angeles Co., April 14, 1933, on *Rhamnus crocea* (Michener, Coll.).

Differs from *T. cubiceps* (Cress.) by the absence of an emargination on anterior edge of clypeus (the clypeus appears slightly emarginate if viewed from above) and by more coarsely punctured tergites.

While on the subject of *Titusella*, I wish to state that *T. pronitens* Ckll. is the same as *T. cubiceps* (Cress.). A specimen from Monanche Meadows, Tulare Co., Calif., July 26, 1935 (W. A. Evans) is indistinguishable from Colorado specimens.
A NEW SOUTHERN RACE OF EUCHLOE AUSONIDES
(DIURNAL LEPIDOPTERA)

By Lloyd M. Martin
Los Angeles Museum, Exposition Park, Los Angeles, Calif.

EUCHLOE AUSONIDES R. ANDREWSI RACE NOV.

♂, expands 35 mm.

Superior surface, ground color snow white with no suggestion of yellow tinge, the bases of wings greatly reduced in gray scaling, such as is characteristic of ausonides and coloradensis; apex considerably rounded, with powdering of gray scales (sometimes slightly tinted yellow) as in the usual markings of coloradensis; bar at outer end of cell reduced, sometimes becoming only a small black oblongate bar. Secondaries generally clear white with a mottled appearance resultant from the markings on the under surface showing through. Inferior surface of primaries; apex tinted with yellow-green scales which correspond to the gray on the superior surface; bar at outer angle of cell repeated but slightly reduced with a minute white mark in the center. Secondaries; the marbling is much reduced compared with that of typical coloradensis; mottled with light yellow-green forming no distinct bands, and with a much increased area of the white ground color. All veins yellow, standing out very prominently, and with no pearly luster on the ground color of the under surface.

♀, expands 36 mm.

Same size and coloring as the ♂, with no suggestion of yellow such as is characteristic of ♀ ♀ of ausonides and coloradensis.

The three main features that distinguish andrewsi from coloradensis (which is its nearest ally) are: first, the very rounded apex; second, practically no dark scales at base of wings, and third, the under surface on the secondaries having no pearly luster and with very light yellow-green marbling.

The type series contains twenty-five ♂ ♂ and twenty-six ♀ ♀ which are as follows:


Paratypes Nos. 2 to 30, fourteen ♂ ♂ and fourteen ♀ ♀, Crest Line Highway, near Lake Arrowhead, San Bernardino Co., Calif., June 8 and 10, 1936.
Paratypes Nos. 31 ♂, 32 ♀, 33 ♂, 34 ♀, 36 ♀, 38 ♂, 40 ♀, 42 ♀, and 44 ♀, Crest Line Highway, near Lake Arrowhead, San Bernardino Co., Calif., June 15 and 18, 1936.


Paratypes Nos. 35 ♂, 48 ♀, near Big Bear Lake Dam, San Bernardino Co., Calif., June 14 and 18, 1935.

Paratypes Nos. 7 ♂, 8 ♀, 9 ♂, 10 ♀, will be placed in the collection of the U. S. National Museum, Washington, D. C.

Paratypes Nos. 11 ♂, 12 ♀, 45 ♂, 32 ♀, will be placed in the collection of the Canadian Museum at Ottawa, Ontario, Canada.

Paratypes Nos. 37 ♂, 50 ♀, are to be placed in the California Academy of Sciences, Golden Gate Park, San Francisco, Calif.

The holotype, allotype and the remainder of paratypes will be retained in the collection of the Los Angeles Museum, Exposition Park, Los Angeles, Calif.

All specimens except one were collected by Mr. Robert H. Andrews of Pasadena, Calif., for whom I take pleasure in naming this new race.

I am informed by Mr. Andrews that the butterflies were quite scarce and hard to capture as they fly in dense underbrush and on steep hillsides at an elevation of 5,000 to 6,000 feet.

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NOTES ON THE EARLY STAGES OF EREBUS ODORA L. (LEPIDOPT.)

By John Adams Comstock

This giant Noctuid has been frequently reported in the literature as occurring in the various states, and has even reached Canada. There has always existed a doubt as to its breeding north of the Mexican line.

It seems a surprising fact that North American collectors have failed to locate the larvae. These have been taken by several collectors in southern California, and we have little doubt but that it will be found in many of the southern states.

The foodplant of choice in this area is Acacia decurrens Willd. The larvae are night feeders, and rest during the day on the bark or branches of the tree, where their protective coloration makes them difficult to find. The young larva is flat, and presses close to the bark. The mature larva is stout and cylindrical, and would be a conspicuous object, but for the fact that it chooses depressions or crevices in the bark, or a deep crotch between two limbs in which to hide.
The larva is difficult to rear in its earlier instars. It does not stand handling, and refuses to eat if disturbed. It must be fed with the youngest and most tender leaves. We have not been successful in rearing young larvae, but Mr. Karl Christian of Los Angeles has managed to bring a few through to maturity, from the egg.

The egg has been described several times, as will be noted in the appended bibliography. Gundlach described the larva and pupa in Entomologica Cubana, but this publication is not available to the average worker. The young larva was described by Fernald, and also by the Hisers (see bibliography). We know of no published illustrations of the early stages.

Larva, intermediate instar.

Ground color gray, irregularly mottled with dark grayish brown, as noted in the accompanying cut, Plate 21.
Head, black, or brownish black over the crown, topped by two light spots on the apex. The lower part of the cheeks, light gray. Ocelli black.

The legs are relatively large and are held wide apart. The posterior two pair of prolegs are prominently developed, and with the anal pair of prolegs are separated laterally, thus showing prominently in a view of the dorsal aspect.

Mature larva, length 63 mm.

Cylindrical, plump, widest at the fourth segment tapering abruptly at the eleventh segment.

Ground color gray or gray-brown, heavily mottled with black. There is a wide mid-dorsal longitudinal band of light gray, irregular in outline, expanding on the tenth segment into a sub-triangular area. This is bordered laterally with an irregular wide black, or brownish-black band. There is also a narrow broken black stigmatal band.

Stigmata, prominent, dark centered, with grayish margins. Head, black over the crown; mottled gray on the sides. The accompanying illustrations, Plate 22, adequately figure this larva.

PLATE 22
Mature larva of Erebus odora enlarged approximately x 1 1/2.
Upper figure, dorsal view. Lower figure, lateral view.
Photo by Menke.
The very fragile semblance of a cocoon was formed among leaves on the floor of the breeding cage. Pupation occurred October 13, 1935.

Pupa, length 45 mm. Greatest width through shoulders, 12 mm. Color, uniform blackish brown. Surface, smooth, except for the rugosity of the caudal area. There are two long black cremasteric hooks with recurved tips, measuring 1.75 mm., and at the base of these a few short brown hooklets about one-third the length of the long pair.

The form of this chrysalis is adequately shown on Plate 23. Imago emerged November 8, 1935.

Foodplants listed: Cassia, Acacia, Kentucky coffee tree (Gymnocladus dioica (L.) Koch., Pithecolobium, Samaun.

BIBLIOGRAPHY

PLATE 23
Pupa of Erebus odora enlarged x 1½.
A. Ventral view. B. Lateral view. C. Dorsal view.
Photo by Menke.
NOTES ON THE EARLY STAGES OF FIVE MOTHS FROM SOUTHERN CALIFORNIA

By John A. Comstock and Charles M. Dammers

Euchaetias elegans Stretch.

Described from a series reared from eggs that were secured from a ♀ (taken in copula) collected in Rattlesnake Cañon, San Bernardino Co., Calif., on May 1, 1932, on milkweed. The description of mature larva was subsequently checked with numerous examples collected in the Ibanpah Mts., San Bernardino Co., in May, 1936, feeding on a broad-leaved Asclepias.

Egg: Spherical, with a smooth glistening surface; translucent and nearly colorless. Eggs are laid in a mass on the leaves of the foodplant, and are covered with a mat of hairlike scales, produced from the caudal portion of the female's abdomen. Period in the ovum, 15 days. See Plate 24.

PLATE 24
Egg and first larval instar of Euchaetias elegans.
Upper figure, egg, highly magnified.
Lower figure, larva, first instar x 14.
Reproduced from painting by Comm. C. M. Dammers.

Larva: First instar. Extended, 3 mm. The body is translucent, the upper half being a delicate blue green, and the lower half yellow. There are twelve brown spots arranged in alternating diagonals on each segment, from each of which arises a single long seta. The upper eight of these setae are brown and the lower four white.

A black scutellum is present on the first segment.

Legs, black; prolegs and anal prolegs green, with a dark brown patch on the side of each. Claspers, colorless. Head, black. This instar is illustrated on Plate 24, lower figure.

Second instar, similar, except that the body is a dull white and the single hairs are replaced by groups. The central hair in each group is black, surrounded by a small number of white hairs. The lower groups of hairs, however, are all white.
Third instar. Body greenish white. The bases of the hair tufts are dark olive. On the upper part of the body these tufts are composed of several long black hairs. Those on the caudal and first segments are very long and white, while the series along the lower edge of the body are composed entirely of white hairs.

Penultimate instar: Length intended, 17 mm.

Body, pale green. All hair tufts arise from prominent black tubercles. The three upper rows of tufts on each side are composed of long black hairs, intermixed with a few that are white. The next lateral row contains black hairs only. The next latero-inferior row contains black hairs exclusively; the next inferior row contains the mixture of black and white, while the lower row contains shorter black hairs on its upper half and long white arching hairs on the lower half. The first segment is atypical, as it bears only the two lower tufts, while superiorly the tufts are replaced by a black scutellum.

On the second and third segments, a few very long black and white hairs arise from the upper tufts.

The hairs on the fourth, tenth and eleventh segments are slightly longer than the others.

Legs, jet black. Prolegs and anal prolegs, green, with a black blotch on their sides. Claspers, pale brown.

Spiracles, black rimmed, with white centers.

Head, shiny black. A fringe of white hairs from the first segment arches over it.

Abdomen, green.

This instar is illustrated in Plate 25, Fig. A.

PLATE 25
Larva and pupa of Euchaetias elegans.
A. Larva, penultimate instar x 3 1/5.
B. Larva, last instar x 2 1/2.
C. Pupa, lateral aspect, x 2 1/4.
Reproduced from painting by Comm. C. M. Dammers.
Mature larva: Length, extended, 28 mm.

Body, pale green. The dorsal tufts of hairs on the fourth to caudal segments are composed of a dense brush of soft black hairs, with a few orange hairs in the center of the brushes that occur on the fifth to tenth segments.

From the top of the first segment there extends a fringe of long white hairs, arching anteriorly. On the second and third segments the dorsal tufts contain very long mixed black and white hairs. On the fourth, tenth, eleventh and caudal segments the sub-dorsal tufts contain very long white hairs. Otherwise the larva is similar to the last instar, except that the two lower rows of tufts on each side are now composed exclusively of white hairs.

Pupation takes place on the foodplant, in a silk cocoon, into which the hairs are incorporated.

The mature larva is illustrated on Plate 25, Fig. B, and also on Plate 26.

Pupa: Length 14 mm. Color, deep chestnut; the surface is heavily punctate or rugose. Spiracles, silver white. The form is illustrated on Plate 25, Fig. C.

Miodera stigmata Sm.

Two larvae of this species were collected near Arlington, Riverside Co., Calif., feeding on Artemisia californica Less. These were secured March 1, 1931. In their earlier instars both larvae were green, but in the final instar one was brown. Probably the larvae are variable, with every intergradation between the brown and green forms. Both of the color phases are described and figured herein.
PLATE 27
Larva of *Miodera stigmata*.
A. Larva, penultimate instar, just prior to moulting, x 3.
B. Larva, last instar, head highly magnified.
Both figures show dorsal aspect.
Drawing by Comstock.

Mature larva: Length, extended, 32 mm.
Green form: Body color, pale green. The upper half is striped longitudinally with faint white lines. There is a narrow mid-dorsal soiled white band, also a relatively wide dorso-lateral clear white band. A narrow supra-stigmatal white band, and a wide infra-stigmatal white band are also present.

The segmental junctures are tinged with yellow; spiracles, white, with black rims. Abdomen, pale green.

Legs, pale green, the terminal segments brown. Prolegs and anal prolegs, pale green. Claspers, brown.

Head, pale blue-green, with a brown “W” on its crest.

The setae are soiled white, and are inconspicuous except on the head, caudal area, and over the dorsum. Plates 27 and 28 illustrate this form.

PLATE 28
Mature larva of *Miodera stigmata*, green form, x 2½.
Upper figure shows two typical segments in dorsal view.
Reproduced from painting by Comm. C. M. Dammers.
Brown form: The body color is a rich brown except for the abdomen below the infra-stigmatal line, which is mottled dark olive green.

There is a narrow light brown mid-dorsal band, shaded with black at the segmental junctures.

The dorso-lateral band is soiled white, mottled with yellow along its center, and margined with black. Lateral to this is a broad area of soiled yellow mottled with brown, below which is a broad band of light brown mottled with dark brown, its superior edge flecked with black, particularly on the segmental junctures.

The infrastigmatal band is soiled white, covered with olive mottling. This band is margined with black.

![PLATE 29](Image)

Mature larva (brown form) and pupa of *Miodera stigmata*.

A. Two segments of larva, dorsal aspect, x 2¼.
B. Larva, lateral aspect, x 2¼.
C. Pupa, lateral aspect, x 2¼/2.

Reproduced from painting by Comm. C. M. Dammers.

Spiracles, white with black margins.

Abdomen, olive green, mottled with black.

Legs, light brown, with dark brown terminal joints.

Prolegs and anal prolegs concolorous with abdomen.

The dorsal aspect of the first segment is dark brown.

Head, dark brown, the checks speckled with white punctae.

A few small soiled white setae are noted on the head, caudal segments, and dorsum. See Plate 29, Figs. A and B.

Pupation occurs under the soil. Pupated March 15, 1931.

Pupa: Length 1¼ mm. Color, rich chestnut, the wing cases, thorax and head of a darker shade. The form is depicted on Plate 29, Fig. C.
Trachea susquesa Sm.

Described from four examples of the larvae collected on Artemisia californica Less, at Arlington, Riverside Co., Calif., on March 1, 1931.

Mature larva: Length, extended, 32 mm.

Body color, predominantly a vivid green, speckled with minute black punctae.

There is a mid-dorsal band of elongated white triangles, the points of each triangle converging at the segmental juncture. These triangles are margined with dark green.

A similar line of triangles occurs, dorso-laterally.

A third line occurs sub-stigmatally, but each of the triangles in this line has a green central diamond-shaped center.

Spiracles, white, with black rims. Abdomen, pale blue green.

Legs, light green, with brown terminal joints; prolegs and anal prolegs, light green; claspers, brown.

The top of the first segment speckled with black.

Head, pale blue-green, spotted with black over the crest.

The position of the setae was not noted. These are very inconspicuous except on the head, and caudal segment.

Mature larva figured on Plate 30.

Pupation occurs under the soil. The pupa was not observed. Emergence of imagos occurred in April, 1931.

Erastria dividua f. opipara Hy. Edw.

This small and boldly marked noctuid ranges in the desert areas of the southwest from southern California to Texas.

Larvae were secured in quantity March 8, 1931, at Palm Springs, Riverside Co., Calif., feeding on Beloperone californica Benth.
Mature larva: Length, extended, 14 mm.

The body color is extremely variable, ranging from a green, through a red-mauve above and green below, to a solid red mauve. We are figuring and describing the intermediate form in which the dorsal area is red-mauve, and the abdomen and lateral surface green.

In this form there is a narrow indistinct white mid-dorsal longitudinal stripe on the red-mauve ground color. This richly colored area is bordered laterally with a broad white line. Inferior to this line the body is olive green, shading to lighter green on the abdomen.

The entire body is speckled with minute white punctae.

Each segment bears six large white raised points each side of the mid-dorsal line, arranged in alternating diagonals. Each of these points is topped with black and bears a single short white seta.

Spiracles, brownish green. Legs, green, with yellow terminal joints. Prolegs and anal prolegs green, with yellow claspers.

Head, olive green, spotted with brown, and sparsely covered with brown setae.

The larva is sub-cylindrical; head, smaller than first segment; widest at about the fifth segment and tapering markedly to the caudal end. Prolegs on the seventh segment much reduced and semi-functional; those on the eighth and ninth segments equal and fully functional. See Plate 31, Fig. B.

PLATE 31
Larva and pupa of Erastria dividua opipara.
A. Two segments of larva, dorsal view.
B. Mature larva, lateral view, enlarged x 4.
C. Pupa, lateral view, enlarged x 4½.
Reproduced from painting by Comm. C. M. Dammers.
Pupation takes place on the foodplant in a light silken cocoon.

Pupa: Length 7.5 mm. Color, a bright chestnut, the wing cases translucent olive-green. The wing cases extend about two-thirds the distance toward the caudal end. The posterior third is strongly recurved dorsally and tapers sharply to the pointed cremaster. Fig. C of Plate 31 illustrates the pupa.

The larvae feed on both the flowers and leaves of Beloperone. A number were parasitized by a small Tachinid, the species undetermined.

Imagos emerged in early April, 1931. We also have records of capture in September indicating a second brood.

Slossonia rubrotincta Hlsl.

This delicately colored Geometrid occurs in the scrub oak belt of the mountains of southern California.

A few larvae were secured in the Fraser Mt. district, near Lebec, by beating Quercus dumosa Nutt, which made possible the following incomplete account of the metamorphosis.

Mature larva: Average length 25 mm.; cylindrical; the body color whitish, thickly covered with gray and black spots and irrorations in an indefinite pattern, but so disposed as to heighten its resemblance to a twig.

There are four warty protrusions on the fourth, and also on the eighth segments, placed between the median area and the spiracles (two on each side). Otherwise the surface of the body is relatively smooth.
Legs and prolegs, white, spotted with black. Abdomen, whitish, with scanty gray spotting. A few short setae are barely perceptible over the body.

Head, mottled brown over the crest and around the mouth parts. Ocelli, black. Plate 32 illustrates the shape, and disposition of the markings.

Pupation occurs on the foodplant among the leaves, in a very scanty webbing that gives practically no protection, and through which the pupa is clearly visible.

Pupa: Average length, 10 mm. Apple green, with lighter lines of green on the wing cases over the venules. Stout; widest through center, abruptly narrowing toward caudal end. Thorax about one-fifth of total length; not protruded.

Plate 33 shows three aspects of the pupa. Shortly before emergence it becomes a light buff.

Pupal duration, ten days.

Our series were taken in February, March, June and July, suggesting the probability of two or more broods.

Plate 33
Pupa of *Slossonia rubrotincta* enlarged x 4½, showing dorsal, lateral and ventral aspects.

Photo by Nemetz.
Front wider than long; antennal scape elongate, clavate; funicle bi-segmented, first segment large, thick, second very small; club segmented only at the extreme tip. Elytra one and one-half times as long as wide and more than twice as long as the pronotum. Tibiae denticulate on the outer edge; foretarsal segments cylindrical. Very small species.

This genus is closely allied to the genus Dolurgus Eich, but is readily distinguished by the antennal funicle which has only two segments. The antennal funicle of Dolurgus has three segments and the antennal club is distinctly segmented whereas in Crypturgus the antennal club has sutures only at the extreme tip. Crypturgus is separated from all other genera of this subfamily by the antennal funicle having less than three segments.

This genus is represented in western North America by a single species which is characterized as follows:

Crypturgus borealis Sw.

Length 1 mm. Front wider than long, with a faint triangular impression on the epistomal area, apex extending posteriorly terminating between the eyes, densely, closely, very finely granulate-punctate, very sparsely indistinctly clothed with very short inconspicuous hairs. Pronotum longer than wide, 1.75:2.0, sparsely, finely punctate, closely, finely reticulate; sides very faintly rounded, narrowed anteriorly; anterior margin narrowly rounded. Elytral striae as wide as the interspaces, not as deep as wide, punctures deep, moderate, very closely spaced (many times less than their own diameter); interspaces very faintly convex, plano-convex, sparsely, finely punctate, sparsely clothed with short hairs; declivity precipitous, rounded, unarmed, becoming confusedly punctate and the interspaces becoming obsolete.

This species is taken on the smaller twigs of Alpine fir in British Columbia, Washington, Oregon and Colorado. Only a single specimen has been seen by the writer.
Dolurgus Eich.
Ber. Ent. Zeit., p. 147, 1868

Head prominent, front wider than long, deeply, densely punctate; antennal scape clavate almost as long as the club, funicle three-segmented; first segment large, wider than long; second much smaller, as wide as long; third very small, club compressed, ovate, four-segmented. Pronotum as wide as long, anterior margin rounded, sides arcuate, somewhat sinuate anteriorly; elytra two times as long as wide. Anterior tibiae denticulate on the outer margin, foretarsal segments cylindrical. Moderately small species, 2 mm.

This genus is readily distinguished from all other genera of this subfamily by the three-segmented antennal funicle. It is distinguished from Crypturgus Er. by having the antennal club segmented. In Crypturgus the antennal club has sutures only at the extreme apex.

The single species, representative of this genus, is characterized as follows:

Dolurgus pumilus (Mann.)
Bull. Mosc., 26, p. 247, 1843

Length 2-2.5 mm. Front of male wider than long, plano-convex, impressed on the epistomal area, deeply, moderately punctate, interpunctal area densely finely granulate, sparsely clothed with short hairs; epistomal process distinct, arcuate on the anterior margin, opaque; eyes entire, coarsely granulate, anterior margin constricted for half the width of the eye; antennal scape clavate, almost as long as the club, funicle three-segmented; first segment large, wider than long; second much smaller, as wide as long, and the third very small, club compressed, ovate, four-segmented. Pronotum as wide as long, 3:3, front margin rounded, sides arcuate, very faintly impressed on the anterior fourth, densely, deeply, moderately punctate, interpunctal area very finely, closely, densely granulate, moderately clothed with short scale-like hairs. Elytra twice as long as wide; striae distinctly but not deeply impressed, wider than deep, strial punctures large, not as deep as diameter, almost as wide as the interspaces, separated by less than one-half their own diameter; interspaces convex, densely rugose, rugosities decrease in size and number posteriorly, inconspicuously clothed with scale-like hairs, declivity steep and strongly narrowed at the apex.

The female differs from the male only by having the front uniformly plano-convex.

This species is found on the larger and smaller branches of Sitkha spruce in Washington and Oregon.
Polygraphus Er.

Arch. f. Naturg. vol. 1. p. 57, 1836

Front as wide as long with a median impression in the male, sparsely surrounded by long hairs, the female with the front without the impression and only very sparsely clothed with short pubescence, in both sexes the front is closely granulate-punctate; antennal scape almost as long as the club, longer than the funicle and decidedly clavate with the basal half uniformly slender; funicle usually six-segmented; club solid, one and one-half times the length of the funicle. Eyes divided. Base of the elytra slightly elevated and moderately crenulate. Anterior coxae narrowly separated; tibiae denticulate on the outer edge; third foretarsal segment cylindric, not widened.

This genus is separated from Crypturgus Er. and Dohtrgus Eich, by the antennal funicle having more than three segments. It is readily separated from all genera in this subfamily by the eyes being divided.

Polygraphus rufipennis Kby. is the only species in this genus and it is characterized as follows:

Polygraphus rufipennis Kby.

Faun. Bor. A., 4, p. 193, 1837

Length 2.5-3.5 mm. Front of male longer than wide, flat, densely, closely, deeply, moderately punctate, moderately clothed with moderately long hair; anterior margin widely elevated, glabrous; eyes divided, widely margined, coarsely granulated; antennal scape distinctly clavate, basal half uniformly slender, almost as long as the club; funicle usually six-segmented, often five-segmented; club one and one-half times the length of the funicle, solid. Pronotum wider than long, 4:3.5, densely, moderately granulate-punctate, moderately clothed with short scale-like hairs, anterior margin rounded, sides subparallel slightly narrowed anteriorly, constricted on the anterior fourth with the constriction extended across the dorsum. Base of the elytra elevated and slightly crenulate; striae very indistinct; interspaces densely, closely rugose-punctate, densely clothed with short scale-like hairs; declivity precipitous, strongly narrowed at the apex.

The female differs from the male only that it is slightly larger, and that the front is broader, almost as wide as long.

This species is found on Picea in Alaska, Canada and the northern part of the United States, east of the Rockies. It has not been recorded from Washington or Oregon.
Carphoborus Eich.
Ber. Ent. Zeit. 8, p. 27, 1864

The front of females clothed with long hairs. Antennal scape only slightly longer than the funicle, stoutly clavate; funicle five-segmented, first segment very large in proportion to the following; club oval, three-segmented. Eyes entire, deeply, narrowly emarginate. Base of the elytra elevated and strongly serrate, the declivity with carinate interspaces. Anterior tibiae denticulate on the outer edge; third foretarsal segment cylindric, not widened. Anterior coxae narrowly separated.

This genus is readily distinguished from Polygraphus Er. by having the eyes entire. It is separated from Renocis Csy., Pseudocryphalus Sw. by the eyes being deeply and narrowly emarginate and by the elytra interspaces on the declivity being carinate. The antennal scape is slightly longer than the funicle in Carphoborus whereas in the other two genera it is shorter than the funicle.

Key to the Species

1. Declivital interspaces moderately or feebly subequally elevated; front concave, at least in the male

Declivital interspaces alternately, unequally, prominently elevated

2. Sutures of the antennal club at least slightly arcuate (pl. 9, fig. 3); declivital interspaces 1 and 3 are feebly serrate in at least one of the sexes

Sutures of the antennal club nearly straight (pl. 9, fig. 2); declivital interspaces 1 and 3 distinctly serrate... radiata Sw.

3. Sutures of the antennal club transversely arcuate (pl. 9, fig. 3)...

Sutures of the antennal club obliquely arcuate (pl. 9, fig. 10)...

4. Second elytral interspace distinct the entire declivital length

cressatyi Br.

Second elytral interspace becoming obsolete on the declivital face...

vandykci Br.

5. First declivital interspace but little more elevated than the second

First declivital interspace distinctly more elevated than the second...
6. Second declivital interspace convex, nearly smooth, narrower behind ........................................... andersoni Sw.  
Second declivital interspace plano-convex, faintly rugose, wider behind ........................................... balisdelli Sw.

7. First and third declivital interspaces very feebly, sparsely serrate ........................................... swainsei Br.  
First and third declivital interspace very strongly, prominently serrate ........................................... ponderosa Sw.

Carphoborus radiata Sw.

Length 1.5-2.5 mm. Front of male closely, deeply, coarsely rugose-punctate, densely clothed with short scale-like hairs, anterior margin clothed with a fringe of long hairs; a deep transverse concavity on the epistomal area; a prominent transverse median carina between the eyes; sutures of the antennal club transverse, nearly straight, segments of the club equal in size, the tip of the club is truncate. Pronotum wider than long, 4:3, densely, closely, deeply punctate, indistinctly clothed with very short scale-like hairs not concealing the surface, a median longitudinal elevation on the basal half, anterior margin rounded, sides subparallel, strongly constricted behind the anterior margin. Elytral striae deeply impressed, as deep as wide, as wide as the interspaces, punctures very large and very closely spaced, as deep as diameter; interspaces confusedly rugose-punctate, punctures small, deep and dense, moderately clothed with short scale-like hairs; alternate declivital interspaces distinctly elevated and serrate; serrations of the first and third small and widely spaced; serrations of the fifth, seventh and ninth larger, and ninth joins the first and is very prominently serrate, the second and fourth obsolete on the declivity.

Front of the female deeply concave on the entire front, densely, closely, coarsely granulate-punctate except on a small median area of the concavity which is very finely granulate and without vestiture, the remainder of the concavity is densely clothed with long yellow hairs; the declivital serrations are not as prominent as those of the male.

This species is closely allied to simplex Lec, but is readily distinguished by the nearly straight sutures of the antennal club. In simplex the sutures are transversely arcuate and the first and third declivital interspaces are not as prominently elevated as in radiata and the second declivital interspace is only narrowed where as in radiata it is obsolete.

C. radiata Sw. is found on the smaller branches of Pinus radiata in California.
Carphoborus simplex Lec.

Proc. Am. Phil. Soc. 15, p. 383, 1875

Length 2-2.5 mm. Front of male wider than long, densely, closely punctate, clothed with short scale-like hairs, deeply impressed on the epistomal area; the impression is not as closely punctate as the surrounding area; a short median carina protrudes between the eyes; anterior margin wide, slightly elevated and opaque; sutures and the tip of the antennal club are transversely arcuate. Pronotum wider than long, 4.5:3, densely, moderately punctate, moderately clothed with short scale-like hairs, a longitudinal, median elevation extending the length of the pronotum; anterior margin round; sides subparallel, strongly constricted behind the anterior margin, constriction extending across the dorsum widening considerably on the dorsal area. Elytral striae hardly as wide as the interspaces, distinctly impressed, as deep as wide, strial punctures very closely spaced, as deep as diameter; interspaces convex, densely, finely punctate, densely clothed with short scale-like hairs; first and third declivital interspaces distinctly but slightly elevated, the serrations of the first, third, fifth and seventh small and widely separated, serrations of the ninth larger; second interspace strongly narrowed on the declivity, almost obsolete at the apex.

The impression on the front of the female extends between the eyes; the surface is glabrous and only very sparsely punctate; it is fringed with long yellow hairs and the carina is obsolete.

This species is closely allied to vandykei Br. but is readily distinguished from it by its size, 2-3 mm. : 1.5-2.5 mm. The longitudinal elevation of the pronotum in vandykei does not extend the full length of the pronotum as it does in simplex which also has a short, broad epistomal process in contrast to the long narrow one in vandykei. The median carina on the front of vandykei is V-shaped while in simplex it is a straight transverse carina.

C. simplex is found on the smaller branches of Pinus ponderosa and P. murrayana and has only been reported from California.

Carphoborus cressatyi Br.


Length 1.5-3 mm. Front of male plano-convex, slightly impressed behind the epistomal margin, entire front moderately clothed with moderately long scale-like hairs; armed with a medial granular-like tubercle between the eyes; epistomal margin
fringed with sparse long hairs; cephalic portion minutely granulate punctate; sutures of antennal club strongly, obliquely arcuate, tip of club rounded to conform with sutures. Pronotum wider than long. 1.3:1.0, very densely, minutely punctate, densely clothed with very short scale-like hairs; sides distinctly sub-parallel on posterior two-thirds, strongly narrowed anteriorly and distinctly behind the anterior margin; very densely, finely punctate, punctures deeper on the posterior two-thirds than on the anterior third; densely clothed with very short scale-like hairs. Elytral striae distinctly impressed with large deep, closely placed punctures; interspaces plano-convex, densely, finely, closely punctate, densely clothed with very short scale-like hairs, wider than the striae except on the declivity where the first is as wide as the striae, the second narrower, and the third wider; first and third declivital interspaces very sparsely armed with acute tubercles, slightly longer than the scale-like hairs.

The female differs from the male by having the front deeply impressed between the eyes; impression densely, finely granulate-punctate, and densely fringed with long hairs; serrations of the declivital interspaces larger and more numerous than in the males.

This species is found under the bark of dead and dying limbs of Pseudotsuga macrocarpa in California.

Carphoborus vandykei Br.

Can. Ento. 65: 5, p. 103, 1933

Length 1.5-2.5 mm. Front of male densely, closely, moderately punctate, moderately clothed with short scale-like hairs, deeply impressed on the epistomal area, epistomal process long and narrow extending between the mandibles; a single bifed, carine-like tubercle medially between the eyes with the ends bent anteriorly simulating a V-shaped carina; the impression is less densely punctate than the surrounding area; the interpunctal area is very finely, shallowly granulate; sutures of the antennal club are obliquely arcuate. Pronotum is wider than long, 4:3.5, densely deeply punctured on the posterior two-thirds and moderately densely punctate on the anterior third; the fine interpunctal granulations are more pronounced on the anterior third than on the posterior portion giving it an appearance of a more dense punctuation; punctures small; a median longitudinal elevation extending from the base to the center; anterior margin rounded; sides arcuate, constricted behind the anterior margin; constriction extending across the dorsum becoming broad on the dorsal area. Elytral striae slightly more than one-half as wide as the interspaces, as deep as wide; interspaces convex, becoming wider
on the declivity except the second which becomes strongly narrowed, transversely rugose, finely punctured and clothed with short scale-like hairs; serrations on the first declivital interspace are very few in number, almost obsolete and granular-like, slightly larger on the third, very few on the fifth and seventh; more numerous, larger and more widely spaced on the ninth.

The front of the female has a larger concavity extending between the eyes, without the tubercle between the eyes; concavity is sparsely fringed with long hairs, surface glabrous, moderately punctate with deep moderate punctures, except at a small median portion which is smooth and very slightly elevated and very minutely, finely, shallowly granulate. The declivital serrations are more numerous and more distinct than in the male.

This species is easily distinguished from *C. simplex* Lec. by the obliquely arcuate sutures of the antennal club, the oblique tip of the club, and by the long epistomal process which extends anteriorly between the mandibles. It is readily separated from *C. radiata* Sw. by the antennal club being less than twice as long as wide, the arcuate oblique sutures of the antennal club, and by the serrations of the elytral declivity being less pronounced. *L. vandykei* Br. is readily separated from *C. blaisdelli* Sw. by the long epistomal process, the median longitudinal elevation of the pronotum extending only to the constriction, whereas in *blaisdelli* it extends the entire length although only faintly on the anterior half. The first and third declivital interspaces of *blaisdelli* are more distinctly elevated, the serrations are slightly longer, and the second interspace, although narrowed, is wider than in *vandykei*.

*C. vandykei* is found on the smaller branches of *Pseudotsuga taxifolia* in California.

**Carphoborus andersoni** Sw.


“Length 2.5 mm., width 1 mm.; color, pale reddish (immature).

Description of the female: The head has the front flattened and densely clothed with a brush of rather short yellow hairs; the antennae slender, the club longer than wide.

The pronotum is slightly wider than long, with the sides arcuately narrowed from base to apex, only feebly constricted in front; the front broadly rounded; the disc closely deeply but not coarsely punctured, the median line very faint; the pubescence very small, scale-like, not concealing the surface.

The elytra are elongate, the sides subparallel, broadly rounded behind; the bases very strongly elevated and rugose as
usual; the striae distinctly impressed; the interspaces convex, feebly granulate, clothed with abundant rather slender scales which do not entirely hide the surface; the declivity with the first interspace but little more elevated than the second and only feebly granulate, the second interspace convex, nearly smooth, narrower behind; the third interspace rather strongly elevated and armed with five or six rather coarse acute serrations; fifth and seventh interspaces united in rather broad curves slightly elevated behind and together bearing three or four acute serrations. This species will go in my key, Dom. Ent. Br. Bull 14, pt. 2, p. 57, under AA, BB, but is widely separated from *bicristatus* and *bifurus* by the large size, coarse declival serrations, less elevated declival alternate interspaces, and characters of the front.

Type No. 153, Sandstone Rapids, Coppermine River, Northwest Territories, F. Johansen, collector; Feb. 15, 1915; one para-type (a few fragments); lot 2908. Host, *Picca canadensis*.

**Carphoborus blaisdelli** Sw.

Can. Ent. 56, p. 234, 1924

Length 2-3 mm. Front of male wider than long, distinctly impressed on the epistomal area, a short, latitudinal, median carina between the eyes; the area surrounding the impression is densely, closely, rugose-punctate and clothed with short scale-like hairs; impression is sparsely, deeply punctate, interpunctal area is very finely granulate and very sparsely clothed with short scale-like hairs; anterior margin clothed with a tuft of long yellow hairs on each side of the short, broad, epistomal process; sutures of the antennal club subtransverse and slightly arcuate, tip of the club is truncate and subtransverse. Pronotum wider than long, 4:3, densely, shallowly, moderately punctate, clothed with short scale-like hairs; anterior margin slightly rounded; sides subparallel, constricted behind the anterior margin; constriction extending across the dorsum; median longitudinal elevation extending the full length of the pronotum, less distinct on the anterior half. Elytral striae as deep as wide, as wide as the interspaces, punctures variolate, as deep as diameter, very closely placed; interspaces convex, densely, closely, rugose-punctate, punctures small, deep, densely clothed with short scale-like hairs; first and third declival interspaces distinctly elevated, serrations of the first larger than those of the third but not longer than the scale-like hairs; second interspace distinct the entire length of the declivity although slightly narrower than on the disc widening behind.

Front of the female with the impression extending between the eyes, fringed with a dense growth of long hairs, the vestiture of the impression is less dense and shorter than that on the remainder of the front but dense enough to obliterate the surface.
The declivital serrations are more prominent and slightly longer than the scale-like hairs.

This species is closely allied to *C. andersoni* Sw. but is readily separated by the second declivital interspace being only slightly narrowed, more nearly as wide as on the disc, whereas in *andersoni* it is distinctly narrower than on the disc. *C. swainei* and *ponderosa* are much narrower than either of the above mentioned species.

*C. blaisdelli* is found on the pines of southern California.

**Carphoborus swainei** Br.

_Can. Ent._ 65:5, p. 103, 1933

Length 2-3 mm. Front of male densely, moderately, deeply, rugose-punctate, clothed with short scale-like hairs, deeply impressed on the epistomal area, epistomal margin wide and glabrous, finely rugose; epistomial process short, densely and finely rugose; impression densely, closely, finely rugose-punctate, very sparsely clothed with short scale-like hairs; a double tuberculate-like carina medially between the eyes; first suture of the antennal club is transverse and straight, second is slightly arcuate, the apex is slightly obliquely rounded. Pronotum wider than long, 3.75:2.5, closely, deeply, moderately punctate on the posterior two-thirds, interpunctal area finely granulate, anterior third more sparsely and more finely punctate but the interpunctal area very closely, very finely granulate, thereby being more opaque than the posterior portion, moderately clothed with short scale-like hairs, median longitudinal elevation extending from the base only to the impression; a callus on the dorsal third medially between the base and the anterior margin; anterior margin rounded, sides slightly arcuate, constricted behind the anterior margin, contractions extending across the dorsum. Elytral striae not as wide as the interspaces, as wide as deep, punctures large and deep and very closely placed; interspaces convex, densely, moderately rugose-punctate, punctures deep, moderately clothed with scale-like hairs; basal margin of the elytra with the serrations widely spaced; alternating declivital interspaces faintly serrate with granular-like tubercles, first moderately elevated, third and ninth distinctly elevated, second obsolete, eighth nearly so.

Female with the frontal impression deeper and extending to between the eyes, densely fringed with long hairs, surface shining and definitely, very minutely, finely, shallowly reticulate with only a few moderate punctures and those near the edges, without the median tubercle between the eyes but with a minute latitudinal carina-like tubercle at the base of the epistomal process; declivital serrations slightly larger than in the male.

This species is readily distinguished from *C. andersoni* Sw. and *C. blaisdelli* Sw. by the second declivital interspace being obsolete. It is readily separated from *C. ponderosa* Sw. by the
smaller declivital serrations, and the less pronounced elevation of the first and third declivital interspaces, particularly the third. In *C. swainei* the serrations on the base of the elytra are more widely spaced than in *ponderosa*.

*C. swainei* is found on smaller branches and twigs of *Pinus sabiniana* and *P. jeffreyi* in California.

**Carphoborus ponderosa Sw.**

*Can. Ent.*, 56, p. 236, 1924

Length 1.5-2.5 mm. Front of male wider than long, densely, closely, rugose-punctate, clothed with short scale-like hairs, deeply impressed on the epistomal area, a short, slightly elevated, median carina between the eyes, epistomal margin narrow; sutures of the antennal club subtransverse, straight, tip truncate, first segment as long as the second and third united. Pronotum wider than long, 4:2.5, densely, moderately punctate, clothed with short scale-like hairs, longitudinal elevation very faint; anterior margin slightly arcuate; sides subparallel, slightly narrowed anteriorly, slightly constricted behind the anterior margin, impression very faint on the dorsum. Base of elytral margin closely serrate; elytral striae not as wide as the interspaces, as deep as wide, punctures large, as deep as diameter and very closely spaced; interspaces coarsely, densely rugose-punctate, densely clothed with short scale-like hairs; alternating declivital interspaces distinctly serrate, serrations longer than the scale-like hairs and very acute; those of the first are much smaller than those of the other interspaces, first and third distinctly elevated, third much more pronounced than the first, second strongly narrowed.

Front of female densely, moderately granulate-punctate; impression extends between the eyes, fringed by dense, long hairs. Declivital serrations not as acute as in the male but larger.

This species is closely allied to *C. andersoni* Sw. and is readily distinguished by the second declivital interspace being very greatly narrowed, the first and second striae are separated by only a single row of short scale-like hairs while in *C. andersoni* the second interspace is almost as wide as on the disc and it distinctly separates the first and second striae. It is readily separated from *C. swainei* Br. by the closely spaced serrations on the base of the elytra, the larger and more prominent serrations on the declivity, and by the first segment of the club being as long as the second and third united, and also by the unequal elevations of the first and third declivital interspaces, the third being greatly more elevated than the first.

This species is taken on the smaller branches of *Pinus ponderosa* in British Columbia and Utah.
Renocis Csy.
Cal. Acad. of Sc., Decs. Notices 1, p. 257. 1886

Front hairy in both sexes; eyes entire; feebly sinuate in front, hardly emarginate. Antennal scape shorter than the funicle; first joint of the funicle large, subglobular; club faintly four-segmented, oval, strongly compressed, sparsely pubescent, longer than the scape and funicle combined. Pronotum wider than long, strongly arcuate at the sides, and strongly rounded anteriorly. Base of the elytra strongly serrate and elevated, not deeply striate, interspaces wide and sparsely pubescent with scale-like hairs. Anterior coxae contiguous and in contact with the head beneath. Anterior tibiae margined with short, stout teeth; third tarsal segment cylindric, not widened.

This genus is closely allied to Pseudocryphalus Sw. but is readily separated by the anterior coxae being in contact with the head beneath and not separated by a short prosternum as in Pseudocryphalus.

Key to the Species

1. Pronotum without tufts of long setae-like hairs on the anterior margin; anterior margin bisulcate with the sulcus short and the lobes elevated heterodoxus Csy.
   Pronotum with two tufts of long slender setae-like hairs on the anterior margin which is straight penicillatus Br.

Renocis heterodoxus Csy.
Cal. Acad. of Sc., Desc. Notices 1, p. 258. 1886

Length 1.5-2.5 mm. Front of male slightly wider than long, very closely, finely, densely rugose-punctate, densely clothed with moderately long hairs, deeply impressed on the epistomal margin; a short tubercle on each side of the median line at the top of the impression between the eyes; antennal club two and one-half times longer than wide. Pronotum wider than long, 4.5:2.5; densely, moderately punctate, interpunctal area densely granulate, very densely clothed with short, very broad, brown and white scale-like hairs; anterior margin bisulcate with the sulcus short, each half of the margin arcuate and turned upwards with long, very flat, upright, scale-like hairs; fringing the margin and with a dorsal lateral tooth on each side; sides strongly arcuate, narrowing anteriorly and constricted behind the anterior margin, constriction more distinct on the dorsum. Elytral striae distinct, not as wide as the interspaces, not as deep as wide, punctures moderately large and shallow, very closely placed; interspaces densely, confusedly, closely rugose-punctate, clothed with a single median row of short, broad, white, brown and white, scale-like hairs and densely clothed with short, stout, brown and white
setae; elytral base very strongly elevated and closely serrate with short, broad serrations; declivity steep, interspaces unarmed.

Female front with shorter hairs and with shorter frontal tubercles.

This species is easily separated from *R. penicillatus* Br. by its larger size, 1.5-2.5: 1.5 mm, by the two frontal tubercles and by the shallow frontal impression. In *penicillatus* the male has the front very deeply concave, and the female is flat. The anterior margin of the pronotum in *heterodoxus* is fringed with moderately long scale-like hairs whereas *penicillatus* has two tufts of very long setae-like hairs and two dorsal lateral teeth.

This species is found on Mt. Mahagony, *Cercocarpus ledifolius*, in Washington, Oregon, Utah and California.

**Renocis penicillatus** Br.,
Can. Ent. 65: 10, 239, 1933

Length 1-1.5 mm. Front of male very deeply concave, concavity fringed with very long hairs, vestiture in the concavity is sparser, shorter, and finer; frontal surface has a few moderate punctures and many very fine punctures; antennal club long and slender, two and one-half times longer than wide. Pronotum is wider than long, 3.5: 2, densely moderately granulate-punctate, very densely clothed with brown and white scale-like hairs; anterior margin straight, fringed with two tufts of very long setae-like hairs and with two dorsal-lateral teeth; sides strongly arcuate, narrowed anteriorly, faintly constricted behind the anterior margin, constriction more distinct on the dorsum. Elytral stria one-half as wide as the interspaces, distinctly but shallowly impressed, not as deep as wide, punctures small, widely spaced, separated by several times their own diameter; interspaces densely, closely, finely rugose-punctate, densely clothed with very short inconspicuous scale-like hairs and with a single, median row of widely spaced, short, upright, wide, scale-like hairs; declivity steep; elytral base very strongly elevated, surmounted by four teeth, two on each side, and with a tuft of short scale-like hairs posteriorly to the teeth.

The front of the female is flat with only a faint longitudinal impression and with the vestiture of uniformly, uniform, shorter hairs.

This species is very easily separated from *R. heterodoxus* Cay. by its smaller size, the tuft of long hairs on the anterior margin of the pronotum, and by the more narrow, indistinct striae, and the smaller striae punctures.

The host of this species is *Rhus integrifolia* and *R. ovata*, working in the smaller twigs of the plant. It has only been recorded from southern California and undoubtedly extends over the range of its hosts.
Pseudocryphalus Sw.

Front as wide as long; eyes entire; antennal funicle five-segmented; antennal club almost as long as scape and funicle combined, four-segmented, sutures subtransverse, fourth segment as long as two of the others combined, glabrous, densely clothed with short upright hairs, entire club is about five times longer than wide, strongly compressed. Pronotum wider than long, widest at the base, strongly narrowed anteriorly, densely clothed with short, brown and white, broad, flat, scale-like hairs. Elytral base elevated, closely distinctly serrate, very strongly elevated at the scutellum, elevation very densely, closely clothed with long, upright, scale-like hairs; interspaces sparsely clothed with short scale-like hairs; declivity unarmed. Anterior coxae almost contiguous, separated from the head by only a very short prosternum. The third foretarsal segment cylindric; tibiae margined with long slender teeth on the outer side.

This genus is closely allied to Renocis Csy., but is easily separated by the short prosternum which separates the anterior coxae from the head and the tibiae having long slender teeth. It is readily separated from Chramesus Lec., by the third tarsal segment being cylindric.

Key to Species

Elytral interspaces sparsely clothed with scale-like hairs and without row of spatulate hairs; pronotum without serrated brown spot on the sides ........................................... brittani Sw.

Elytral interspaces densely clothed with scale-like hairs and with a row of long spatulate hairs; lateral brown spot of pronotum distinctly serrated ........................................... maclayi Br.

Pseudocryphalus brittani Sw.

Length 2.0 mm. Front of male deeply impressed, densely clothed with short scale-like hairs almost obliterating the surface which is densely, closely granulate punctate; epistomal process very narrow and short; anterior margin densely fringed with long hairs; eyes long and narrow, coarsely granulate, widely margined on the posterior margin and ends. Pronotum wider than long, 4.5:3, densely, moderately punctate, densely clothed with short scale-like hairs; sides strongly arcuate on the basal two-thirds, strongly narrowed anteriorly, faintly constricted across the dorsum behind the anterior margin which is broadly rounded and densely fringed with moderately long upright scale-like hairs. Elytral base very strongly elevated and densely clothed with upright scales on the scutellar area, base distinctly serrate; striae more than one-half as wide as the interspaces, not as deep as wide, punctures small and separated by less than

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their own diameter; interspaces flat, densely finely punctate, sparsely clothed with short white scale-like hairs with a definite median row of long upright, widely spaced, scale-like hairs; declivity unarmed and steep.

Only a single specimen has been observed by the writer. This species is found on apple trees in British Columbia.

**Pseudocryphalus maca1yi** Br.


Length 2 mm. Front densely, finely granulate; densely, very minutely, shallowly punctate; moderately densely clothed with short coarse hairs, longer hairs on the epistomal margin, distinctly impressed between the eyes; lateral borders of the impression clothed with short, narrow, very coarse, brown, tooth-like hairs and armed medially on each side with a prominent, coarse, granule-like tooth; epistomal margin armed with a small median granule and clothed with long hairs; antennal club short and stout, sparsely clothed with short stiff hairs. Pronotum wider than long, 1.4:0.9, densely clothed with short brown and white scales hiding the pronotal surface; scales forming pattern of white with a light brown arrow head-shaped median spot on the disk and a lateral dark brown spot, the anterior border of which has two prominent teeth, one acute; the other rounded and shorter; the posterior border is armed with three equally prominent, subacute teeth; sides strongly arcuate, strongly impressed behind the anterior margin; anterior margin broadly rounded, fringed with recurved short, broad, scale-like hairs. Elytra densely clothed with short, brown and white scales forming brown and white bands across the elytra; the anterior band is brown and narrow, becoming very narrow laterally; the third band is as wide as the white second band, the posterior margin attains the summit of the declivity; striae distinctly impressed with moderate, deep punctures separated by less than their own diameter from which arises a very fine, very short, very inconspicuous hair; interspaces plano-convex, armed with a single median row of upright, very broad, brown, spatulate hairs; declivity steep, clothed with white scales on the declivital face surrounded by brown scales; first and second interspaces flat, finely granulate, minutely punctate, vestiture when present is of white, short scales but unarmed with the broad spatulate hairs of the elytra; strial punctures small, shallow, separated by several times their own diameter.

Frontal variations are that the tooth-like hairs are shorter and less numerous in some specimens; the vestiture laterally of the impression is often sparse or lacking. On the declivity the striae often do not attain the posterior margin. These may be sexual differences but due to the intergradation of the extremes the writer does not find them constant enough to name them as definite sexual characters.
This species is readily separated from *P. brittanini* Sw. and *P. cridellei* Sw. by the more dense vestiture of the elytra; characters of the elytral declivity, and by the serrations on the lateral brown spots of the pronotum.

*P. maclayi* is found under the bark-like epidermis of dead and dying *Encelia californica* in southern California.

**Chramesus** Lee.

Syn. of Scolytidae (Zimm. ed. by Lee)
Trans. Am. Ent. Sec. 11. p. 168, 1868
Syn. d. Scolytides, separate dated 1869, p. 46

Front concave in the male, slightly convex in the female; antennal scape twice as long as the funicle, slender, gradually and slightly enlarged toward the tip, with a tuft of long yellow hair on the enlarged portion; funicle six-segmented attached to the side of the club; first segment is larger than the following; club as long as the scape and the funicle combined, unsegmented. Pronotum one and one-half times wider than long, sides arcuate and scabrous, strongly sinuate anteriorly. Elytra serrate and cordate on the basal margin, twice as long as the pronotum, obtusely rounded behind with the declivity oblique, short scale-like hairs comprising the vestiture. Anterior coxae widely separated; tibiae serrate on the outer edge; third tarsal segment distinctly widened and bilobed. Body hump-backed in shape.

This genus is distinguished from the preceding genera of this subfamily by having the third foretarsal segment distinctly widened and bilobed and it differs from *Crypturgus* Er. and *Dolurgus* Eich, by having more than three segments in the antennal funicle. It is readily separated from the following genera in this subfamily by having the antennal club unsegmented.

**Key to Species**

1. Elytral intervals convex, vestiture of pronotum uniform in size and type, punctures becoming strongly muricate or asperate on the sides, small species, 1.75 mm. long, 1 mm. wide ..................................................... 2

Elytral intervals nearly flat, vestiture of pronotum not uniform as some scales are longer than others and are intermixed with very narrow hair-like scales, only a few asperities on the sides of the pronotum, larger species 2.25 mm. long, 1.5 mm. wide ......................... *subopacus* Schffr.

2. Front with a conical tubercle at apex of the beak, strongly muricate on the sides of the pronotum .... *dentatus* Schffr.

Front without a conical tubercle at the apex of the beak, strongly asperate on the sides of the pronotum ............................................................. *asperatus* Schffr.
**Chramesus subopacus Schffr.**

*Jour. N. Y. Ent. Soc. 16, p. 221, 1908*

"Form of icorae but much larger; color black, antennae and tarsae testaceous; moderately densely clothed above with cinereous or yellowish - cinereous oppressed scales, which are smaller and rounded on the elytra and each interval with a row of short erect, larger scales. Head in the male rather deeply excavated; side margins slightly below the middle of the eyes suddenly raised; shining in a subtriangular apical space; above this the surface subopaque and finely reticulate-punctate; in the female the head is somewhat convex, finely reticulate and sparsely punctate, dull; apical and side margins distinctly beaded. Prothorax wider than long; sides rounded; base much wider than apex; the latter scarcely constricted; disc not densely punctate. At sides a few asperities. Elytra as wide as the prothorax; basal margin strongly carinate; sides nearly parallel; apex broadly rounded, punctate-striate; striae feebly impressed, punctures moderate; intervals moderately wide and nearly flat; the row of median punctures from which the erect setae arise, the three or four near the suture very strongly muricate in the female. Underside sparsely clothed with cinerous hairs, apical margin fringed with a row of pale setae. Length 2.5 mm; width 1.5 mm.

"Huachuca Mts., Arizona.

"The description of the Central American, tumidiulus, fits this species (page 222) rather closely, but the differences given in the remarks following the description in comparing it with icorae do not agree very well with the above described species.

"The female is rather dull while the male is more shining. The vestiture of the prothorax is not uniform, some of the scales are long and there are here and there a few very narrow, hair-like scales."

**Chramesus dentatus Schffr.**

*Jour. N. Y. Ent. Soc. 16, p. 221, 1908*

Length 1.5-2 mm. Front of male longer than wide, very deeply concave; surface very finely, densely reticulate, very sparsely, finely granulate, sparsely clothed with short hairs; epistomal margin broad, truncate, a short median tubercle posterior to the epistomal margin; antennal scape clavate, clothed with very long hairs. Pronotum wider than long, 4.5:3.5, densely
closely reticulate, moderately punctate with moderate, shallow punctures, densely clothed with short erect scale-like hairs; anterior margin broadly rounded; sides very faintly arcuate, strongly narrowed anteriorly, very faintly constricted behind the anterior margin. Elytral striae as wide as the interspaces, not as deep as wide (one-half as deep as wide), punctures large and shallow and very closely spaced; interspaces convex, densely finely punctate from which very short scale-like hairs arise, with a single row of widely spaced, moderate sized, deep punctures from which long, stout, setae-like hairs arise; basal margin closely distinctly serrate.

Front of female planoconvex, median epistomal tubercle smaller than that in the male.

This species is closely related to C. asperatus Schffr. but is readily separated by the tubercle on the epistomal area.

C. dentatus is found on twigs of oak in Arizona and California.

**Chramesus asperatus** Schffr.

*Jour. N. Y. Ent. Soc.* 16, p. 220, 1908

"Form of icoriae, black, tarsi and antennae testaceous; elytra with more or less distinct rows of small, narrow scales and each interval with a row of longer, stouter, erect scales. Head in the male broadly impressed, very finely reticulate; in the female flat, feebly, transversely elevated between the antennal insertion. Prothorax wider than long; sides broadly arcuate; apex scarcely constricted; surface indistinctly reticulate, with rather large, not densely placed muricate punctures, which become strongly asperate towards the sides, each puncture bearing moderately long, semi-erect, scale-like hair. Elytra as wide as the thorax at the base; sides almost parallel; apex broadly rounded, punctate-striate; striae scarcely impressed; intervals feebly convex. Abdomen sparsely clothed with pale hairs. Length 1.75-2 mm.; width 1-1.2 mm.

"Page 221.) Chiricahua Mt., Arizona (E. A. Schwarz).

"Very closely allied to icoriae but the thorax, especially in the male, is wider and more strongly asperate.

"A single female from Huachuca Mt. has the striae more deeply impressed and the median row of punctures on each interval strongly muricate, but does not seem to differ otherwise."

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Phthorophloeus Rey
Revue d'Ent., 2, p. 128, 1883

Front as long as wide, concave impressions in one of the sexes, convex in the other; antennal scape clavate, as long as the club, twice as long as the funicle, with a tuft of long yellow hairs; antennal funicle five-segmented attached on to the end of the club, first segment globose, twice as wide as the following segments and as long as the two following combined; club three-segmented, loosely segmented, segments produced on one side giving it a sublamellate appearance. Pronotum as wide as long, sides arcuate, narrowed in front. Elytral basal margin cordate, elytra twice as long as wide. Anterior coxae widely separated. Third foretarsal segment distinctly widened and strongly bilobed.

This genus differs from Chramesus by having the antennal club segmented, and it differs from all other genera in this subfamily by having the antennal club loosely segmented, the segments produced on one side giving a sublamellate appearance.

Only one species of this genus is found in western North America and it is characterized as follows:

Phthorophloeus puberulus (Lec.)

"Cylindrical, black, nearly opaque, clothed with fine erect yellowish pubescence; base of antennae and tarsi piceous. Head finely sparsely punctured; front nearly smooth, shining, broadly concave, with two small cusps on the epistoma. Prothorax wider than long, sides oblique slightly rounded, coarsely punctured (520), dorsal line obsolete, visible only near the middle. Elytra with shallow striae, formed of quadrate punctures, interspaces somewhat elevated, not wider than the striae, with the hairs arranged in rows. Length 2.5 mm.

Veta Pass: one specimen. This species resembles in appearance Hylosinus opacus, but is quite different in characters. The joints of the antennae are less prolonged than in the other species, so that the club becomes elongate-oval, and as long as the remaining joints united."

This species has only been reported from Colorado.
EUPHORBIA IN THE PACIFIC STATES
By Louis C. Wheeler

This paper includes notes concerning species of Euphorbia occurring in or reported from the Pacific States (California, Oregon, and Washington), a key to all the native or naturalized species occurring in this area, and an alphabetized cross-referenced list of the valid species and their synonyms.

The writer expresses his gratitude to Dr. P. A. Munz for advice and the privilege of using the botanical library and herbarium of Pomona College, to Dr. Ivan M. Johnston, Arnold Arboretum, Harvard University, Mr. LeRoy Detling, Stanford University, and Mr. J. A. Ewan, University of California, Berkeley, for looking up references, and to the curators of the following herbaria for loaning material or permitting its study at the herbaria.

NOTES
Specimens are cited from the following herbaria:

(C) University of California, Berkeley.
(CA) California Academy of Sciences, San Francisco.
(D) Dudley Herbarium, Stanford University, California.
(F) Field Museum, Chicago, Illinois.
(G) Gray Herbarium, Harvard University, Cambridge, Mass.
(L) Los Angeles Museum, Los Angeles, Calif.
(P) Pomona College, Claremont, Calif.
(Per) Frank W. Peirson Herbarium, Altadena, Calif.
(SB) Santa Barbara Museum of Natural History, Santa Barbara, Calif.
(UCLA) University of California, Los Angeles.
(W) Louis C. Wheeler Herbarium, La Verne, Calif.

The abbreviations given are those used in citing specimens.

Section Anisophyllum

Euphorbia cinerascens Engelm. in Torr., Bot. Mex. Bound., 186. 1859. This species does not occur west of Texas. The specimen of this species cited as E. melanadenia Torr. var. subinappendiculata Engelm. ex Boiss., DC. Prod. 15: 32. 1862, collected by Gregg at "Monterey, Californiae" must have come from Monterey, Nuevo Leon, Mexico, for E. cinerascens does not occur in California but does occur in Coahuila, Tamaulipas, and San Luis Potosi (I have seen specimens from these states), and so is to be expected in Nuevo Leon, Mexico. Gregg is known to have collected at Monterey, Nuevo Leon, as evidenced by Gregg's collection from Monterey, Mexico, of E. cinerascens cited by Engelmann, Bot. Mex. Bound, 186. 1859. It is probable that both authors were citing the same collection.


Euphorbia glyptosperma Engelm. in Torr., Bot. Mex. Bound., 187. 1859. Millspaugh, Field Mus. Pub. Bot. 2: 409. 1916, gives Chamaesyce aequata Lunell, Amer. Midl. Nat. 1: 204. 1910, and Ch. aequata var. claudicatus Lunell, idem, as synonyms of Ch. glyptosperma. I am unable to place them here from Lunell's description. Likewise, Ch. glyptosperma var. integrata Lunell, Amer. Midl. Nat. 3: 142. 1913, is given by Millspaugh, FMPB 2: 409. 1916, as another synonym of Ch. glyptosperma. Without examining the type I cannot be sure that the plant Lunell described was Euphorbia glyptosperma. I have seen the type of E. Greenei Millsp., Pittonia 2: 88. 1890; Beaver Canyon, Idaho, E. L. Greene in 1889 (F), and agree with Millspaugh's later reduction of this to synonymy under E. glyptosperma. Rydberg, Fl. Prairies & Plains, 517. 1932, cites Chamaesyce erecta Lunell, Amer. Midl. Nat. 1: 204. 1910, as a synonym of Ch. glyptosperma. The description does not enable me to refer it to that species.

Euphorbia hirtula Engelm. ex. S. Wats., Bot. Calif. 2: 74. 1880. Apparently this has not been reported from the Coast Ranges. There are two collections. California: Monterey Co.: Jolon, Eastwood in 1894 (C); "The Indians," Santa Lucia Mts., J. T. Howell 5651 (CA).

Euphorbia humistrata Engelm. in Gray, Man. ed. 3: 386. 1859. Greene, Fl. Franc., 92. 1895, reports this from a specimen collected by him at lone, Amador Co., Calif. I have not seen the specimen. It if were this it was introduced and the species has not reappeared.
"Euphorbia inaequilatera" Engelm., in Torr., Bot. Mex. Bound. 187." 1859, appears in Index Kewensis. As a matter of fact Engelmann, idem, properly credited this to Sonder, Linn. 1850: 105. Boissier, DC. Prod. 15º: 43. 1862, was the first writer to erroneously credit Engelmann with this species. This "E. inaequilatera Engelm." equals E. serpyllifolia at least for the most part.

Euphorbia micromera Boiss., DC. Prod. 15º: 44. 1862. In California this has been reported (Bull. So. Cal. Acad. Sci. 33: 107. 1934) north of the Colorado Desert only from Owens Lake, Inyo Co., Purpus 3046 (C). It occurs at Rosamond, Mohave Desert, Los Angeles Co., collector not stated but probably Hoffmann, in 1928 (SB).

Euphorbia novomexicana (K. & G.) Wheeler comb. nov. Anisophyllum novomexicanum Klotzsch & Garcke, Abh. Akad. Wissen. Berlin 1859: 31. 1860. There seems to be no reference in American botanical literature to this species. It was published too near the appearance of Euphorbia in De Candolle's Prodromus 15º. 1862, for Boissier to include it. Greene, in publishing his Euphorbia neomexicana, Bull. Cal. Acad. Sci. 2: 56. 1886, made no reference to Anisophyllum novomexicanum. It is doubtful that he knew of that name. A study of the literature makes it appear that Greene’s name was the equivalent of the earlier name of Klotzsch & Garcke. The type collection of A. novomexicanum was Fendler 795 from New Mexico. Engelmann, Bot. Mex. Bound., 187. 1859, cites Fendler 795 as Euphorbia inaequilatera Sonder. Boissier, DC. Prod. 15º: 43. 1862, cites Fendler 795 as E. serpyllifolia var. consanguinea Boiss. Greene, Bull. Cal. Acad. Sci. 2: 56. 1886, cites in synonymy under his E. neomexicana: "... E. inaequilatera, Engelm., Mex. Bound. as to the plant of New Mexico, E. serpyllifolia var. consanguinea, Boiss. DC. Prod. XVº: 43, with the same limitation." Therefore, according to Greene’s own statement, Fendler 795 is his species and his name must be a synonym of Anisophyllum novomexicanum.

An examination of an isotype of A. novomexicanum; New Mexico, Fendler 795 in 1847 (G); reveals that this specimen is at best a peripheral member of an entity separable from Euphorbia serpyllifolia by narrow, sharply quadrangular, acute, seeds; and usually narrow leaves. The seeds of the isotype of Anisophyllum novomexicanum are shorter and less sharply quadrangular and some of the leaves much broader than is typical of the species as here interpreted. Sometimes specimens of Euphorbia serpyllifolia such as Lumgrey Creek, Siskiyou Mts., Siskiyou Co., Calif., Wheeler 3289 (P, W); have the leaves narrow and some linear by revolution on drying. However, the seeds definitely place this collection in E. serpyllifolia. This Wheeler 3289 was erect in part but the erect plants were rusted which seems to explain the erect habit for some usually pros-
trate Euphorbias assume an erect habit when rusty. (E. novomexicana is usually at least suberect.) A specimen with rather narrow seeds is: Flagstaff, Coconino Co., Arizona, Jones 3998 (P). The habit was prostrate and the leaves mostly broad so that I leave it in E. serpyllifolia. This collection furnished the seed chosen by Millspaugh to illustrate E. serpyllifolia in Plate 1, No. 5, Pittonia 2: opposite 86. 1890. This seed looks too much like Plate 1, No. 16 from the type of E. neomexicana Greene. It is unfortunate that Millspaugh used this atypical seed from Jones 3998 for his illustration. . . . The smooth, or at least not transversely ribbed, seeds of E. novomexicana (K. & G.) Wh. readily separate it from E. glyptosperma Engelm. For the present I am using E. novomexicana as the earliest specific name applicable to this entity. (According to Standley, Con. US Nat. Herb. 13: 146. 1910, “novomexicanum” is the proper adjective while “neomexicanum” is a hybrid of Greek and Latin forms. Happily the valid name here is the grammatically correct.)

Millspaugh placed undated annotation labels on Fendler 791 and 795 mounted together on one sheet at Gray Herbarium. He considered 795 to be part Chamaesyce serpyllifolia and part Anisophyllum novomexicanum. I consider both parts to be the second species. He labeled 791 Chamaesyce serpyllifolia. I consider it Euphorbia novomexicana. Millspaugh must have placed his annotation labels on the sheet about 1909 or later for he seems to have used Chamaesyce first about 1909. Strangely he never combined Anisophyllum novomexicanum into Chamaesyce and never disposed of it in synonymy to my knowledge.

Euphorbia nutans Lagasca, Gen. et Sp. Nov., 17. 1816. Rydberg, Fl. Prairies & Plains, 517. 1932, cites as synonyms of Chamaesyce hyssopifolia (L.) Small, Euphorbia nutans Lagr., and E. Preslii Guss. Small, Man. SE Fl., 796. 1933, adds E. brasilienis LAM. to the list of synonyms. For the present it seems advisable, at least for our territory, to consider E. nutans as valid and E. Preslii as its synonym. No Pacific States specimens have been referred to the other two species in local literature. Boissier, DC. Prod. 152: 23. 1862, uses E. Preslii Guss. and cites E. nutans as a synonym. E. nutans is the earlier name. Several species that are closely related to, if not conspecific with E. nutans, need study.

Euphorbia occidentalis Drew, Bull. Torr. Club 16: 152. 1889. I have seen a specimen of the type collection which is probably the type: Hy-Am-Pum, Humboldt Co., Calif., Chestnut & Drew, July 23, 1888 (C); and it is typical E. serpyllifolia Pers. The herbage is quite glabrous and not "puberulent" as stated by Jepson, Man. Fl. Pls. Cal., 599. 1925. The above locality is evidently the Hyampom, Trinity Co. of present maps.

Euphorbia ocellata D. & H. var. Rattanii (S. Wats.) Wheeler, Bull. So. Cal. Acad. Sci. 33: 107. 1934. At the time of Rattan's collection of the type Colusa Co., Calif., included all of the present counties of Colusa and Glenn and part of Tehama Co. Consequently Watson's statement that Stony Creek, the type locality, was in Colusa Co., was correct at the time. At the present time Stony Creek lies in the north end of Glenn Co. in its lower reaches. The third collection of this rare variety and the second collection at the type locality was made recently by the writer; Stony Creek two miles north of Orland, Glenn Co., Wheeler 4041, Oct. 16, 1935 (P. Peir, UCLA, W). It was growing on the dry sunny gravelly flood bed of the creek with Chrysopsis, Mentzelia laevicaulis, and Brickellia californica.


Euphorbia serpyllifolia Pers. Syn. Pl. 2: 14. 1807, not Balb. Persoon spelled the specific name "serpillifolia" but nearly all later authors have taken the liberty of spelling it "serpyllifoia" as it was apparently named for Serpyillum.

I have yet to be satisfied with the validity of any of the proposed varieties of this species except var. neomexicana which seems to be a good species to which I apply an earlier name. E. serpyllifolia is greatly in need of study. Judging by comments here and there in the literature, similar or perhaps identical African species must be considered when the relationships of this species are studied.
Section Tithymalus

Workers preferring to use the segregate genera of Euphorbia would do well to consider the validity of Tithymalus Adanson. Rydberg, Fl. Prairies & Plains, 519. 1932, takes up Galarhoecus Haworth (under a variant spelling). Small, Man. SE Fl., 800. 1933, also uses Galarhoecus. Incidentally, Small, l. c., 804, takes up Tithymalus Mill, instead of Pedilanthus Neck.

Euphorbia crenulata Engelm. var. franciscana Norton, Ann. Rep. Mo. Bot. Gard. 11: 38. 1899 (reprint 38). I have seen topotypes of this, notably: San Francisco, Calif., Heller 6625 (P); and the only difference I can see is that the fifth gland is perhaps a trifle longer than usual but I do not consider that sufficient difference to maintain the variety. The San Francisco Bay region plants are neither more nor less perennial than those from Monterey, the type locality of the species, and I consider none of them perennial.

Euphorbia Cyparissias L., Sp. Pl., 461. 1753. Although reported in the Pacific States only from Pullman, Washington, Piper, Con. US Nat. Herb. 11: 382. 1906, it is included here because it is likely to reappear as it is sometimes cultivated about cemeteries.


Euphorbia Lathyris L., Sp. Pl., 457. 1753. This species has long been known in California. It was first noted by Engelmann, Bot. Mex. Bound., 193. 1859, at Monterey. In California herbaria there are specimens from all the coastal counties south of San Francisco Bay except San Diego, Ventura, and Santa Clara. Norton, Ann. Rep. Mo. Bot. Gard. 11: 10. 1899, cites specimens from Ventura and Santa Clara counties. It was collected in Berkeley, Alameda Co., Chestnut in 1888 (C). North of San Francisco Bay it is known from Myer's Ranch, South
Fork Eel River, Humboldt Co., Tracy 5110 (C), reported Jepson, Man. Fl. Pl. Cal., 601. 1925; and from Scott Bar, Scott River, Siskiyou Co., Wheeler 3358 in 1934 (P, W). The altitudinal range of the species is considerable, for it ranges from near sea level as at Watsonville, alt. ca. 25 ft., Santa Cruz Co., Wheeler 4058 (P, W); to 3,250 feet altitude at Seven Oaks, San Antonio Canyon, San Gabriel Mts., Los Angeles Co., Johnston 1747 (C, D, L, P).

Euphorbia nortoniana A. Nelson, Bot. Gaz. 47: 437. 1909. It appears that Nelson did not understand what Euphorbia crenulata is. Furthermore, if he had considered the plants about San Francisco Bay region distinct as did Norton, and Heller (Muhl. 1: 56. 1904), he should have taken up Tithymalus franciscanus Heller. I have seen duplicates of both collections constituting Nelson's "type": Calif.: San Francisco, Heller 6625 (P); woods about Pacific Grove, near Monterey, Heller 6486 (P); and they are both Euphorbia crenulata. This last is a topotype of E. crenulata. E. nortoniana is typical E. crenulata.

Euphorbia platyphylla L., Sp. Pl. 460. 1753. Reported by Hooker, Fl. Bor. Am. 2: 140. 1838, from "Plains of the Columbia River. Douglas." There is some doubt as to the validity of the report. Aside from this report there is no other report of this species west of the Rocky Mts. If it ever occurred in Oregon or Washington it was probably a waif.

Tissa luteola Greene, Pittonia 5: 114. The line bearing the above species name, author, and reference was misplaced at the end of Tithymalus in Index Kewensis Sup. 3: 180.

KEY

Leaves all opposite, not decussate, usually inaequilateral; stipules present; inflorescence solitary or glomerulate; glands 4 .......................... Sect. I Anisophyllum

Leaves alternate at least below the inflorescence (except decussate in Euphorbia Lathyris), aequilateral; stipules wanting, or, if present, gland-like; inflorescence cymose or umbellate, or, if solitary, glands 5.

Shrub; glands 5, with petaloid appendages .......................... Sect. II Tricherosstigma

Herbs; glands 3 to 5, without petaloid appendages.

Glands 3-5 per involucre; inflorescence cymose; stipules gland-like .......................... Sect. III Poinsettia

Glands 4; inflorescence mostly umbellate, stipules wanting .......................... Sect. IV Tithymalus

133
I Anisophyllum

Leaves toothed at least at the apex.

Perennial; andropeds (staminate pedicels each bearing one stamen) more than 20 .................................. 4. *E. capitellata*

Annual; andropeds fewer than 12.

Some of the leaves 1-2 cm. long; plant usually erect .................................. 20. *E. nutans*

Leaves shorter than 1 cm.; plant usually prostrate or ascending, sometimes erect.

Herbage glabrous throughout.

Seeds sharply quadrangular; leaves mostly narrowly oblong to linear.

Seeds with transverse ridges including the angles; plants usually prostrate; leaves never linear ............ 11. *E. glyptosperma*

Seeds with nearly smooth facets; plants usually nearly erect; some of the leaves often linear though sometimes only by revolution of the margin on drying ........

........................................ 19. *E. novomexicana*

Seeds ovoid-quadrangular, i. e., turgid with rounded angles; leaves broadly oblong to obovate .................................. 31. *E. serpyllifolia*

Herbage, at least the stems, hairy.

Andropeds ca. 10; seeds turgidly quadrangular .................................. 13. *E. hirtula*

Andropeds ca. 5; seeds sharply quadrangular.

Involucral lobes next to sinus mostly entire; sinus U-shaped, depressed ca. one-third of distance to base of involucre ....

........................................ 15. *E. maculata*

Involucral lobes next to sinus parted into 3-4 linear segments; sinus very narrowly V-shaped, not depressed 

........................................ 1. *E. Abramsiana*
Leaves entire.

Glands discoid (circular) or radially elongate, without appendages (except E. ocellata var. Rattanii).

Andropeds more than 10; upper stipules distinct.

Glands radially elongate; seeds rounded on back, face nearly flat .................................. 8. *E. cremica*

Glands strictly discoid; seeds quadrangular or ovoid.

Seeds ovoid; leaves mostly over 10 mm. long.

Herbage glabrous.

Leaves ovate - lanceolate, at most slightly falcate, usually without evident lateral veins; seeds always smooth .......... 22. *E. ocellata* var. *arenicola*

Leaves ovate-deltoid-falcate, blunt or mucronulate, lateral veins evident below; seeds rugolose or rugose ..........

.................................................. 21. *E. ocellata*

Herbage pubescent ..................................

.................................................. 23. *E. ocellata* var. *Rattanii*

Seeds quadrangular; leaves mostly less than 4 mm. long ........................................... 25. *E. Parishii*

Andropeds fewer than 10; upper stipules united ..........

.................................................. 17. *E. micromera*

Glands tangentially elongate, usually appendaged.

Stipules united into a white glabrous membranous scale

.................................................. 2. *E. albomarginata*

Stipules distinct or at least not forming a white glabrous membranous scale.

Andropeds 10 or fewer.

Appendages little if any wider than the glands, or wanting; sinus not greatly depressed .......... 17. *E. micromera*

(See also 1, 11, 13, 19, 31, which are sometimes entire-leaved.)

Appendages 3-4 times as wide as the glands; sinus depressed ca. two-thirds of distance to base of involucre.

Appendages deeply 3-4 parted into atten-
uate segments; annual; hairs tapering .......................... 32. E. setiloba
Appendages entire to crenate; perennial; hairs mostly clavate ........ 3. E. arizonica

Andropeds more than 10.

Plants glabrous or with short spreading hairs.

Seeds 1.75 mm. or more long; capsule 2.25 mm. or more long; plant glabrous throughout .................................. 10. E. Fendleri

Seeds 1.25 mm. long or shorter; capsule 1.75 mm. long or shorter; plant glabrous to pubescent but stipules always hairy.

Plant glabrous, or if pubescent appendages wider than glands ........... 28. E. polycarpa

Plant pubescent and the appendages no wider than the glands ........... 29. E. polycarpa var. hirtella

Plant (at least the stems) with curved, appressed hairs, or tomentose.

Seed cylindrical, encircled by 4-5 rounded ridges; at least the stems with curved, appressed hairs .............. 26. E. pediculifera

Seed quadrangular; plant tomentose.

Appendages wide and with short spreading hairs on margin and beneath .......................... 33. E. vallis-mortae

Appendages wide to absent, glabrous or rarely with a few hairs beneath next to glands .... 16. E. melanadenia

II TricheroStigma

Our only species ......................................................... 18. E. misera

III Poinsettia

Our only species ......................................................... 9. E. eriantha
### IV Tithymalus

Stem leaves decussate; capsule 7-10 mm. long, spongy before drying .......................... 14. *E. Lathyris*

Stem leaves alternate; capsule less than 5 mm. long, never spongy.

Stem leaves serrate or serrulate; glands entire and rounded; seeds reticulate.

Capsule smooth; seeds ovoid .......................... 12. *E. Helioscopia*

Capsule verrucose; seeds distinctly flattened-ovoid .................................................. 7. *E. dictyosperma*

Stem leaves entire (or crenulate); glands usually horned, at least not entire; seeds not reticulate though often mottled.

Stem leaves narrowly linear; capsule rugose .......................... 6. *E. Cyparissias*

Stem leaves not linear; capsule smooth.

Seeds with two longitudinal rows of pits on the back, one row on each side, and two longitudinal grooves on the face; andropeds 1.5 mm. long or shorter ........................................ 27. *E. Peplus*

Seeds without regular pits or grooves; andropeds 2 mm. or more long.

Horns longer than the gland; annual or biennial ........................................ 5. *E. crenulata*

Horns shorter than the gland; perennial.

Glands horned, margin otherwise entire or nearly so; andropeds glabrous ...................... 24. *E. Palmeri*

Glands short horned or hornless, margin lacerate, andropeds usually sparsely pubescent ........................................ 30. *E. schizoloba*

---

**THE NOMENCLATURE**

First, is an alphabetical list of valid species and varieties, their type localities, and their ranges in the Pacific States. This list is the result of compilation from floras and papers dealing with the Pacific Coast species combined with a study of material in the major California herbaria and a revisional study, to appear shortly in the Bulletin of the Torrey Club, of the entire-leaved members of section Anisophyllum for this territory. The numbers following each citation refer to the synonyms of that name in the second list.
Second, is an alphabetical list of synonyms. This list was compiled and assembled in the same way as the first. The synonymy for section *Tithymalus* before 1899 was taken almost entirely from Norton, Ann. Rep. Mo. Bot. Gard. 11:1-60. 1899 (reprint 38). The number following each synonym refers to its valid name in the first list.

The numbers following the name of each section refer to the valid names in that section given in the first list below.

**Valid Names**

   Type loc.: Heber, Imperial Co., Calif. Imperial Co., Calif., on the arid desert; Lower Sonoran Zone.

   Type loc.: Not stated. Cismontane Southern California east of Ventura Co., and in the Colorado and Mohave Deserts and north to Inyo Co.; Lower and Upper Sonoran Zones.

   Type loc.: Sierra Yanos, Sonora, Mexico. Edge of the mountains bordering Coachella Valley and Colorado Desert, Calif., on the west; Lower Sonoran Zone.


   Type loc.: Near Monterey, Calif. Western Oregon and throughout California in the hill country; Upper Sonoran and Transition Zones.

7. *E. dictyosperma* F. & M., Ind. Sem. Hort. Petrop. 2: 37. 1835 ................................................................. 55, 56 57, 58, 69, 70, 80, 81, 82, 118, 123, 125, 126, 130, 136, 137 Type loc.: "The type was grown from seed collected at Bodega Bay, Sonoma Co., Calif." Heller, Muhl. 1: 56, 1904. Hill country of cismontane California, southern Oregon, and southeastern Washington; Upper Sonoran Zone.


14. *E. Lathyris* L., Sp. Pl., 457. 1753.46, 47, 68, 114, 120, 122, 135 Type loc.: European. Coastal from Orange Co., to San Francisco Bay, also in Humboldt and Siskiyou Co., Calif., reported from Oregon by Howell, Fl. NW Am. 7: 605. 1902; Upper Sonoran Zone.


Type loc.: “San Gabriel,” Calif. Probably actually the foot of the San Gabriel Mts, a few miles north, South side of the Santa Monica, Verdugo, and San Gabriel Mts., San Jose and Puente Hills, Los Angeles Co., and desert drainage of San Diego Co., Calif.; Upper Sonoran Zone.

17. *E. micromera* Boiss. DC. Prod. 15^e^: 44. 1862

Type loc.: New Mexico. Occasional on the deserts from Inyo to Imperial Co., Calif.; Lower Sonoran Zone.


Type loc.: San Diego, Calif. Coast of Orange and San Diego Co., Whitewater, Colorado Desert, Calif.; Lower and Upper Sonoran Zones.


Type loc.: New Mexico. Panamint Mts., and Barnwell, eastern Mohave Desert, Calif.; arid Upper Sonoran Zone.


Type loc.: “Habitat in N.[ova] H.[ispania].” Sierra Nevada foothills from Placer to Butte Co., and at Chico, Calif. Introduced from eastern U. S. or Mexico; upper Sonoran Zone.


Type loc.: Poso Creek, Kern Co., Calif. Sacramento and San Joaquin Valley, and near San Bernardino, Calif.; Lower Sonoran Zone.


Type loc.: Stony Creek, Glenn Co., Calif. Lower Stony Creek drainage, Glenn Co., Calif.; Lower Sonoran Zone.


Type loc.: Warm Springs, Mohave Desert, San Bernardino Co., Calif. Deserts from Inyo south to San Diego Co., Calif.; Lower Sonoran Zone.

......................... 10, 18, 28, 64, 77, 88, 89, 110
Type loc.: Sonora, Mexico. Colorado Desert, Calif.; Lower Sonoran Zone.

27. *E. Peplus* L., Sp. Pl. 456. 1753 ..
......................... 50, 52, 53, 115, 117, 141
Type loc.: European. Occasional weed near the coast in Calif., reported from Washington but not Oregon.

Type loc.: Magdalena Bay, Lower California, Mexico. California deserts from Inyo south to Imperial Co., along the coast from Ventura Co., to San Diego, and occasionally inland; Lower and Upper Sonoran Zones.

29. *E. polycarpa* var. *hirtella* Boiss., DC. Prod. 15°: 44. 1862 
.......................... 30, 43
Type loc.: “California,” probably Colorado Desert, Calif. Southeastern Mohave Desert, and Colorado Desert, Calif.; Lower Sonoran Zone.

Type loc.: “East of the Lower Colorado, lat. 35°.” Desert ranges of Mohave Desert, Calif., also Fig Tree John Spring, Colorado Desert; Lower and Upper Sonoran Zones.

Type loc.: “Hab, in Amer, [ica] calidioire.” Cismontane Calif., Oregon, and Washington; Lower and Upper Sonoran and Transition Zones.

Type loc.: Fort Yuma, Imperial Co., Calif. California deserts from Inyo Co., south to Imperial Co.; Lower Sonoran Zone.

.......................... 44
Type loc.: Between Mohave and Keeler, northwestern Mohave Desert, Calif. Northwestern Mohave Desert to Owens Lake, Calif.; Lower Sonoran Zone.
Synonyms

4. *A. novomexicanum* Klotzsch & Garcke, l. c., 31 .......... 19
5. *Chamaesyce albomarginata* (T. & G.) Small, Fl. SE US, 710, 1903 ................................................................. 2
7. *Ch. arizonica* (Engelm.) Arthur, Torreya 11: 260, 1911 .. 3
9. *Ch. capitellata* (Engelm.) Millsp., 1 c., 408 ................... 4
10. *Ch. conjuncta* (Millsp.) Millsp., idem ................................ 26
14. *Ch. glyptosperma* (Engelm.) Small, l. c., 712 ................ 11
18. *Ch. involuta* (Millsp.) Millsp., 1. c., 410 ...................... 26
19. *Ch. maculata* (L.) Small, Fl. SE US, 713, 1903 ............ 15
21. *Ch. micromera* (Boiss.) Wooton & Standley, Con. US Nat. Herb. 16: 144, 1913 ............................................................. 17
22. *Ch. neomexicana* (Greene) Lunell, Amer. Midl. Nat. 1: 205, June, 1910 ................................................................. 19
24. *Ch. nutans* (Lag.) Small, Fl. SE US, 712, 1903 ............ 20
26. *Ch. ocellata* (Dur. & Hilg.) Millsp., idem ........................................ 21
28. *Ch. pediculifera* (Engelm.) Rose & Standley, Con. US Nat. Herb, 16:12, 1912 ................................................................. 26
32. *Ch. Preslii* (Guss.) Arthur, Torreya 11:206, 1911 .............. 20
34. *Ch. pycnanthema* (Engelm.) Millsp., idem, ......................... 4
35. *Ch. pseudoserpyllifolia* (Millsp.) Millsp., idem. .................. 17
36. *Ch. Rattanii* (S. Wats.) Millsp., idem. ......................... 23
38. *Ch. saltonensis* Millsp. in Parish, Carn. Inst. Wash. Pub. 193:6 (110), 1913 ................................................................. 1
39. *Ch. serpyllifolia* (Pers.) Small, Fl. SE US. 712. 1903 .... 31
41. *Ch. setiloba* (Engelm.) Norton, Con. US Nat. Herb. 25:345, 1925 ................................................................. 32
43. *Ch. tonsita* Millsp., l. c., 412 .................................................. 29
44. *Ch. vallis-mortae* Millsp., l. c., 403 .................................... 33
45. *Ch. versicolor* (Greene) Norton, Con. US Nat. Herb. 25:345, 1925 ................................................................. 3
47. *Epurga pensylvanica* Gandoger, Fl. Eur. 20:70, 1890 ... 14
50. *Esula minima* Haw., l. c., 158 .................................................. 27

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57. *E. a. var. coloradensis* Norton, idem ...................... 7
58. *E. a. var. missouriensis* Norton, l. c., 19 ...................... 7
68. *E. decussata* Salisb., *Prod.*, 389. 1796 ........................................ 14
73. *E. Greenei* Millsp., *Pittonia* 2: 28. 1890 ........................................ 11
74. *E. hypericifolia* of Calif, authors, not L. .................. 20

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76. *E. incisa* Engelm., Ives Rept. on Colorado R. of the West 4: 27, 1861 ........................................ 30


79. *E. l. var. crenulata* (Engelm.) Boiss., DC. Prod. 15: 143, 1862 ...... 5


88. *E. pediculifera* var. inornata T. S. Brandegee, Zoe. 5: 209, 1905 ........................................ 26


95. *E. pseudoserpyllifolia* Millsp., Pittonia 2: 87, 1890 ...... 17


97. *E. ps. forma villosa* J. T. Howell, l. c., 53 ............... 17


101. E. rugulosa (Engelm.) Greene, Fl. Franc., 92. 1891 ....... 31
102. E. rupicola Scheele, Linnaea 25: 153. 1849, not Boissier .. 10
103. E. scirpyllifolia var. consanguinea Boiss., DC. Prod. 15°: 43. 1862 .............................................................. 31
104. E. s. var. genuina Boiss., idem .................................. 31
105. E. s. var. neomexicana (Greene) Millsp., Pittonia 2: 84. 1890 ................................................................. 19
106. E. s. var. occidentalis (Drew) Jepson, Fl. Mid. West. Calif. ed. 1: 262. 1901 .................................................. 31
107. E. s. var. rugulosa Engelm. ex. Millsp., Pittonia 2: 85. 1890 ................................................................. 31
108. E. stipulacea Engelm. ex. Boiss., DC. Prod. 15°: 30. 1862 .. 2
109. E. subserrata Engelm. ex. Boiss., l. c., 43 ....................... 31
111. E. versicolor Greene, Bot. Gaz. 6: 184. 1881 ................. 3
113. Euphorbion Helioscopium (L.) St. Lager, idem .......... 12
114. Euphorbion Lathyrum (L.) St. Lager, idem ............. 14
115. Euphorbion Peplum (L.) St. Lager, l. c., 125 .............. 27
116. Keraselma Cyparissias (L.) Rafin., Fl. Tell. 4:116. 1836 .. 6
117. K. Peplus (L.) Rafin., idem ...................................... 27
118. Galarhoeus arkansanus (Engelm. & Gray) Small in Rydb., Fl. Prairies & Plains, 520. 1932 .................. 7
119. G. Cyparissias (L.) Small in Rydb., idem .............. 6
120. G. decussatus (Salisb.) S. F. Gray, Nat. Arr. Brit. Pls. 2: 256. 1821 ................................................................. 14
122. G. Lathyris (L.) Haw., l. c., 143 ................................ 14

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127. *T. crenulatus* (Engelm.) Heller, Muhl. 1: 56. 1904


129. *T. Cyparissias* (L.) Lam., Fl. Fr. 3: 96. 1778


133. *T. leptocerus* (Engelm.) Arthur, Torreya 22: 30. 1922


143. *Tricherostigma benedictum* (Greene) Millsp., Addisonia 2: 3, t. 42. 1917


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Bulletin of the
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The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

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The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1935, including volumes XXIV to XXXIV, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.
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Office of the Academy
Los Angeles Museum, Exposition Park, Los Angeles, Cal.
A NEW MOUNTAIN GOAT FROM THE
QUATERNARY OF SMITH CREEK CAVE, NEVADA

By Chester Stock

M. R. Harrington has called attention to the occurrence of a large limestone cave in the canyon wall of Smith Creek, approximately 34 miles north of Baker, White Pine County, Nevada. Preliminary excavations by the Southwest Museum brought to light considerable material representing a Quaternary assemblage of mammals and birds preserved in the cave deposits. The relationship of the fauna to a possible occupancy of the cavern by Man and the intrinsic interest which this assemblage possesses as coming from a site with elevation of approximately 6,200 feet, adjacent to the Bonneville basin of Utah, made a further investigation desirable. This was undertaken with the support of the Carnegie Institution of Washington during the past summer.

One of the mammals whose remains are found in the Smith Creek Cave deposits is a mountain goat. While the genus Oreamnos occurs in the Pleistocene of North America, no species distinct from that of the living type has been recorded. In the present instance, however, the animal is clearly separable specifically from Oreamnos americanus.

Family Bovidae

Oreamnos harringtoni n. sp.


Paratypes: Front cannon bone, No. 2030, and hind cannon bone, No. 2029, plate 35, figures 5 and 3.


Specific characters: Approximately two-thirds the size (linear) of Oreamnos americanus. Horn-core extends farther at tip end and possesses greater backward curvature than in O. americanus. Anterior cannon bone with better developed knob for tendon attachment on anterior face of Metacarpal III adjacent to proximal border. Posterior cannon bone with shaft narrower in lower half than in Recent species and with median groove of anterior face deeper. This species is named for Mr. M. R. Harrington in recognition of his noteworthy contributions to the study of cave occurrences in the Southwest.

Description: Probably no less than six individuals are rep-

2 Study of the bird remains is now in progress and the description of a new species of extinct eagle has been published by Hildegarde Howard in The Condor, vol. 87, pp. 206-209, fig. 40, 1935.
resented in the collections thus far acquired from the deposits in Smith Creek Cave. All of the material occurs in a dry dust or earth within three or four feet of the surface of the cave. *Oreamnos harringtoni* is clearly a smaller type than the living mountain goat, *O. americanus*. It differs likewise in character of size from the specimen recorded by Sinclair3 from Potter Creek Cave in Shasta County, California. Unfortunately, no skull of the extinct species is available, but the horn-cores furnish evidence of the difference between this type and the modern species. When the profile of the frontal bone in front of the horn-core is so placed as to correspond to the profile in *O. americanus*, the horn-core in the extinct species is seen to be less erect than in the former. It is also extended more at the free end. Thus the horn-core possesses over its length a greater curvature than is the case in the living form.

The illustrations of the metapodials from Smith Creek Cave indicate the known variation in size in these elements in *O. harringtoni*. The front metapodial corresponds more closely in shape to that in *O. americanus* than is the case when the hind cannon bones of the extinct and living species are compared. As viewed from the proximal end, plate 35, figures 5 and 6, the knob for tendon attachment, situated on the anterior face and at the upper end of metacarpal III, stands in bolder relief in the fossil than in the living species. The nutrient foramina appear to have a variable development for in No. 2030, plate 35, figure 5, not only is the lower one present but a second occurs on the median line approximately at the middle of the shaft. This foramen is absent in No. 2032.

The shaft of the hind cannon bone does not widen so noticeably in its lower half as in the Recent species and possesses in this regard a little of the appearance of the element in *Capra*. The median longitudinal groove on the front face of the shaft appears to be a trifle deeper than in the Recent species of *Oreamnos*. The cannon bone illustrated in plate 35, figure 4, lacks the lower nutrient foramen and shows in the lower half of the shaft an elongate depression on the posterior face which is absent in No. 2029.

Remarks: The finding of remains of *Oreamnos harringtoni* at Smith Creek Cave is perhaps not surprising in view of the elevation of the Snake Range in which the cavern is located. Mountain goats are rarely encountered in Pleistocene deposits of North America and the occurrence in eastern Nevada is the most southerly of the four localities recorded from the region south of the present range of *Oreamnos* (Plate 34). It is evident that, as in the case of other bovid groups, the area of distribution of mountain goats in western North America has shrunk since the period of its optimum size, sometime during the Pleistocene. One may wonder whether the differences that separate

Map showing Quaternary occurrences of mountain goats (1, Smith Creek Cave, Nevada; 2, Potter Creek Cave and Samuel Cave, California; 3, Washtucna Lake, Washington; Klondike, Canada.) Area shown with oblique lines indicates Recent range of *Oreamnos*, after Ernest Thompson Seton, *Lives of Game Animals* published by Doubleday, Page & Co.

*Oreamnos harringtoni* from the living species are due to an isolation of the former species on the Snake Range. Associated with *O. harringtoni* in the fauna from the deposits of Smith Creek Cave are the genera *Equus, Camelops* and *Ovis* among the larger herbivores. While the age of the assemblage is presumably late Quaternary, the question of position of this stage in the Quaternary succession may be answered assertively only when the occurrence and entire fauna are studied in detail.
Measurements (in millimeters) of *Oreamnos harringtoni* n. sp.:

<table>
<thead>
<tr>
<th>Skull Fragment</th>
<th>Type Specimen</th>
<th>No. 2028 C. I. T.</th>
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**Transverse diameter across frontals**
- between outer bases of horn-cores ........ 67.2

**Transverse diameter of horn-core at base**
- 26.8

**Anteroposterior diameter of horn-core at base**
- 30

**Length of horn-core in straight line from anterior base to tip**
- 89.8

**Least distance between bases of horn-cores**
- 17

<table>
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<th>Hind Cannon Bone</th>
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<td>81.5</td>
<td>91</td>
</tr>
<tr>
<td>108.2</td>
<td>96.5</td>
</tr>
<tr>
<td>28.5</td>
<td>28</td>
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<tr>
<td>19.6</td>
<td>19</td>
</tr>
<tr>
<td>20.5</td>
<td>20</td>
</tr>
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<td>12.3</td>
<td>13.5</td>
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<tr>
<td>32.1</td>
<td>32.8</td>
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<tr>
<td>32</td>
<td>33</td>
</tr>
<tr>
<td>17.5</td>
<td>20</td>
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* Approximate.

Postscript: While this paper has been in press, remains of mountain goats with characters of *Oreamnos harringtoni* have been uncovered by the National Park Service in quaternary deposits of Rampart Cave, lower Grand Canyon, Arizona.

PLATE 35 (opposite page)

**Oreamnos americanus** (Blainville)

Figure 1. Skull, lateral view, x ½. Recent, Canada.

**Oreamnos harringtoni** n. sp.

Figure 2. Type specimen, parts of frontals with horn-cores, No. 2028, lateral and anterior views, x ½.

Figures 3 and 5. Paratypes, posterior cannon bone, No. 2029; anterior cannon bone, No. 2030; anterior and proximal views; x ½.

Figures 4 and 6. Topotypes, posterior and anterior cannon bones, Nos. 2031, 2032, anterior and proximal views; x ½.

PLANT REMAINS IN SHELTER CAVE, NEW MEXICO

By F. Raymond Fosberg

University of Hawaii, Honolulu, Hawaii

In the summer of 1930 the writer was privileged to spend two months with the Shelter Cave Expedition of the Los Angeles Museum, collecting plants in the Mesilla Valley, Dona Ana Co., New Mexico, chiefly in the vicinity of Pyramid (Bishop's Cap) Peak.

While excavating in Shelter Cave on the west side of Pyramid Peak the paleontologists of the expedition frequently encountered plant remains. A few of these which seemed identifiable were set aside, unfortunately however without any data as to the location or association in the cave deposit. The depth was not satisfactorily determinable due to the looseness of the material and to possible and observed disturbance by Indians and animals. It is definite that none were taken from the partially consolidated bottom layer. Indian material was found chiefly in the upper layers while the remains of extinct animals were found throughout the deposit excepting possibly at the very top and the consolidated layer at the bottom.

There is some uncertainty as to the age of this material. Paleontologists place it as either late pleistocene or early recent. It is suggested that the mammals and birds formerly thought of as only pleistocene may have in some localities persisted into recent times. Dr. Chester Stock who has worked extensively with fossils from this and other caves tentatively suggests that the caves may be considered early recent. The remarkably good preservation of the material, permitting specific determination in most cases is an indication supporting this idea. The mere association of these remains with those of extinct animals seems to make it of sufficient importance to record in detail.

The only significant fact that this study brings to light is that the flora of the region at the time that this deposit was laid down was an arid land flora in all discoverable respects similar to that of the country at present. This view is completely supported by Dr. Eames' findings in the study of the plant remains contained in a sloth coprolite found with a sloth skeleton in Aden Crater, a few miles west of the Shelter cave deposit.

Dr. Eames found the sporangia of a Polypodiaceous fern, fragments of cruciferous fruits, stems of Sida and Sphaeralcea, stems, roots and fruits of Atriplex representing at least three species and stems, roots, flower fragments, involucres and achenes of Gutierrezia and possibly other composites.
Coprolites of either sloth or horse found in Shelter Cave have not been opened up and examined minutely as yet, but on the surface they seem to be made up largely of grass with a few fragments of woody stems of some sort.

The following were identified from the material collected from the Shelter Cave debris:

*Hilaria mutica* (Buckl.) Benth., (?) plant minus leaves (except a sheath) and inflorescence.

*Dasylirion Wheeleri* Wats., fragments of stems, leaves and leaf bases.

*Agave* sp., tip of leaf.

*Selinocarpus chenopodioides* Gray, (?) part of fruit minus seed; S-4258.

*Prosopis pubescens* Benth., fruits; S-4253.

*Prosopis chilensis* (Mol.) Stuntz, woody branches, leaves, parts of fruits with seeds. Only the hard inner part of the sections of these pods was left. The softer outer part had evidently been eaten off by small rodents or insects.

*Fouquieria splendens* Engelm., thorns; S-4251.

*Opuntia spinosior* (Engelm. & Bigel.) Toumey, stems, joints and distal end of fruit; S-4254.

*Opuntia phaeacantha* Engelm., spine clusters with glochids; S-4261.

*Opuntia Engelmannii* Salm-Dyck, spine clusters with glochids; S-4262.

*Echinocereus, neomexicanus* Standl. (?) base of plant with spines; S-4259.

*Echinocereus pectinatus* (Scheidw.) Engelm., (?) spine cluster;

This plant was not found growing in the vicinity, but this is well within its range. S-4268.

*Echinocereus stramineus* (Engelm.) Rumpl., spine clusters; S-4266.

*Echinocereus Rosei* Woot. & Standl., spine clusters; S-4265.

*Coryphantha tuberculosa* (Engelm.) Fosberg, spine clusters; S-4263.

*Lippia Wrightii* Gray, small branch with twigs; S-4252.

*Brickellia* sp. involucre; S-4267.

*Fluorensia cerina* DC., leaves; S-4260.

The determinations were made by the author. The specimens are preserved in the Los Angeles Museum Herbarium. The numbers are the author’s collection numbers.
REVIEW OF THE WILLISTONI, FULGIDA, PAROWANA AND SENILIS GROUPS OF THE GENUS CICINDELA (COLEOPTERA-CICINDELIDAE)

By Mont A. Cazier
University of California

The present paper represents the results of a detailed study of the Great Basin species of Cicindela belonging to the groups enumerated above, presenting evidence which tends to indicate that these groups have been incorrectly associated in the past. For example, Cicindela parowana Wickham is a well marked species and a representative of a distinct Great Basin group, being only distantly related to C. fulgida Say, under which it has been listed as a sub-species by Dr. Walther Horn (Genera Insectorum, 1906, p. 378). A new race of C. parowana is recorded herewith. Evidence is also presented to show that the senilis group of the Pacific Coast is closely related to the willistoni group and that the fulgida group does not enter the Great Basin as previously recorded by others.

The Great Basin, as considered in this paper, is that area lying between the Rocky Mountains on the east, the Sierras and Cascades on the west, and extending from Mexico north to the Okanagan Valley in British Columbia. For many years it has been known that species occurring within these limits often exhibit remarkable variations. The area has comparatively few species overlapping from adjacent territory due to the presence of the mountain barriers, which are especially effective in preventing the migration of species of Cicindela. The species occurring within the limits of the Great Basin break up into many variations as a result of the varied geological and climatic conditions present.

Inasmuch as the southern limit of the Great Basin does not have a distinct barrier and the fact that the senilis group occurs in southern California as well as in central California leads me to conclude that, although the species are distinct at the present time, they probably arose from a common ancestor occurring in the south. This is also supported by the marked structural similarity to be indicated below. The same may also apply in the case of the fulgida and parowana groups.

The author wishes to express his appreciation to Dr. F. C. Van Dyke for his many helpful suggestions and for the loan of material from the collection of the California Academy of Sciences. Also to Mr. J. C. von Bloeker, Jr., for reading the manuscript and giving many constructive criticisms. I am greatly indebted to F. R. Platt, Edson Fichter, Roy Wagner, and H. P. Lanchester for generous loans and exchanges of specimens which helped in the study of the groups presented.
Key to Groups

A. Labrum short with acute median tooth; humeral lunale C-shaped.
   1. Front sparsely hairy or bare; tarsi short; elytra rugosely-punctate; cupreous brown to blue ... _willistoni_
   2. Front moderately hairy; tarsi long; elytra granulate punctate; cupreous brown to green ............ _senilis_

B. Labrum moderately long, imperfectly tridentate; humeral lunule transversely descending; elytra strongly, evenly punctate; red to black ......................... _fulgida_

C. Labrum very long with one long median acute tooth; humeral lunule descending less transversely, longer; elytra evenly punctate with interspaces smooth; brilliant blue to cupreous-brown ......................... _parowana_

Willistoni Group

Cicindela willistoni Le Conte


Moderately robust; brown or green-bronze, beneath metallic green or blue. Head sparsely hairy or bare, interocular striae coarse; labrum short with acute median tooth; prothorax wider than long, impressed lines shallow, subquadrate, convex, scarcely narrowed behind; elytra rugosely-punctate and plainly dilated a little in front of the middle in the female; elytral markings broad, consisting of a C-shaped humeral lunule which is broadly connected with middle band; middle band enters perpendicularly, rectangularly bent at two-thirds width of elytra, descending portion long, hooked at tip and almost reaching the apical lunule; apical lunule connected on margin with middle band or in a few cases narrowly separated; beneath moderately hairy; tarsi shorter than tibiae.

Length: 12-13 mm.

Habitat: The only locality from which this species is recorded is Lake Como, or Aurora Lake, Wyoming. June.

_C. willistoni_ subsp. _echo_ Casey


Narrow and more parallel than in _willistoni_; brown to greenish-bronze or black with very little bronze. Head and prothorax same as in _willistoni_; elytral markings narrower than in that species; middle band sometimes narrowly connected at margin with humeral lunule which is the same as in _willistoni_, descending portion shorter than in _willistoni_ and hooked at tip in only a
few specimens; apical lunule complete, widely separated from middle band; otherwise as in willistoni.

Length: 11-13 mm.

Habitat: Great Salt Lake and Provo, Utah; atypical black forms which show no sign of cupreous, being black or brown throughout, were taken at Amedee, Calif., July, by Wickham; Humboldt Lake, Nev., June, by Wickham; Saltdate and Mojave, Calif., June, by K. D. Sloop.

These latter phases were intermingled with greenish-brown forms that are similar to the typical echo occurring at Salt Lake, Utah. This illustrates the instability of the subspecies and the tendency of divergence from the typical form as the geographical range is extended. A brownish-black specimen collected at Owens Lake, Calif., July, by Wickham is similar to those specimens taken at the above localities, showing the progressive divergence of this subspecies down the Owens Valley and southward to Saltdate and Mojave, Calif.

C. willistoni subsp. pseudosenilis W. Horn


This subspecies is identical to subspecies echo Csy., except that the elytra are dark green and have little or no bronze tinge. C. W. Leng (1902, p. 141) states that the elytra are "green-bronze or almost black"; H. F. Wickham (1904, p. 648) gives the color as "green, shining, a few varying to brownish or reddish," otherwise as in echo.

A specimen from the Leng collection collected by H. F. Wickham at Owens Lake, Calif., July 7 is brown in color and is inseparable from those forms of echo collected at Mojave and Saltdate, Calif., and Humboldt Lake, Nev. These localities lie on either side of Owens Lake, Inyo Co., Calif., (type locality of pseudosenilis) and as there are no great barriers between, I am inclined to believe that the brown form occurring at Owens Lake, Calif., is C. willistoni echo. The subspecies pseudosenilis should apply only to the green forms of willistoni which, as far as I know, occur only at Owens Lake, Calif. The less brilliant forms of pseudosenilis are inseparable from the dark green forms of echo except for the lack of the bronze lustre.

C. willistoni subsp. spaldingi Casey


"Rather narrow, moderately convex; bright green above and beneath. Head finely and closely strigilate, bald in the male; labrum white, short and transverse, with a broad truncate median lobe; prothorax one-third wider than long, narrowed but little at base, surface deeply impressed, finely and closely sculptured medially, less finely toward the sides; elytra three-fourths longer
than wide, the entire sides and apex broadly white, with two small subequal sinuses toward the base, broadly dilated at the middle, the dilated part with a short posterior internal lobe, which is very narrowly separated from the broad white margin; punc-
tures strong and close; anterior tarsi of male extremely narrowly dilated, very closely clothed beneath."

Length (male): 12.0 mm.

Habitat: Callao, Utah, Mr. Tom Spalding.

This subspecies is allied to willistoni, but is much more broadly marked, more coarsely punctured. Although I have never seen a specimen of this subspecies I include it as such in view of the close parallelism existing in the related parowana group, to be given later.

Senilis Group

CICINDELA SENILIS G. Horn


Form throughout as in subspecies echo Casey; color black or brown tinged with green and coppery reflections; head moderately hairy in front, granulate rugose; labrum imperfectly tri-
dentate, short; prothorax as in echo except that the impressions are deeper; elytra granulate-punctate, interspaces granulate giv-
ing a dull appearance; markings as in echo except that the trans-
verse portion of the middle band is arcuately bent upward before bending rectangularly downward, the descending portion at right angles or transverse toward margin; humeral and apical lunules sometimes broken; beneath densely clothed with long white hair.

Habitat: San Francisco Bay Region, Calif. May to Sep-

This species occurs abundantly on the tidal flats and shores of San Francisco Bay at Alameda, Redwood City, Antioch, Berke-
ley, San Francisco, San Rafael, and Port Costa. Specimens have also been taken at Seal Beach, San Diego, and Anaheim in southern California. So far as I know, no specimens have been taken in the intervening area, although it is probable they do occur there.

Fulgida Group

CICINDELA FULGIDA Say


Red cupreous, brilliant, highly polished, grading into deep purple, dark green and black, beneath green. Elytral markings broad, consisting of obliquely descending humeral lunule, which
approaches and rarely connects with middle band, never marginally connected; middle band enters perpendicularly, descending portion either oblique or rectangularly bent, expanded at extremity; apical lunule complete and never connected with middle band; head rugose, hairy in front; labrum imperfectly tridentate, interocular striae fine and numerous; prothorax moderately rugose, hairy at sides, impressed lines deep; elytra strongly punctate, area between punctures finely granulate; beneath hairy.

Length: 10-12 mm.

Habitat: Wyoming, Colorado, Kansas, Nebraska, and New Mexico.

C. fulgida subsp. westbourniei Calder


Form, size, and general maculation similar to fulgida; above deep chestnut brown to dark green with distinct purple lustre; beneath deep greenish-black, tinged with cupreous on the sides of the prothorax; elytral markings similar to fulgida, differing in that the humeral lunule is less oblique, longer, extending almost to middle band; transverse portion of middle band shorter than in fulgida extending to middle of elytra, dilated at margin, descending obliquely and closely approaching the apical lunule, extremity slightly enlarged; apical lunule complete.

Length: 11 mm.

Habitat: Westbourne, Manitoba (J. B. Wallis), representing the northern limit of the fulgida group.

C. fulgida var. subnitenis Calder


This is a color phase of fulgida and differs from that species by being completely black with no metallic lustre; beneath wholly black without tendency towards greenish.

Habitat: Lincoln, Nebr., F. N. Schoemacker.

Parowana Group

Cicindela parowana Wickham


General form as in fulgida, but larger and more elongate; markings heavier; above bright shining blue-green, sometimes with cupperry reflection, beneath purple-blue; head granulate, interocular striae fine and numerous, front very hairy, cheeks with a few white hairs; labrum strongly, arcuately lobed, the median tooth narrow, long and asciculate; prothorax as in fulgida but more narrowed behind; elytra more finely and clearly punc-
tate than in *fulgida*, the intermediate areas being smooth; elytral markings of the same type as *fulgida* but heavier; humeral lunule longer sometimes connected with transverse portion of middle band, less transverse; middle band prolonged backward along margin but not reaching apical lunule, descending portion longer, not transverse and not hooked at tip; apical lunule as in *fulgida*; middle and hind legs longer than in *fulgida*.

Length: 12-13 mm.

Habitat: Iron Spring, Iron Co., Utah, 5,500 feet, July 20, 1917 (Engelhart); Parowan, Utah, 6,000 feet, July 24, 1921 (Knaus); Bear River, Milford, Utah, July; Little Salt Lake, Utah; Touchet and Walla Walla, Wash.

This species is collected along irrigation ditches leading out of reservoirs, and around the reservoirs. It was collected at Lind, Wash., April 25, 1924 by M. C. Lane; Touchet and Walla Walla, Wash., by H. P. Lanchester. The specimens from these localities are typical *parowana* except that the color is cupreous-green. Casey described this phase as *remittens*, but in my opinion it is identical with *parowana* and is not of subspecific standing. The cupreous-green phases also occur at Parowan, Utah.

C. *parowana* subsp. *platti* Cazier subsp. nov.

Form as in *parowana* but more parallel and elongate; above, head and prothorax green with brilliant coppery reflections, elytra brown to black with brilliant coppery reflections, sometimes tinged with green, head as in *parowana* but more hairy; labrum more strongly lobed in center and longer; prothorax same but more narrowed behind; elytra more evenly punctate with inter-spaces smooth; elytral markings consist of a broad white marginal band, sometimes slightly interrupted in front of apical lunule; tip of humeral lunule indicated by small interior lobe; descending portion of middle band narrowly separated from margin and approaching near to but never connected with apical lunule; apical lunule usually connected at margin, interior lobes entering logitudinally; underside as in *parowana*.

Length: 13-15 mm.

Type locality: Benton’s Crossing, Mono Co., Calif., July and September, 1935. Taken by Mr. F. R. Platt and the author.

Holotype male, allotype female, and paratypes in the Cazier collection. Two paratypes in the California Academy of Sciences, two paratypes in the collection of Mr. F. R. Platt, and one paratype in the collection of Mr. J. C. von Bloeker, Jr.

I take pleasure in naming this subspecies in honor of Mr. Platt, who presented the two specimens collected by himself in July to me for study and returned to the type locality with the author in September when 271 additional specimens were taken.
The specimens were collected on the slope of a hillside where the soil was dry and powdery. There were stubbles of grass sparsely scattered over the area which made it difficult to see the insects who stayed, for the most part, within the shaded area beneath the plants. The region in which all the specimens were collected was about 100 feet from the Owens River and extended farther away for approximately 150 yards in a narrow contour band from 10-30 feet wide along the base of a hill. Extensive collecting in the surrounding area did not yield additional specimens of this subspecies although other species were in abundance.

Explanation of Plate 36

Figures 1 to 6 show the size, shape and markings of the species concerned.
Figures 7 to 9 show the shape of the labrums.
Figure 1. Cicindela senilis G. Horn.
Figure 2. Cicindela willistoni Lec.
Figure 3. Cicindela willistoni subsp. echo Csy.
Figure 4. Cicindela fulgida Say.
Figure 5. Cicindela parowana Wickh.
Figure 6. Cicindela parowana subsp. platti Cazier.
Figure 7. Labrum of willistoni and senilis groups.
Figure 8. Labrum of fulgida group.
Figure 9. Labrum of parowana group.
PLATE 36

(For caption, see opposite page)
A NEW MELYRID OF THE GENUS TANAOPS
(COLEOPTERA)

By M. Y. Marshall, M. D.
Los Angeles, Calif.

The unique specimen from which the following description is drawn has been in my cabinet for several years, waiting for others, especially males, of the same species, but as no others are apparently forthcoming, there seems to be no good reason for further delay in describing it. The specimen has been examined by several well-known coleopterists in this part of the country and I am especially indebted to Dr. E. C. VanDyke, who has compared it with the material of the same group in the research collection of the California Academy of Sciences and who likewise agrees that it has been hitherto undescribed.

The peculiar and distinctive habitus given to the insect by the extreme narrowing and elongation of the head, especially in the post-ocular portion, suggests the possible propriety of establishing a new genus for it, but this idea will not be further pursued at the present time.

Tanaops testaceus, new species. Oblong, parallel, uniform rufotestaceus in color, with the antennae, palpi, knees, tibiae and tarsi fuscos and the elytra gradually paler toward the apex. Head narrow and elongate, fully twice as long as the width across the eyes, which is the greatest width, and scarcely one-half as wide as the prothorax. Eyes elongate oval, placed midway between the labrum and the occiput. Antennae slightly longer than one-half the entire length of the body, practically filiform, inserted just behind the frontal suture and slightly closer to the sides than to the midline, the basal three joints largely testaceous. Clypeus paler, membranous, the mandibles exposed. Surface of head glabrous, shining, the punctures and yellowish pubescence fine and inconspicuous. Thorax quadrate, the angles all broadly rounded, the base very slightly wider than the apex, the surface similar to that of the head. Elytra gradually widening toward the apices, which are separately rounded; lateral margins narrowly explanate, the humeri well defined. Surface of elytra definitely more opaque than that of head and thorax, finely wrinkled, very finely and rather densely punctured and pubescent, the pubescence yellow, depressed, with a few longer erect hairs toward the sides. Legs long, slender, finely and densely pubescent, the tarsi and claws simple, the membranous appendages slightly more than one-half the length of the claws. Under surface very finely punctured, shining, the last abdominal segment prominent, elongate, evenly rounded and with numer-
ous long, dark bristling hairs. Length 4 mm. Collected by Mr. C. C. Searl at Grand Canyon, Ariz., August 20, 1929.

Holotype, female, in collection of author.

This species may easily be distinguished from all others of the genus Tanaops, as well as from those of the genus Attalus with elongate heads, by the uniform testaceous color. As the characters that separate Tanaops and Attalus are mainly sexual in nature, the assignment of the present species to the former genus is, in the absence of the male, provisional. It is not thought, however, that there is much chance of error in doing this, as none of the known species of Attalus and only one of Tanaops, angusticeps Fall, even approach it in the extreme narrowing and elongation of the head. The length, as given, is inclusive of the head, but for purposes of comparison with the species described by Fall in 1917, would be 3 mm. from the anterior margin of the thorax to the tips of the elytra.

NOTES ON THE LIFE HISTORY OF OENEIS DAURA, STKR. (LEPIDOPTERA)

By John A. Comstock, John L. and Grace H. Sperry

The most southerly of our Arctics, Oeneis daura, was first described by Strecker in 1895 from a ♀ taken by Morrison on Mt. Graham, Arizona. For many years the record was questioned and the species was generally considered as one of the “lost” items.

Some four or five years ago examples began to reach our museums through a commercial collector stationed in Arizona.

In the summer of 1935 the authors spent considerable time collecting on the high meadows in the White Mountains, at a point about twenty miles west of Springerville, Arizona, on the McNary road. Our attention had previously been called to this locality through the courtesy of Dr. E. L. Hulbirt of Glendora, California.
These meadows lie at an average altitude of about 9,000 feet. They are gently rolling lands, cut by occasional streams and small canyons, interspersed with patches of aspen and pine, and stretch for many miles along the divide. This area is the center of the daura population in the White Mountains. Late June and early July is the best period for collecting.

An ovipositing female was followed, and a single egg secured on June 16, 1935. This hatched July 1.

Egg: Ovoid, the base slightly flattened. Color, when first laid, lime-green, changing very rapidly to white. Micropyle very small, and only slightly depressed.

There are about nineteen longitudinal slightly sinuous ridges, rounded at the top, the sides furrowed like an eroded hillside. Several of these ridges fuse before reaching the micropylar area. We were unable to measure the size, having no micromillimetric scale in our field outfit. A sketch was made, with the aid of a pocket lens, the result being recorded on Plate 37.

The egg is laid on the side of a blade of grass.

The newly emerged larva consumed the entire egg shell.

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**PLATE 37**

Egg of Oeneis daura, highly magnified.
Reproduced from painting by John A. Comstock

**LARVA, FIRST INSTAR:** Length 3.1 mm. Color, ivory white with fine longitudinal stripes of light brown. The widest of these is a mid-dorsal, lateral to which are two narrower stripes on each side running parallel with the mid-dorsal. A third interrupted stripe occurs in the stigmatal area.

Legs and prolegs white. Abdomen white.

The body is cylindrical, tapering progressively toward the tail, and ending in two pointed processes.

Head, white, wider than body segments, with a few minute dark points on its surface. Ocelli, black, mouth parts tinged with brownish black.
As the young larva grows the body becomes as wide as the head throughout the thoracic area, gradually tapering toward the tail. The stigmatal line becomes wider, and is margined with darker brown, giving it a doubled appearance.

The larva cast its first skin July 14.

**Second Instar:** Length, 24 hours after moult, 5 mm.

The head is now longitudinally striped with brown, these stripes being a forward continuation of the bands on the body, the mid-dorsal line however being doubled on the head. These bands are of about equal width on the face, whereas they are of unequal measurement on the body.

The body color remains, as in the first instar, an ivory, with the longitudinal lines light brown. The lines of the stigmatal area are more prominent, being formed of a double supra-stigmatal band which is continued caudally onto the tail-like projections. Below this is a much lighter stigmatal band. In all other respects the larva is colored and marked as in the prior instar.

The larva cast its second skin July 27.

**Third Instar:** Length 6.5 mm.

There is no change in color or markings except that an additional longitudinal band begins to be apparent below the infra-stigmatal area. This band is clearly defined along its upper margin, but gradually fuses and blends inferiorly with the ivory color of the abdomen.

Third skin cast August 5.

**Fourth Instar:** Thirty hours after moult, length 11.5 mm.

Head, ivory white as formerly; heavily rugose. The same bands of grayish-black color occur, and it becomes increasingly apparent that these are formed of dark pigment placed in the bottom of shallow pits. The entire face is pitted in this manner but the pigment occurs only in the area of the six longitudinal bands.

Between these pits are numerous white warty prominences, each of which bears a short spiculiferous hair.

Ocelli black, as formerly. Mouth parts ivory, except on the edge of mandibles which are black.

Body, ivory ground color as in previous instars. The mid-dorsal line is very distinct and is composed of a central gray area and a narrow outer edging of black. This line is more intense on the posterior half. The marginal black edging is also intensified at each segmental juncture, giving the entire line a checkered appearance. There is also a slight contraction of the line at the juncture and a widening at the middle of the segment.

The dorso-lateral line is now rather poorly defined and there is a slight suggestion of another stripe above and below it.
The supra-stigmatal line is gray, with black margins, and is slightly wider than the mid-dorsal line. The upper margin of this line is a more intense black than is its lower edge. It continues as formerly to the tip of the caudal process.

The double stigmatal band is light gray, edged with darker gray above and below. The black stigmata show in strong contrast to it.

Abdomen, ivory. Legs and prolegs, ivory, as in former instars.

The entire larva is covered with minute white papillae bearing very short spiculiferous hairs which give it a frosted appearance. This instar is shown in Plate 38. It measured 18 mm. just prior to the ecdysis. Moult occurred August 18.

PLATE 38
Larva of *Genus daura*, lateral aspect, approximately x 7.

Photo by the late Wm. Menke

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Fifth instar: Twenty-four hours after moult, length 20 mm. All markings and coloration as in the previous instar except for a slight intensification of the mid-dorsal band. The papillae over the head are very noticeable, due probably to their increased size.

The larva discontinued feeding on about August 20 and gradually shrank in size. It failed to pupate, and eventually died.

A NEW RECORD AND A LIFE HISTORY (LEPIDOPTERA)

By John A. Comstock

In 1935 one of our Museum attendants brought in two examples of a larva that was quite unfamiliar to me, reporting that it was taken on Wandering Jew (Tradescantia fluminensis Vell.).

One of these was raised to maturity and proved to be a noc-tuid which, through the courtesy of Dr. J. McDonough and Dr. J. F. Gates Clarke, was finally determined as Mouralia tinctoides Gn.

This moth has not heretofore been recorded north of the Mexican border. We have seen examples taken in Santa Barbara, California, and Dr. Clarke reports that it is represented in the U. S. National Museum by an example taken in Victoria, Texas. It seems to be permanently established in the southwest.

In 1936 Mr. James Morrill of Glendale, California, secured a number of examples of the larvae which were turned over to Mr. Chris Henne, and were raised to maturity on Wandering Jew. We also found the larvae in large numbers in our garden on the same foodplant. Eggs were secured, and the following life history notes recorded.

Egg: Sub-spherical, the base flat; color, ivory white. Size, .68 mm, broad x .44 mm, high. Micropyle not depressed. The surface is covered by some 35 longitudinal ridges about half of which join with others before reaching the micropylar area. High magnification discloses numerous fine transverse lines or ridges crossing the depressions between the longitudinal ridges. The egg is usually deposited on the under surface of the leaf. See Plate 39.
PLATE 39
Egg of Mouralia tinctoides, enlarged x 36

First instar, immediately after emergence: Length, 1.5 mm. Head, large, jet black, strongly bilobed; width about .38 mm., which is about twice the width of the average body segment. Body, cylindrical, sub-translucent. Color, ivory white.

The first segment is topped by a prominent shield-shaped scutellum bearing two setae each side of the median line. There are three black papillae lateral to the scutellum, each bearing a seta.

The body has five rows of setae each side of the median line. On the typical segment these are placed as follows: One placed anteriorly on the segment close to the median line. The next lateral seta is posteriorly placed on the segment. The third, laterally placed is anteriorly located, and the fourth, posteriorly located. The fifth is again anteriorly placed on the segment. Thus each segment alternates in its position in the usual typical manner.

Each seta arises from a black tubercle.

Legs, black. Prolegs concolorous with body. There are four pairs of prolegs, the anterior two being small and non-functional. Anal prolegs concolorous with body. Duration of the first instar, four days.

Second instar, twenty-four hours after first moult:

Head: .56 mm. wide; translucent ivory, with a number of blackish-brown spots over the crest and upper cheeks. Mouth parts, dark brown. Ocelli, black.

Body, translucent ivory; cylindrical, the green food substance showing through and giving the larva a slightly green tinge.

Over the head and body the numerous black papillae give rise to colorless setae.

Legs: Terminal two joints, black; proximal joint concolorous with body.
Prolegs, concolorous with body—the first pair much dwarfed, second pair larger, third and fourth pairs fully formed and functional. Claspers, brown. Period of the instar, two days.

**Third Instar**: Length, 6.5 mm. Head, .8 mm. wide. Color, ivory. Two brownish black mottled bands extend from the crown nearly to the base of antennae. Mouth parts, light brown. Ocelli, black. Setae arise from minute black tubercles.

Body: First segment bearing a scutellum formed by two brownish-black patches, one each side of the median line, each bearing four papillae from which the usual setae arise.

Body color, ivory, with an olive-green cast due to translucence, and the alimentary content.

On the fourth segment in the median line there is a large black patch placed midway between the two uppermost papillae. Period of the instar, two days.

**Fourth Instar**, twenty-four hours after moult; length, 11 mm.

Head, 1.1 mm. wide. Coloring as in previous instar.

Body: Semi-translucent, olive-green, with the darker markings of the following instar present but less clearly indicated.

Mid-dorsally on the fourth segment there is a large black shield-shaped spot, anterior to which is an arched or crescentic white shading. Lateral to the black spot, a prominent round white dot.

Abdomen, lighter than the dorsal and lateral areas.

Legs, black. Prolegs, concolorous with abdomen. Setae as before, the black papillae from which they arise showing prominently. Period of the instar, two days.

**Fifth Instar**: Length, twenty-four hours after moult; 14 mm. Head, 1.4 mm. wide.

Color and markings much as in the last instar except that the dark markings are somewhat more clearly developed, and a white stigmatal broken line begins to be apparent. Setae, white, arising from minute black papillae, each papillus being placed in the center of a round white spot. There is also a large white elongate spot on the fifth segment between the two most dorsally placed setae, on each side of the median line. Period of the instar, two or three days.

**Sixth Instar**: Length, 23 mm.

Head: Width 2.08 mm. Similar in coloring to last instar, except for more intense coloring, a heavy black band across the face, and a narrow black line on inferior margin. Mouth parts tinged with yellow-brown. Mandibles black.

Body: Similar to preceding instar except that on the mid-dorsal portion of the fifth segment there is a slightly darker mottling suggestive of the large prominent spot which is to occur in the next instar. One example shows this large spot fully developed. Period of the instar, four or five days.
Larva of *Mouraia tinctoria*, last instar, enlarged x 2.
Upper figure, dorsal aspect. Lower figure, lateral aspect.

There is a whitish area, mid-dorsally, on the first three segments, shaded laterally with a dark olive green band. This band continues on to the fourth segment, but there inclines latero-inferiorly and runs superior to the stigmata as a wide dark band, which continues caudally to about the tenth segment where it becomes obsolescent. This band is bordered inferiorly by a white area on which the spiracles show prominently as black-rimmed ovals with gray-green centers.

The first three segments are narrow, the fourth to tenth cylindrical and larger, the eleventh largest of all and bearing a poorly defined bump on its dorsal aspect. Setae as before.

Period of the instar, three or four days.

Seventh Instar: Length, 38 mm.

Head, 2.80 mm, wide; soiled ivory, heavily mottled with black, and narrower than the first segment. Ocelli, black. Mouth parts, soiled ivory, tinged with maroon.

The body color has now changed to a rich mixture of black, brown, chocolate and white, giving it a very different appearance from that of previous instars. Mid-dorsally there is a whitish line on the first three segments, overcast with chocolate, and shaded outwardly with black.
Mid-dorsally on the fourth segment, a large velvety-black shield-shaped spot, bordered by a narrow white or yellowish-white line. At the outer angle of the shield, a round yellowish-white spot.

On the fifth segment, mid-dorsally, a black spot, larger than the one anterior to it, but somewhat similarly shaped. This lacks the round white spots at each of its outer angles.

From this large spot there runs, mid-dorsally, a narrow, discontinuous mid-dorsal stripe, bordered laterally by a mottled cream and chocolate area.

Lateral to this is a wide mottled black band which begins near the supra-stigmatal band and inclines medially and caudally, to meet with its fellow of the opposite side, thus forming a prominent V on each segment. This V is, however, somewhat obscured on the last two or three caudal segments. The upper figure of Plate 40 shows this dorsal ornamentation.

There is a black supra-stigmatal line from the fourth to the ninth segments, below which is a whitish stigmatal band, overlaid with mottled light chocolate. On the eighth and ninth segments this light area extends diagonally downward and backward on to the prolegs. (See Plate 40, lower figure.)

Stigmata, black rimmed, cream centered,

Legs, light brown. Prolegs concolorous with body. Claspers, black. All setae black, those on the body arising from lighter colored round points. Period of the instar four to six days.

Pupation occurs on or near the foodplant, a thin fragile cocoon being formed with leaves incorporated in it. The pupa can be clearly discerned through the cocoon.

Pupa: Length, 21 mm. Color, blackish brown, the wing cases slightly darker. Thorax not prominent. Stigmata concolorous with body.

The surface of thorax and wing cases, heavily rugose, as is also the cremasteric projection.

Cremasteric hooks: A pair, centrally placed, strongly recurved laterally, and a few very minute recurved hooks at the base of the larger pair.

Period in pupa, ten to twelve days. The pupa is illustrated on Plate 41.

Eggs hatched August 20, 1936, produced imagos Sept. 23.

We have not determined the number of broods in a season. In a series of more than twenty examples reared, no parasites have resulted.
The larvae are mainly night feeders, resting by day on the ground under the foodplant, or on the stems. In the earlier instars they feed only on the parenchyma of the leaves, giving the plants a slug-seared appearance. After each ecdysis the larva consumes its cast off skin.

Larvae of *Prodenia ornithogalli* have been taken on the same foodplant.

The imago of *Mouralia tinctoides* is illustrated in Biologia Centralia America, Heterocera III, plate 91, fig. 10 under the synonymic name *annulifera*.

PLATE 41

Pupa of *Mouralia tinctoides* enlarged x approximately 2½.

Ventral, lateral and dorsal aspects.
AN ANNOTATED LIST OF THE LEPIDOPTERA OF SANTA CATALINA ISLAND, CALIFORNIA

PART I—RHOPALOCERA

By DON MEADOWS
Laguna Beach, Calif.

Only a few scattered references to the lepidopterous fauna of Santa Catalina Island are found in scientific literature. During the past forty years many entomologists have visited the island and collected for brief periods, usually in the neighborhood of Avalon, but until the material for this paper was assembled no extensive collections of island butterflies and moths were made. During the years 1927 to 1934 insects were netted at all seasons on all parts of the island, and during 1932 and 1933 light traps for moths were operated at Avalon and Middle Ranch. Excluding the micro-lepidoptera, which have not yet been worked up, 167 species of lepidoptera were taken.

Santa Catalina is one of the California channel islands, lying twenty miles southwest of San Pedro. It is approximately twenty-two miles long, seven miles wide at its widest part, and contains 48,400 acres. It is a sunken mountain range which was separated from the continental land during Miocene times. A greater part of its surface consists of rolling table land averaging 1,400 feet above sea level. Two peaks, Black Jack and Orizaba, reach an altitude slightly over 2,000 feet.

The fauna and flora of the island is typically upper sonoran, with tendencies toward the San Diegan region. Four more or less distinct associations are evident. The first is in the immediate vicinity of Avalon where extensive plantings of subtropical plants and the close commercial contact with the mainland have introduced conditions not native to the island. A second association is that of the deep shaded canyons which drain from the highlands into the sea. Island oaks (Q. tomentella) cottonwood, willow, Catalina cherry and elderberry trees mark well defined areas. Hamilton, Gallegher, Toyon, White’s, Cherry, Howland’s, Johnson’s, Cottonwood, Middle Ranch, Bullrush, Grand and Silver Canyons are typical examples. Running water is found in most of these canyons throughout the year.

A conspicuous ecological condition exists in the upper parts of all the canyons on the leeward or channel side of the island. Here the southern exposed slopes are densely covered with white sage, sumac, deer-weed and giant buckwheat (E. giganteum), while the northern exposures are usually massed with a dense jungle of scrub oak.
A third association, covering the greater part of the island, is the high, windswept table land and the upper slopes of the canyons above 600 feet in altitude. Scrub oak, scattered holly trees, cactus and tree tobacco are distinctive. Grasslands are common. In sheltered spots considerable groves of Catalina ironwood and amanzanita are found.

A fourth association is that of the Salte Verde on the southwest slope of the island where an area two miles wide and five miles long is almost destitute of vegetation. Tuna cactus (O. occidentalis), and Astragalus are the only noticeable plants. The soil is of volcanic origin and is badly eroded. Salte Verde is the nearest approach to the lower Sonoran zone found on the island.

Trapping for moths was carried on in a canyon near the outskirts of Avalon about a mile from the sea, where the exotic flora of the village contacted the holly-sage-sumac-oak association of the island canyons. Collections made with the trap were representative of the Avalon-canyon association. At Middle Ranch a trap was operated at an altitude of 600 feet on a greasewood covered slope near the ranch buildings north of the reservoir. Catches at Middle Ranch were representative of the canyon and highland associations. No trapping was done in the Salte Verde.

I am indebted to Dr. John A. Comstock of the Los Angeles Museum for help with the butterflies and Noctuidae; to the late Mr. W. S. Wright of the San Diego Museum of Natural History for assistance with the Geometridae and to Mr. E. P. Van Duzee of the California Academy of Sciences in San Francisco for use of the collections at that institution. The nomenclature of Barnes and Benjamin (Bull. S. Cal. Acad. Sci. XXV, 1926) has been followed in the classification of the diurnals and that of Barnes and McDunnough, List of North American Lepidoptera, (1917) in the rest of the families.

Family Papilionidae

   Fairly common during the spring in the island valleys.

Family Asciidae

2. *Ascia occidentalis* (Reak.)
   Two males were taken in Avalon, Sept. 30, 1927.

3. *Ascia protodice-vernalis* (Edw.)
   Only two records: male near Summit, April 1, 1933, and a female, Avalon, April 6, 1933, both by Clyde Gibson.

4. *Ascia rapae* (L.)
   Rather an uncommon species taken during late winter and early spring.

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5. *Ascia rapae yreka* (Reak.)

A common form frequently taken at many places on the island. Most abundant around Avalon.

6. *Anthocharis cethura* race *catalina* race nov.

Upper side. Typical *Anthocharis cethura* F. & F.

Under side. Primaries: Apical spot a pale creamy yellow instead of orange yellow as in typical *cethura*. Green maculations between spot and apex of wing lacking, or only faintly showing. When present they appear as a few very small flakes of olive green, contrary to the yellow green of the typical species. Secondaries: Less heavily marked than typical *cethura* with maculation a pale olive green in place of the usual yellow green.

Twelve examples, eight males and four females, as follow: Males, Grand Canyon IV-1 and IV-9 1933; White's Landing IV-7-1929; Renton Mine III-28-1930 (3); and III-23-30; Salte Verde IV-15-30. Females, Grand Canyon IV-1-33 and IV-9-33; Little Harbor III-31-28 (2).

Type locality, Catalina Island, California.


My attention was first called to the apparent differences between *catalina* and *cethura* by Mr. C. N. Rudkin who has made an extensive study of the *Anthocharis* group. When a series of *catalina* and typical *cethura* are compared the island race has a more chalky white appearance on the upper surface. Probably the most accessible locality where *catalina* may be collected is a small open meadow at the top of a ridge between the Renton Mine and Jewfish Point, two miles south of Avalon, at the head of Pebble Beach canyon.


Typical *sara* were taken at Little Harbor, Middle Ranch and Avalon during the latter part of April, although never in such abundance as the following form which flies from two to six weeks earlier in the year.


The most common Orange-tip on the island, on the wing from December until late in April. Frequents grassy canyons and highlands up to 1,400 feet. In certain localities extremely abundant at times. My good friend, Mr. Chas. II. Ingham of Los Angeles, described this spring form from the island as *A. sara gunderi* (Pan-Pacific Entomologist, IX, 75, 1933), from specimens collected at Middle Ranch in April. After a careful comparison of a large series of specimens with material taken on the mainland I fail to find any characteristics which would warrant the separation of the island forms from *reakirtii*.
9. *Catopsilia sennae eubule* (L.)
Not seen at all in 1927 but in increasing numbers each year since that time. Fairly common around Avalon in 1934, probably due to the extensive cultivation of the food plant, *Cassia*.

10. *Catopsilia sennae pallida* (Ckll.)
A single badly worn specimen of this female form was taken in Avalon, X-24-'29.

11. *Eurymus eurhythme* (Bdv.)
Contrary to expectations, the eurhythme group was poorly represented on the island. Only one typical specimen was taken, a female, Little Harbor, VI-26-'30.

12. *Eurymus eurhythme amphidusa* (Bdv.)
Somewhat better represented than the above. Three specimens were taken: a male, Avalon X-26-'32, and two females, Empire Landing XI-11-'27 and Middle Ranch V-25-'30.
An aberrant female *alba* (Stkr.) was collected in Avalon, XI-2-'32.

13. *Eurema nicippe* (Cram.)
Common around Avalon during the autumn months.

Family **Danainae**

14. *Danaus menippa* (Hbn.)
Common on the island during fall and spring migration, especially during 1932.

15. *Danaus berenice striyosa* (Bates)
One record, a female, Avalon XI-2-'27.

Family **Nymphalidae**

16. *Dione vanillae* (L.)
One record, a male, Avalon II-19-'30.

17. *Hamadryas californica* (Bdv.)
The first record of this species was a badly worn male taken in Avalon on October 26, 1932 following a hard wind which blew from the mainland. During March and April, 1933, several specimens were taken around Avalon.

18. *Hamadryas antiopa* (L.)
Common at the Haypress and in Cottonwood canyon where willows are abundant. Frequently taken at other parts of the island.

19. *Cynthia atalanta* (L.)
An uncommon species found on windswept ridges above 1,400 feet. Records: Renton Mine I-1-'28, X-31-'29, IV-1-'33, Black Jack Peak V-13-'30.
20. *Cynthia virginiensis* (Dru.)

Fairly common around Avalon.

21. *Cynthia cardui* (L.)

The most abundant butterfly on the island. In the fall and winter it swarms in thousands around the lantana bushes in Avalon. Well distributed over the whole island. Several specimens were taken in the light trap at night.

22. *Cynthia carye* (Hbn.)

Common with the two preceding species. Two aberrant forms, *muelleri* (Letch.) and *letcheri* (Grin.) were occasionally collected.

The relative abundance of species in the *Cynthia* group found on Catalina was in the approximate proportion of *C. cardui* 1.000, *C. carye* 100, *C. virginiensis* 40 and *C. atalanta* 1.

Family **Lycaenidae**

23. *Strymon avalona* (Wright)

A common endemic distributed over the entire island. Especially abundant in the hills around Avalon, the type locality. Taken every month in the year. Multiple brooded with the early spring brood by far the largest. The food plant is *Lotus*, though the imagoes have a decided preference for the flowers of the giant buckwheat, *E. giganteum*, and the common sumac, *Rhus laurina*. Most available collecting locality is around the sumac along the road to Renton Mine, south of Avalon, in early March.


24. *Leptotes marina* (Reak.)

Not uncommon.

25. *Brephidium exilis* (Bdv.)

Abundant around *Atriplex* wherever that plant grows on the island.

26. *Everes amyntula* (Bdv.)

Common in the Salte Verde country, Little Harbor ridge, Johnson’s Valley and Parson’s. Rare at other places on the island. Food plant *Astragalus*.

27. *Lycaenopsis pseudargiolus echo* (Edw.)

Common in the wooded valleys and canyons. Larvae feeds on a great number of plant species.
Family Hesperiidae

28. *Urbanus tessellata occidentalis* (Skin.)
   An uncommon species taken a few times in Avalon during the winter months.

29. *Erynnis tristis* (Bdv.)
   One record, a male, September 22, 1931, in Avalon,

30. *Hylephila phylaeus* (Dru.)
   Extremely abundant around Avalon during the summer and fall. Greatly attracted by *Lantana* flowers.

31. *Ochlodes sylvanoides* (Bdv.)
   Only three records, all males: Ridge above Avalon VII-10-'29 (2), and Black Jack Peak VI-28-'30.

32. *Ochlodes nemorum* (Bdv.)
   One example, an extremely light colored female, Avalon VII-10-'29, identified by Dr. Comstock.

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IN MEMORIAM—PROFESSOR MELVILLE DOZIER

Professor Melville Dozier's long period of service in the educational advancement of California has established for him a permanent place in the history of this state.

Born in Georgetown, South Carolina, May 22, 1846, he received his early education in the academic department of Furman University, in his native state. At the opening of the Civil War Mr. Dozier, then fifteen years old, entered the State Military School at Charleston, and two years later the entire academy entered the Confederate Army, serving under General Jenkins. After the war Mr. Dozier was able to return to his alma mater, and was graduated in 1867.

Choosing education as his field, and coming west at this juncture, Mr. Dozier has lived and worked in California since, the only exception being the two years spent in teaching in Nevada, 1870 and 1871.
Professor Dozier's early teaching was done in Solano County, California, his first promotion coming in 1874 when he became principal of the high school at Santa Rosa. In this same year Professor Dozier married Miss Elizabeth Wilds Edwards, who remained at his side, a loyal helpmate, for forty-four years.

It was in the year 1884 that Professor and Mrs. Dozier came to make a permanent home in Los Angeles. As professor of mathematics he was identified with the State Normal School of this city for twenty-two years, part of this time functioning as vice-principal. Then came a period of four years, from 1906 to 1910, when he filled the position of auditor in the Los Angeles Acqueduct Department, but still education held him, for he served as member of the Board of Education during that period. Immediately afterward he came into the executive responsibilities of assistant superintendent of the Los Angeles Public Schools, which position he held until he retired from active duties in 1921.

An early member of the Southern California Academy of Sciences, member of Upsilon Chapter of the Chi Psi Fraternity, member of the National Education Association and of the Los Angeles Chamber of Commerce, each of these organizations has felt the influence of his personality.

Professor Dozier published a charming description of his visit to Alaska. His travels also included a journey to Arizona and to Honolulu and others of the Hawaiian Islands. But perhaps the crowning event of his career of devotion to education came in 1928 when he returned to his native state, after an absence of sixty-one years, and addressed the graduating class in the same hall in which he had himself received his diploma. Surely Professor Dozier has won a position of high esteem and has honored this community by his life and activities.

In the passing of Professor Dozier the Academy of Sciences loses one of its veterans. He was a member of this organization for nearly forty years. In the early years of his membership he served as secretary of the Astronomical Section and as a member of the Publication Committee. He served one term as President, several terms as member of the Board of Directors, and at the time of his death was a member of the Advisory Committee.

William A. Spalding
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