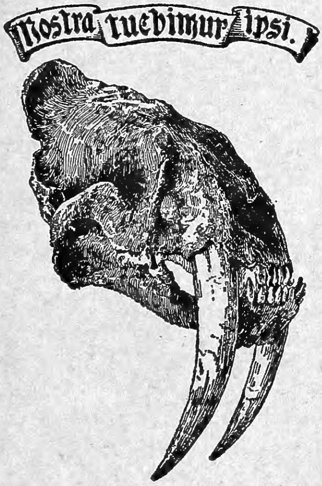
BULLETIN OF THE Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA



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FOSSIL ARTHROPODS OF CALIFORNIA

W. DWIGHT PIERCE

5a. A CRYSTALLIZED MILLIPEDE FROM VOLCANIC ROCK IN A WELL (Cont.)

(PLATE 1)

Continuing the article in vol· 43, part 1, p. 18, it was decided to publish Mr. Peter Marry's excellent photograph of the crystallized millipede found at the depth of 900 ft. in a well at Oxnard, California and to dedicate it to its finder, General Carl F. A. Last. It will therefore bear the name *Parajulus lasti n.* sp., and is recorded in the Los Angeles Museum under Accession No. A 3104, and in the Paleontology collection as S 9002.

Although critical characters are not visible this species differs as follows from other American species in its size and segmentation·

Species of Parajulus	Distribution	Number of Segments	Length	Width
lasti n. sp.	Fossil in Calif.	65 or 66	38	2.0
ectenes Bollman	North Carolina	67	46 - 54	1.6-1.8
pennsylvanicus (Brandt)	Eastern U.S.A.	55 - 65	20 - 38	1.5-2.
canadensis (Newport)	Canada, N.E.U.S.	56 - 57	18 - 25	1.3-1.5
rugosus Bollman	Pennsylvania	51 - 54	35 - 40	2.2-3.0
obtectus Bollman	Indiana, Florida	50 - 55	18 - 30	1.8-2.2
varius Bollman	California	50 - 55	18 - 24	1.5-1.8
impressus Say	Eastern U.S.A.	45 - 55	18 - 32	1.8-2.0
zonatus Bollman	Washington	52 - 53	25 - 40	2.0-2.5
diversifrons Wood	Minnesota	42 - 51	23	2.0
ellipticus Bollman	Minnesota	47	28 - 30	2.3-2.5

By the above measurements *lasti* is closest to the present day eastern *Parajulus pennsylvanicus,* but is given a name because of its locality and age.

PLATE 1

Parajulus lasti Pierce, crystallized millipede from depth of 900 ft. in well at Oxnard, Cal., in basaltic lava, with crystallized quartz.

6. TWO NEW FOSSILS FROM THE UPPER MIOCENE OF THE PUENTE HILLS

The two new specimens were found by Dr. Lore Rose David in Upper Puente shale of the Mohnian Horizon, Upper Miocene, at depth of 2105-2127 ft. in the Puente Hills, southeast of Puente, Los Angeles Co., California. They were given by her to Miss Jane Everest, who presented them to the Los Angeles County Museum of History, Science and Art.

Specifically, the location is 2649° N.- 2′ E. from the S. W. corner of Section 21 - 2 S -10 W, La Habra quadrangle, elevation 620, in Axis Co. well Rowland No. 1.

This is a light gray shale, and the first specimen is beautifully etched in white lines, while the second specimen is such a faint impression that it is quite marvellous that it should have been detected.

The first wing is of the mayfly type, but more primitive than the modern mayflies, because of the complete absence of cross veins. It shows relationship to the Megasecoptera, but to keep the record clear a new ordinal name is proposed.

Order APHELOPHLEBIA, *new order*

An order of fossil insects in which there are no cross veins in the wings. The radius extends the entire length of the wing and has three apparent branches; medius has two long stems and a short intermediate branch; cubitus is entire; paracubitus is apparently branched.

Family APHELOPHLEBODIDAE, new family

With the characters of the order.

Genus APHELOPHLEBODES, new genus

Name based on ἄφελῶς, simply, and φλεβῶδης, veined. The costal-subcostal region is not visible. Radius is slightly concave in the supposed subcostal region, thence almost straight to its apex in the wing margin. Near its apical fourth a short vein, interpreted as Radius 2 + 3 branches off and reaches the margin at the apex of the wing. At about the middle of Radius a longer vein, interpreted as Radius 4 branches off, and reaches the margin of the wing. Below this and just before its apical fourth a short little vein, interpreted as Radius 5 branches off and reaches margin of wing. The next vein is longer and looks as if it were also a branch of Radius from its basal fourth, but is interpreted as Medius 1. The next long vein arises at the base of the wing and is interpreted as Medius 3 + 4. Apically between these two is a fainter vein reaching the wing margin, and interpreted as Medius 2. Cubitus arises at base and extends to wing margin, parallel to Medius 3 + 4. Paracubitus is basally strong, but about midway to the wing margin seems to be branched, perhaps into a long branch and two shorter branches, which are indicated by typical whitening of the other veins.

Aphelophlebodes stocki, new species. (Plate 2)

Type of the genus; named in honor of Dr. Chester Stock, Professor of Paleontology of California Institute of Technology, Senior Curator of Earth Sciences at the Los Angeles County Museum of History, Science and Art, and a Director of the Southern California Academy of Sciences. Type in Los Angeles Museum, under Accession No. A4709, Paleontology specimen S 9006.

PLATE 2

Aphelophlebodes stocki Pierce; impression of wing of fossil mayfly from oil well core, near Puente, Cal., at depth of 2105-2127 ft., in Upper Puente shale, Mohnian Horizon, Upper Miocene.

Length of impression 7 mm., greatest width 2.6 mm. The fossil consists of impressions of the veins, which are milky white, smooth texture, on a small square piece of shale.

The species description is that of the genus. The excellent photograph is by Mr. Peter Marry, Photographer of the Museum.

Order LEPIDOPTERA LINNAEUS

Family HEPIALIDAE Stephens

Genus PROTOHEPIALUS, new genus

This genus is typically hepialid, because of the three basal cells formed by Radial Sector, Medius 2, Medius 3, and Cubitus 2 with the R-M, M-M, and M-Cu crossveins. These crossveins are very indistinctly shown by the photograph by Mr. Marry, but can be seen by other lighting. The genus differs from other Hepialidae by having Radius 1 and Subcosta united at base; by the faintness of Medius 1; the presence of an indication of Medius 4; the division of Cubitus 1 into two or possibly three veins.

PROTOHEPIALUS COMSTOCKI, new species. (Plates 3, 4)

Type of genus; named in honor of Dr. John Adams Comstock, Head Curator of Science of the Los Angeles Museum of History, Science and Art, and Secretary-Treasurer, Editor of the Southern California Academy of Sciences. The holotype is a faint impression of a portion of a wing of a primitive hepialid moth, occupying a space about 5x5 mm. The sketch (Plate 4) interpreting the photograph gives the Author's ideas of the venation, which is typically hepialid.

Briefly the elements of venation discernible are: Subcosta and Radius united for some distance; Radial sector divided beyond the cross veins into Radius 2 and 3; Radius 4 and 5 branching from the first cell; Medius 1 indistinct between Radius 5 and Medius 2; Medius 2 and 3 almost parallel, forming with M-M cross vein the second cell; Medius 4 faint; Cubitus 1 divided into two, possibly three branches; Cubitus 2 forming with the M-Cu cross vein and Medius 3, the third cell.

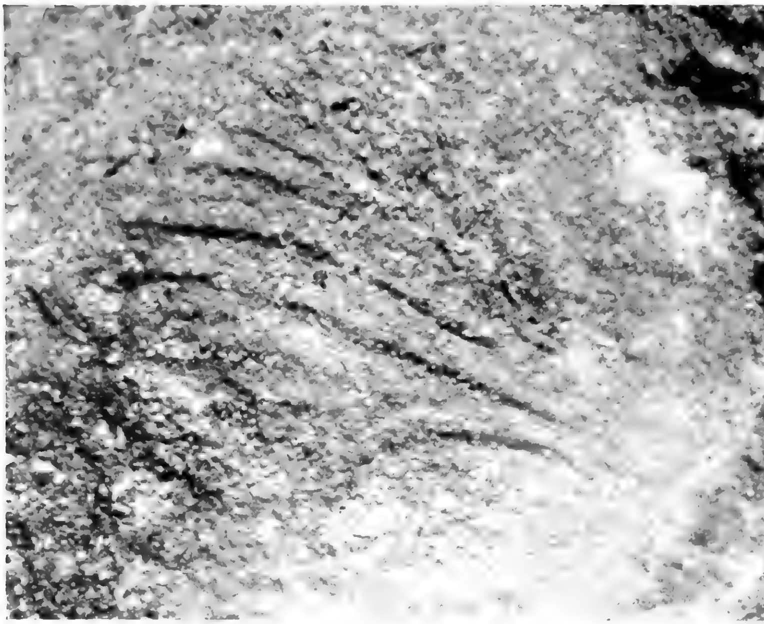

PLATE 3

Protohepialus comstocki Pierce; impression of wing of moth from oil well core, near Puente, Calif., at depth of 2105-2127 ft., Upper Puente shale, Mohnian Upper Miocene

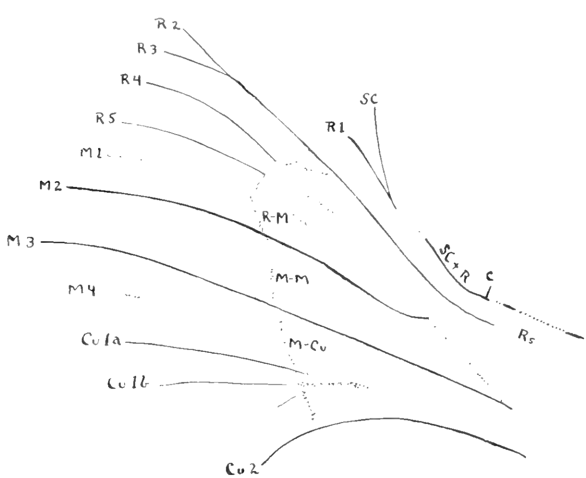

PLATE 4

An interpretation of the venation of *Protohepialus comstocki* Pierce

7. A FOSSIL WHIPTAIL SCORPION FROM CABRILLO BEACH

In November, 1944, Mr. E. E. Hadley found a piece of shale lying on the Cabrillo Beach shore at San Pedro, California, which contained the crushed remains of a whiptail scorpion. The writer has seen only one other fossil in this group, from Mexican onyx, and knows of no fossil species having been described. The specimen is too badly crushed to give any adequate description of the appendages, but deserves to be placed on record.

Order PEDIPALPI Latreille

Family THELIPHONIDAE Lucas

Genus THELYPHONUS Latreille, sens. lat.

THELYPHONUS HADLEYI, new species. (Plate 5).

This species is dedicated to its finder, Mr. E. E. Hadley, a member of the Southern California Academy of Sciences and a

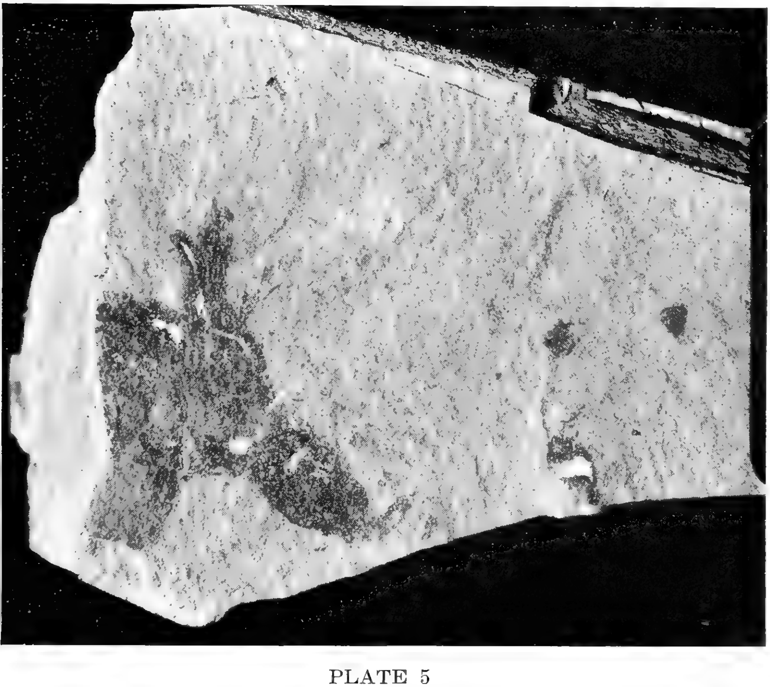

PLATE 5

Thelyphonus hadleyi Pierce; fossil whiptail scorpion from Middle Miocene Monterey shale found on shore at San Pedro, Calif.

collaborator of the Los Angeles County Museum, working in Invertebrate Paleontology. It is recorded under Accession Number A6, and in Paleontology records as S 9008.

The shale is probably of local origin, for a bank of diatomaceous shale above where it was found contains many rocks of this type imbedded at various levels. It is Middle Miocene, Monterey shale.

Total length 22 mm., cephalothorax 7x3 mm., abdomen 9x4 mm. Only a part of the tail is present, and the heavy chelicerae are so crushed that their character is indeterminate. The photograph by Mr. Marry gives better detail than a description can.

8. A CASE OF PLEISTOCENE MYIASIS FROM THE LA BREA PITS (Plate 6)

In examining bone fragments of the giant fossil bird, *Teratornis merriami*, found in the La Brea Pits, Hancock Park, Los Angeles, Dr. Hildegarde Howard found a piece of the proximal end of a humerus which contained 8 puparia of a blow fly. The exact site of this find was pit 3, at depth of 21½ feet. The period of the material in these pits is Pleistocene.

A reconstruction of the story is probably thus: One of these giant birds alighted on an animal caught in the tar, and began to feed upon it. In the process, it also became caught in the tar and fell prey to a predatory animal, such as the sabretooth tiger. This animal crushed the bones, exposing them to the blowing by flies. Undoubtedly the tiger was caught also. Blowfly attack occurs within the first two or three days after death, and one can assume about 15 days for the fly larvae to develop, pupate and mature. Some of them had matured, others were caught when the bone finally became submerged in the tar. This constitutes the first dipterous evidence from the tar pits.

Order DIPTERA Linnaeus

Family METOPIIDAE Curran

Genus PROTOCHRYSOMYIA, new genus

PROTOCHRYSOMYIA HOWARDAE, *new species*

Named in honor of Dr. Hildegarde Howard, Curator of Avian Paleontology of the Los Angeles County Museum and a member of the Southern California Academy of Sciences. Recorded by the Museum as S 9009 in bone fragment B2309.

Fly puparia, reddish brown in color, 8x3 mm., convex throughout except that there is a slight flattening at the cephalic end, and a distinct depression of the spiracular area. The spiracles are of the same type as those of the Calliphorinae, *Phormia regina*, and *Cochliomyia macellaria* but more widely separated, placing the species in that group. Entire surface transversely pitted. The anterior end shows four slight tubercles, but is otherwise not distinctive. The emergence opening is by a longitudinal slit, and a transverse slit to form a T with the other. The anal tubercular area is definitely depressed with a deep transverse depression below the spiracles; the area is surrounded by a rounded rim on which are 6 dorsal, 2 lateral and 4 ventral little tubercles. Within this are the two spiracular plates with three straight slits each, directed at a point beyond the line between the ventral edges of the plates; without buttons, the lower margin open. These plates are separated by a distance of 12 as compared with a width of 15 for the plates. There are two strong anal tubercles, bluntly pointed and directed slightly outward.

In our modern flies the sarcophagine flies are separated from the calliphorine flies by having the spiracles in a pit, but with the slits directed outward instead of inward as occurs in this species. So little good work has been done in describing the puparia of modern flies that the writer feels justified in recording this species with a new name.

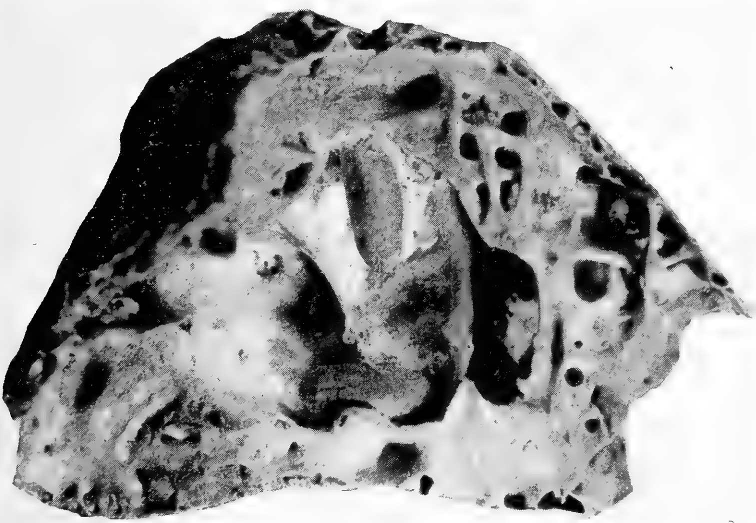

PLATE 6
Puparia of *Protochrysomyia howardae* Pierce in a bone fragment of the giant bird, *Teratornis merriami*, from La Brea Pits, Los Angeles, Pleistocene tar deposit

CONTRIBUTIONS FROM THE LOS ANGELES MUSEUM CHANNEL ISLANDS BIOLOGICAL SURVEY

29. ROBBER FLIES (DIPTERA, ASILIDAE)

By J. WILCOX, U. S. Department of Agriculture, Agricultural Research Administration, Bureau of Entomology and Plant Quarantine, and C. H. MARTIN, California Agricultural Experiment Station

Only five species of robber flies have been taken on the Channel Islands, and only one of these can be associated with previously described species from the mainland. The types of the new species are in the Los Angeles County Museum.

1. **Stenopogon neojubatus,** n. sp. (figs. 2a and 2b)

MALE: Length 16 mm. Head black; face and lower occiput grayish pollinose, front golden-brown pollinose; upper occiput golden pollinose. Mystax and hairs and bristles of front and upper occiput black; beard and hairs of palpi and proboscis white; lateral bristles on upper occiput yellowish. Antennae black; first joint slightly longer than second, the third 1 1/3 times the length of the first two joints together; style ½ the length of the third joint; first two joints yellowish haired.

Thorax and scutellum black and densely golden-brown pollinose. Bristles and hairs largely black; some of the lateral bristles yellow; hairs on humeri and on sides of mesonotum white. Scutellum with about 10 strong, black marginal bristles. Neck with yellowish hairs and bristles; propleura yellowish haired; mesopleura white haired.

Abdomen black, densely yellowish-gray pollinose; segments 2-6 with shining spots on each side anteriorly. Hairs yellowish white, the bristly hairs on the sides and narrow posterior margin of the first segment black or brownish. Genitalia reddish, white haired.

Coxae black, golden-brown pollinose, with long brownish bristles and white hairs which are especially dense on the fore coxae. Legs reddish; femora dorsally and anteriorly and tibiae dorsally, except basal ¼, brownish black; tarsi similar to tibiae, the outer joints mostly reddish. Femora white haired, the bristles light to dark brownish; hairs of tibiae and tarsi golden, the bristles largely light brown. Claws black, reddish basally, pulvilli light brown.

Halteres and alulae yellowish, the latter with a fringe of long white hairs. Wings brown, slightly denser along the veins; anal and axillary cells and axillary lobe milky white. Anterior cross vein at about 3/8 the length of the discal cell; first and fourth posterior cells slightly narrowed; the anterior branch of the third vein with a short stump of a vein basally.

FEMALE: Length 18 mm. Similar to male except about half of mystax light brownish instead of black, hairs of front brown, bristles of occiput yellowish. Bristles on sides of mesonotum and scutellar bristles yellowish. Abdominal hairs wholly yellowish; abdomen grayish pollinose except for small lateral shining spots on segments 3-6; ovipositor reddish. Coxae and legs with yellowish bristles. Wings lighter brown, more contrast between the veins and cells; axillary cell and lobe whitish but not so prominent as in the male.

Holotype: Male, Santa Rosa Island, Calif., VIII-5, '39.

Allotype: Female, same data, VII-8 '39.

Paratypes: 3 males and 3 females, same data, from VII-8 to VIII-9 '39, and 2 males and 1 female, Santa Barbara Island, Calif., VII-8 '39.

This species belongs in the group with black mystax associated with *jubatus* Coquillett and differs from all the closely related species by having the femora reddish posteriorly and ventrally. The stump of a vein on the anterior branch of the third vein near its origin is present in both wings of all but one specimen; this stump is not present in any other *Stenopogon* known to the writers.

2. **Cophura hennei,** n. sp. (figs. 3a and 3b).

MALE: Length 9 mm. Head black; face, front, and occiput densely whitish pollinose. Mystax dense, white, nearly reaching to antennae and with a row of yellowish bristles on oral margin. Hairs white; occipital bristles yellowish; ocellar tubercle with a pair of long brownish bristles. Antennae black; first two joints about as broad as long, the third gradually narrowing apically and 1½ times the length of the first two joints together; style ½ the length of the third joint; first two joints white haired and each with a strong yellowish bristle below.

Mesonotum black, densely grayish pollinose; central stripe and lateral spots brown and anterior third of central stripe dark brown and bisected by a light brownish line. Humeral hairs white, remainder yellowish; bristles yellowish brown, 2 presutural, 1 postalar, 1 supra-alar, and 2 anterior and 2 posterior dorsocentral. Scutellum densely yellowish gray pollinose, with a central longitudinal shining black spot; sparse hairs yellowish; 3 long brownish marginal bristles.

Abdomen shining black; sides of all segments, apical oblique band on segments 2-6, and anterior margins of segments 1-4; grayish pollinose. On segments 2-4 the posterior pollinose bands extend obliquely forward and meet the anterior band narrowly at the middle so that the black portion consists of a narrow triangular posterior spot and a triangular spot on each side. The anterior pollinose bands do not connect with the lateral pollinose margins on segments 3-4. Hairs white, longer on sides of segments 1-3; first segment with 3-4 lateral yellowish bristles. Genitalia small, reddish, dorsally grayish pollinose; hairs yellowish.

Coxae black, densely yellowish-gray pollinose, white haired. Trochanters and narrow base of femora shining reddish, yellowish haired. Femora black, densely yellowish-gray pollinose except basal posterior half of hind ones, which is shining black. Tibiae reddish except the apical fourth and the fore and middle ones, which are anteriorly brownish. Tarsi black; pulvilli light brown; claws black but narrowly reddish at base. Hairs white; bristles yellowish.

Halteres and alulae yellowish. Wings with a brownish tinge, slightly intensified at the cross veins and furcations. All posterior cells widely open; anal cell narrowly closed at margin. Anterior cross vein at 4/5 the length of discal cell; third vein branched slightly beyond discal cross vein.

Female: Length 8 mm. Differs from male as follows: Hairs of face shorter and sparser (about as long as first 2 antennal joints, in male twice as long). Scutellum wholly pollinose and with only a pair of marginal bristles. Abdomen almost wholly yellowish-gray pollinose, the broad posterior margin of first segment, the narrow posterior margins of segments 2-7, segment 8 entirely, and small lateral spots on segments 2-4, shining black. Wings nearly hyaline and but slightly brownish on cross veins and furcations.

Holotype: Male, San Nicolas Island, Calif., XI-27 '40 (C. Henne).

Allotype: Female, same data, XII-8 '40.

Paratypes: 1 male and 25 females, same data as types.

Probably most closely related to *trunca* Coquillett and *highlandica* Cole, but in these species the mystax is composed entirely of sparse bristles, the anterior branch of the third vein bears a stump of a vein, and the anal cell is open.

Named in honor of the collector, Christopher Henne.

3. **Erax anacapai,** n. sp. (figs. 4a, 4b, and 4c)

Male: Length 21 mm. Head black, yellowish-gray pollinose. Mystax composed of long, slender, black bristles with white hairs intermixed. Palpi and proboscis black; palpi with black and white hairs; proboscis white haired. Beard white; occipital bristles largely black with some white hairs intermixed; front black haired with a few white hairs anteriorly; ocellar tubercle black haired with a cluster of 4-6 erect black hairs on each side. Antenna black; first and third joints subequal in length and twice the length of the second; style twice the length of the third joint; first two joints white haired.

Mesonotum golden-brown pollinose and black haired with some white hairs on the lateral and posterior margins. Bristles black, 2 presutural, 2 supraalar, 2 postalar, and about 3 finer posterior dorsocentral. Scutellum golden pollinose, with about 16 black marginal bristles and with a dense clump of white hairs on each side apically. Pleura grayish golden pollinose and white haired, with a few black hairs on mesopleura; hypopleural and neck bristles yellowish white.

Abdomen black; segments 1-3 and 8 golden-gray pollinose; segments 4-7 silvery pollinose; segments 2-7 with a silvery sheen at certain angles. Segments 2-7 with white parted hairs, especially long on segments 2-3 and decreasing in length from segments 4-7; first segment white haired on the sides but black haired at the middle; lateral bristles yellowish. Venter grayish pollinose and white haired. Genitalia black; lower forceps brownish; hairs white except a few dorsally and ventrally and at the apex ventrally, which are black; genitalia as long as segments 4-8 together.

Coxae black; golden-pollinose, and with rather dense white hairs and yellowish bristles. Trochanters reddish. Femora black, the tips reddish; hairs white; bristles black; only a few minute bristles at apex of fore femora. Tibiae and tarsi reddish brown; hairs white; bristles black; fore tibiae posteriorly with a fringe of long white hairs and anteriorly with golden pile. Claws black, narrowly reddish at base; pulvilli brown.

Halteres and alulae yellowish brown; the latter with a dense fringe of white hairs. Wings hyaline; veins brown; anterior cross vein at 13/24 length of discal cell; three submarginal cells.

Female: Length 24 mm. (including ovipositor, which is 7mm. long). Similar to male except that the abdomen is grayish-golden pollinose; hairs short, sparse, on segments 2-4 largely white but some black hairs mostly on dorsum; segments 5-7 black-haired with scattered white hairs laterally; first segment as in male except lateral bristles, which are largely black; ovipositor as long as segments 4-7 together. Fore tibiae posteriorly with only sparse white hairs.

Holotype. Male, Anacápa Island, Calif., VIII-18 '40 (C. Henne).

Allotype: Female, same data, VIII-23 '40.

Paratypes: 1 male and 1 female, same data as allotype; 1 male, Santa Barbara Island, Calif., VII-9 '39; and 1 male and 1 female, Santa Rosa Island, Calif., VII-8 '39.

This species belongs in Hine's *anomalus* group (Ann. Ent. Soc. Amer. XII: 119-120, 1919) and is most closely related to *anomalus* Belliardi. It differs from *anomalus* in the color of the mystax, the hairs of the scutellum, and the color of the legs. In *anomalus* males the long white hairs of abdomen begin on the apical third of the second segment and continue to the sixth segment, and in the females the ovipositor is only as long as segments 5-7 together.

4. **Erax clementei,** n. sp. (figs. 5a, 5b, and 5c)

Males: Length 18 mm. Head black; face and front yellowish-gray pollinose; occiput gray pollinose. Mystax black with finer white hairs intermixed; palpi largely black haired; proboscis white haired; beard white, front largely black haired; ocellar tubercle black haired with long erect tufts on each side; occipital bristles largely black. Antennae black; apex of first and second joints brownish; first joint twice as long as second, third joint slightly longer than first; style twice as long as third joint; first two joints with short white hairs, the first with some longer black hairs and on one side a black bristle below.

Mesonotum black, yellowish-gray pollinose; central stripe and lateral spots brownish. Hairs black, but all margins, including humeri, with some white hairs. Bristles black, 2 presutural, 2 supra-alar, 2 postalar, and about 3 anterior and 3-4 posterior finer dorsocentrals. Scutellum grayish pollinose; 12 black marginal bristles; dense clumps of white hairs on each side of disk apically. Pleura yellowish-gray pollinose; hairs white except a few on mesopleura and sternopleura, which are black; hypopleural and neck bristles yellowish.

Abdomen black; segments 1-2 and 8 yellowish-gray pollinose; segments 3-7 silvery pollinose; segments 2-7 with white hair parted at middle, longest on segments 2-3, slightly shorter on segments 4-6, and very short on segment 7; segments 1 and 8 white haired, the first with a few black hairs posteriorly and slender lateral bristles largely yellowish. Venter yellowish-gray pollinose and sparsely white haired; eighth sternite very small. Genitalia black, largely white haired; a few black hairs dorsally, and the ventral fringe and ventral apical clump largely brownish; genitalia nearly as long as segments 4-8 together.

Coxae yellowish-gray pollinose with dense white hairs and slender yellowish bristles. Femora black, the apex reddish; largely white haired but with scattered black hairs above and a row of fine black hairs below; bristles black; only a few on fore and middle femora. Tibiae and tarsi reddish, the tibiae blackish anteriorly; hairs largely white but with scattered black hairs and a posterior fringe on fore tibiae; bristles black; claws black, narrowly reddish at base; pulvilli light brown.

Halteres and alulae brown, the latter with a dense white fringe. Wings hyaline; veins brown; anterior cross vein at 6/11 length of discal cell; third vein forked at about 3/5 distance between anterior and discal cross veins.

FEMALE: Length 19 mm. (including ovipositor, which is 5 mm. long). Hairs on first 2 antennal joints white. Three of the 11 scutellar bristles yellowish. Abdomen grayish-yellow pollinose and sparsely haired; the hairs largely white but some black hairs on dorsum which increase in extent on the apical segments. Ovipositor as long as segments 4-7 together. Fore and middle femora almost wholly white haired; fore tibiae with scattered black hairs posteriorly.

Holotype: Male, San Clemente Island, Calif., IV-4 '39.

Allotype: Female, same data.

Paratypes: Three females, same data.

This species belongs in Hine's *stamineus* group (Ann. Ent. Soc. Amer. XII: 139-153, 1919) and is most closely related to *canus* Hine, *coquillettii* Hine, and *pilosus* Hine, differing in the color of the mystax and in the clumps of hairs on the scutellum. From *californicus* Schaeffer and *inflatus* Hine, which normally have the mystax black, the scutellar clumps will readily separate it.

5. *Asilus comosus* Hine (fig. 1).

Asilus comosus Hine, Ohio Jr. Sci. XVIII: 319-320, 1918.

This species was described from 3 female specimens collected in Monterey County, Calif., VII—5, '96 (W. M. Wheeler), and has not been reported since. In the California Academy of Sciences, however, there is a good series of specimens taken at Carmel and San Francisco from April to June. The species is closely related to *californicus* Hine, and the males have the upper forceps of the genitalia cleft apically.

Two male specimens were taken as follows: Santa Cruz Island, Calif., III-26 '41, oak, 1941-4704; and V-23 '41, *Comarostaphylis diversifolius,* 1941-4569 (C. Henne).

EXPLANATION OF FIGURES

PLATE 7

Fig. 1. *Asilus comosus* Hine, lateral view of male genitalia.

Fig. 2a. *Stenopogon neojubatus,* new species, lateral view of male genitalia.

Fig. 2b. Same, ventral view of male genitalia.

Fig. 3a. *Cophura hennei,* new species, dorsal view of female abdomen.

Fig. 3b. Same, dorsal view of male abdomen.

Fig. 4a. *Erax anacapai,* new species, lateral view of male genitalia.

Fig. 4b. Same, dorsal view of male genitalia.

Fig. 4c. Same, lateral view of female ovipositor.

Fig. 5a. *Erax clementei,* new species, lateral view of male genitalia.

Fig. 5b. Same, dorsal view of genitalia.

Fig. 5c. Same, lateral view of female ovipositor.

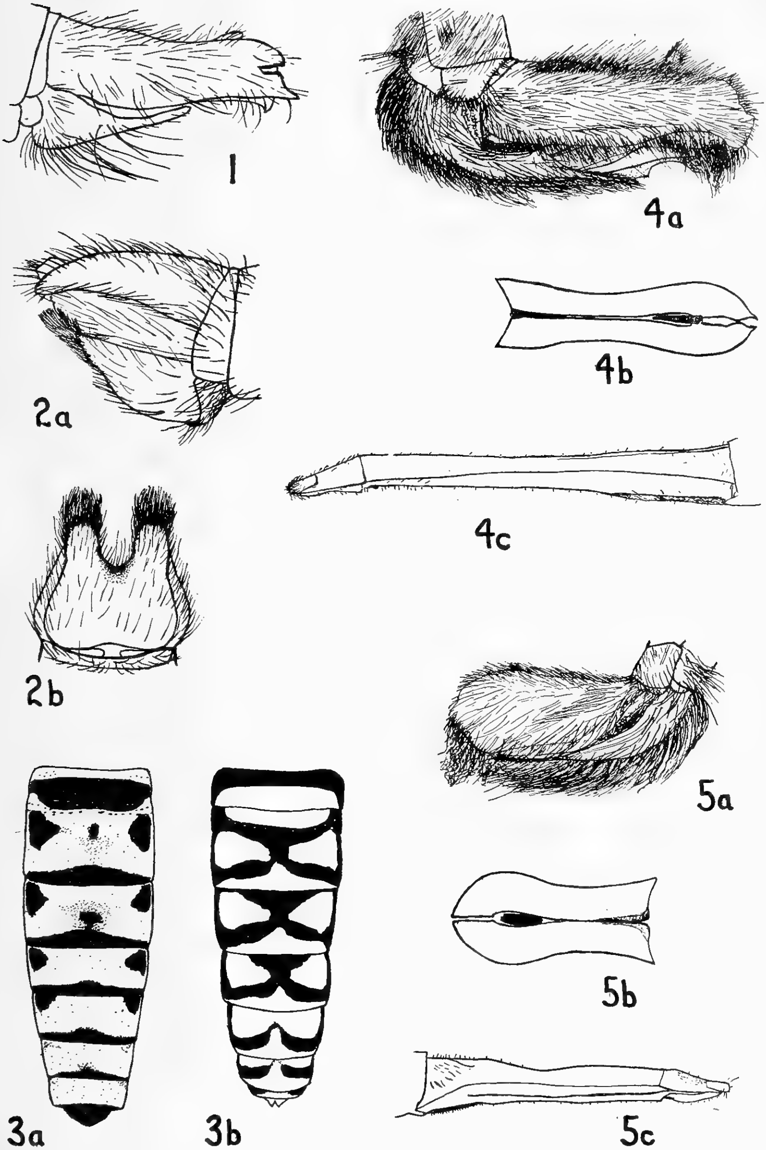

PLATE 7

THE HABITAT OF CALIFORNIA CONE-NOSED BUGS, *Triatoma protracta* (UHLER), NATURALLY INFECTED WITH *Trypanosoma cruzi* CHAGAS

By Sherwin F. Wood

Lieutenant H(S), U.S.N.R.

In December, 1943, five miles southwest of Fallbrook, San Diego Co., Calif., the writer had the opportunity to note the structure of a wood rat house and the distribution therein of cone-nosed bugs, *Triatoma protracta* Uhler, the vectors of Chagas' disease. Twenty-nine bugs were collected from this house, including 27 (3 ♂, 4 ♀, 9 large, 5 medium, and 6 small nymphs) infected with *Trypanosoma cruzi*. The two negative bugs were small nymphs.

This wood rat house (Plate 8) was typical of the brush pile type found in this region. It consisted principally of twigs and

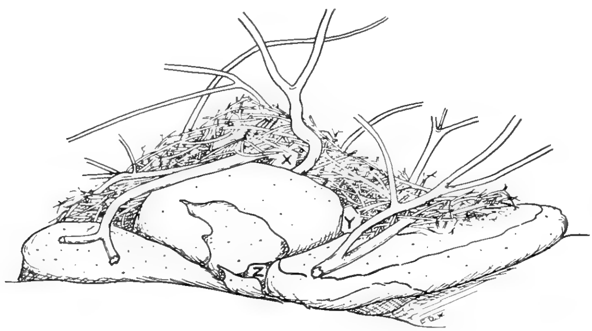

PLATE 8

sticks systematically piled upon several large rocks. This cover of sticks protected the inner areas, housing two bowl-like grass nests. The house was built near the base of a large, sprawling Laurel Sumac, *Rhus laurina* Nutt., which effectively concealed most of the structure. This shrub was approximately 8 feet high and 20 feet across, with many large recumbent stems radiating out from its base. It was on a hillside near the bottom of a small dry side canyon which lead into a larger canyon with a permanent stream.

On examining the rat house for *Triatoma,* approximately three bushels of small sticks and twigs were removed from one side, revealing the cross-sectional view depicted. Grass nests were found in two locations, X and Y. Apparently, most of the bugs were hiding near the more recently built nest, X, on top of the large middle rock. Some of the small nymphs were found in the fine grass of nest X. The larger nymphs and adults were shaken down from the dry twigs and sticks in the immediate vicinity of nest X. A few bugs were collected from the vicinity of the older nest, Y. At Z there was a saucer-shaped area lined with shredded grass.

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NOTES ON THE EARLY STAGES OF NEMORIA DELICATARIA DYAR

(Lepidoptera)

By John Adams Comstock

In the January-April issue of the *Bulletin* for 1940, Vol. 39, pp. 78-80, the author, in association with Christopher Henne, described and figured the egg, larva and pupa of a species of green Geometrid moth which we identified as *Nemoria pistaciaria* Packard. It has since been determined that the species was *Nemoria punctularia* B. & McD.

Mr. Carl W. Kirkwood of Summerland, California, sent me a number of young larvae which he secured in December, 1944, feeding on Toyon (*Photinia arbutifolia* Lindl.) These closely resembled the larvae of *N. punctularia*, but the foodplant suggested the possibility of its being some other closely related species.

Two examples were reared to maturity and photographic records made of the mature larva and pupa. The imagos emerged Feb. 15 and Feb. 23, 1945, and proved to be *Nemoria delicataria* Dyar.

PLATE 9
Larva of *Nemoria delicataria*, enlarged X approx. 3½. Photo courtesy L. A. Co. Museum.

The following incomplete notes were made:

Mature larva. Length, 19 mm.

Body; ground color, light tan, with areas of russet brown on the prominent protrusions. The entire larva is covered with minute cream colored spicules which give it an encrusted appearance. The first segment bears four nodules on its anterior portion placed dorsally and in line. Two of these, which are closest to the mid-dorsal line are russet brown. The posterior portion of this segment bears two more warty tubercles close to the mid-dorsal line. The second segment carries a large irregular warty prominence, dorso-laterally placed. An equivalent tubercle on the third segment is very much reduced in size. The tubercle of the fourth segment is large, and inclines anteriorly and laterally.

On the fifth, sixth and seventh segments the dorso-lateral tubercles are flange-like, and very prominent. On the eighth segment the flange is much reduced and less spiculated along the edges. There is a single small warty tubercle on the mid-dorsal line. The ninth segment is free of tubercles and flanges. The tenth segment has a pair of tall conical tubercles, one each side of the mid-dorsal line. They rise superiorly and do not incline anteriorly.

The spiracles, except for the first, second and last, are minute, and almost impossible to distinguish. They are light tan, with brown circlets.

Legs, concolorous with body except for a slight pinkish tinge. The single pair of prolegs, and anal prolegs are edged with dull pink. Crochets, light brown.

The abdominal surface of the larva is slightly lighter in color than the dorsum.

Head, concolorous with body, and covered by the same character of incrustation. Mouth parts, slightly lighter. Ocelli, light brown.

The larva has the habit of quivering or jerking its body when disturbed or when moving about.

PLATE 10

Pupa of *Nemoria delicatoria*, enlarged X approximately 3½. Photo courtesy L. A. Co. Museum.

Pupation occurs on the foodplant. A delicate fragile cocoon is formed, on the outer surface of which small fragments of the leaf are incorporated.

PUPA. Length, 13 mm.

The shape is very similar to that of *punctularia*, and the color a very light brown, mottled with rather indistinct irregular brown dots. The surface is finely granular, and there are no setae arising from it.

The cremaster bears eight short recurved hooklets of a glistening bright red-brown.

Shortly before emergence the wing cases assume a greenish black shade.

The mature larva is illustrated on Plate 9, and the pupa on Plate 10.

NOTES ON PACIFIC COAST MARINE ALGAE, II

By E. Yale Dawson

Setchell and Gardner, 1920, p. 175, remarked on a flattened *Codium* from La Jolla distributed in Phycotheca Boreali-Americana under the name *Codium Lindenbergii*. At that time they referred the specimens to *Codium tomentosum* with the following statement: "We are not satisfied in referring the plant of Southern California to *C. tomentosum* and feel that it is probably an undescribed species. More experience with the living plant is needed, however, satisfactorily to determine its exact status."

In December of 1944 a great many specimens of this flattened *Codium* were found cast ashore at La Jolla. Additional material was also found on the shore of Todos Santos Bay near Punta Banda, Baja California, and it is now possible to identify the species with some assurance. The specimens are undoubtedly of *Codium simulans*, described from San Marcos Island in the Gulf of California (Setchell & Gardner, 1924, p. 706) and since found to be a common species in that region (Dawson, 1944, p. 206). The illustration of the type of *C. simulans* is an almost exact match for dried specimens from La Jolla and Punta Banda. The characters of the utricles, moreover, do not disagree with those of Gulf of California material.

Our knowledge of the Codia of the Gulf of California is really very limited (Dawson, 1944) for specimens from that region have not been preserved except in the dry state, and we do not know how flat or how nearly cylindrical some of the specimens were in nature. *Codium simulans* and *C. cuneatum* are surely flattened species, but the relative flatness of such plants as were named *C. amplivesiculatum* and *C. longiramosum* can only be guessed from the dried samples. Comparison of dried specimens of *C. simulans* from La Jolla with the illustrations of the latter two entities suggests that they are truly flattened. It is of further interest that some La Jolla specimens of *C. simulans* have an aspect intermediate between *C. amplivesiculatum* and *C. longiramosum*. The author has already voiced suspicion (opus. cit.) that these "species" may be growth forms of the common and variable *C. simulans,* but their exceedingly large utricles present a definite problem which must be studied with the aid of much more material before further enlightenment will be forthcoming.

Codium Palmeri sp. nov.

Figs. 1-4

Thallus e disco parvo spongioso ad 40 cm. altus, parte inferna stipitata cylindrica, 3-5 mm. diam., 2-3 cm. longa, plus minusve ramosa subinde in lobos latos, 2-3-chotome partitos, apice rotundatos abeunte; lobis 2-3 mm. crassis ad 5 cm. vel ultra latis; utriculis pro more 400-500 μ longis, 65-160 μ latis, ratione varia dimorphicis, gracilioribus 65-90 μ latis quam utriculis 140-160 μ latis multo magis obviis, saepius (statu juvenili praesertim) sub apice rotundata constrictis, adultis pilis 4-6 deciduis aut ipsorum basibus verticillatim sub constrictione positis ornatis; membrana pro more apice incrassata ad 25 μ; gametangiis in parte utriculi inferna, fusiformibus, 220 μ longis, 60-70 μ diam., membrana gracili.

Thallus arising from a small, spongy disc, up to 40 cm. high, the lower, stipitate portion cylindrical, 3-5 mm. diam., 2-3 cm. long, more or less branched and abruptly flattened into broad, di-trichotomously branched lobes rounded at the apices; lobes 2-3 mm. thick and up to 5 cm. or more wide; utricles mostly 450-500 μ long, and generally 65-160 μ broad, exhibiting more or less prominent dimorphism, the more slender utricles, 65-90 μ broad, much more abundant than those 140-160 μ broad, often, especially in young utricles, with a constriction just below the rounded apex, at maturity with a whorl of 4-6 deciduous hairs or their peg-like bases just below the constriction; membrane usually thickened at the apicse, up to 25 μ thick, gametangia borne below the middle of the utricles, fusiform, 220 μ long, 60-75 μ diam., with thin membrane.

Type: Collected by Edward Palmer at Guadalupe Island, Baja California in 1875—number 207177 in the Herbarium of the University of California (Fig. 2).

The two plants of this collection were examined as late as 1919 by F. S. Collins in the D. C. Eaton herbarium of Yale University. At that time Collins sent the smaller specimen to Professor Setchell at the University of California and made a tracing of the larger plant. It is from this tracing that figure 1 was drawn. At the time of this writing, those in charge of the Eaton Herbarium have been unsuccessful in relocating the large specimen which otherwise would have been designated as type.

In 1920, Setchell and Gardner first referred these specimens to *Codium latum,* but in describing them pointed out certain differences from the Japanese plants. In 1930, they again cited these plants under *C. latum* but with greater misgivings. Their chief reason for referring them to that species was "the existence of a distinct whorl or verticil of hairs a little below the broad apex of each utricle." That this character is a poor one upon which to base such a reference may be judged from a study of other Codia in which the presence or absence of these hairs is variable. Moreover, typical specimens of *C. latum* from Japan have a very different habit. The very broad, essentially ovate blade which in most cases is simple, certainly does not resemble closely the twice or thrice dichotomous, ligulate blade of *Codium Palmeri.*

Setchell had undoubtedly reached a decision concerning the distinctness of this species from *Codium latum,* for in manuscript notes he adopted the name *Codium Palmeri* in all references to the Guadalupe Island plants. It has seemed best to retain this manuscript name and to place it on permanent record as that of a very unusual and interesting plant of our Pacific Coast.

Blossevillea Brandegeei Setchell & Gardner, has hitherto been reported only from the type locality, Guadalupe Island, Baja California where it has been collected repeatedly. This species has been found for the first time at La Jolla, California. A large plant, 45 cm. high, bearing abundant compound receptacles and lacking only the holdfast and lowermost part was cast ashore near the "Beach Club", La Jolla, October 22, 1944.

Cystoseira neglecta Setchell & Gardner, heretofore known only from Santa Catalina Island, was found in beach drift at La Jolla, March 30, 1945. Epiphytic on the specimen were many young plants of *Coilodesme californica.*

Grateloupia prolongata J. Agardh, known on this coast from the upper Gulf of California and from central Mexico, was found in tide pools near the "Beach Club", La Jolla, March 11, 1945.

Pikea pinnata Setchell, thought, heretofore, to reach its southern limit of distribution in San Luis Obispo County, has been found in drift weed at Coronado, California, November 2, 1944.

Tylotus Cunninghamii (J. Agardh) Kylin, is known in the literature only from the type locality, Santa Barbara, California. Specimens cast ashore at La Jolla, July 17, 1944 extend the distribution considerably.

Callymenia angustata Setchell & Gardner. A sterile plant that seems in every way to agree vegetatively with this species has been found in drift weed at Mission Beach, California. The specimen is somewhat larger (17 cm.) than the type and previously known material from Bahía Santa María, Baja California and Bahía Tepoca, Sonora.

Plocamiocolax pulvinata Setchell, has been found parasitizing *Nienburgia Andersoniana* at La Jolla, California, in November, extending the known range southward from Pebble Beach, Monterey County.

Gracilariophila Gardneri Setchell, has not previously been reported south of Santa Monica, California. It has been found parasitizing *Gracilaria Andersonii* at La Jolla in December.

Stromatocarpus Gardneri Setchell, previously known only from Santa Monica, California, has been found parasitizing *Pterosiphonia Baileyi* at La Jolla in December.

Gonimophyllum Skottsbergii Setchell, previously known to parasitize *Botryoglossum, Cryptopleura* and *Hymenena* from Friday Harbor, Washington to Monterey, California has been found on *Cryptopleura violacea* dredged from a depth of 20 meters off Point Loma, San Diego, California, June 3, 1943. Both polysporic and cystocarpic examples were detected.

Ceramium codiophila Setchell & Gardner, is reported for the first time since its discovery in material from Guadalupe Island, Baja California. It was found growing abundantly on *Codium fragile* cast ashore at La Jolla, California, in November, 1944.

Amplisiphonia pacifica Hollenberg, known heretofore from San Mateo County to Orange County, California has been detected in dredge samples taken in February from a depth of 25 meters in Bahia de Todos Santos, Baja California. The specimens are tetrasporic and were attached to the holdfast of a young *Eisenia* plant.

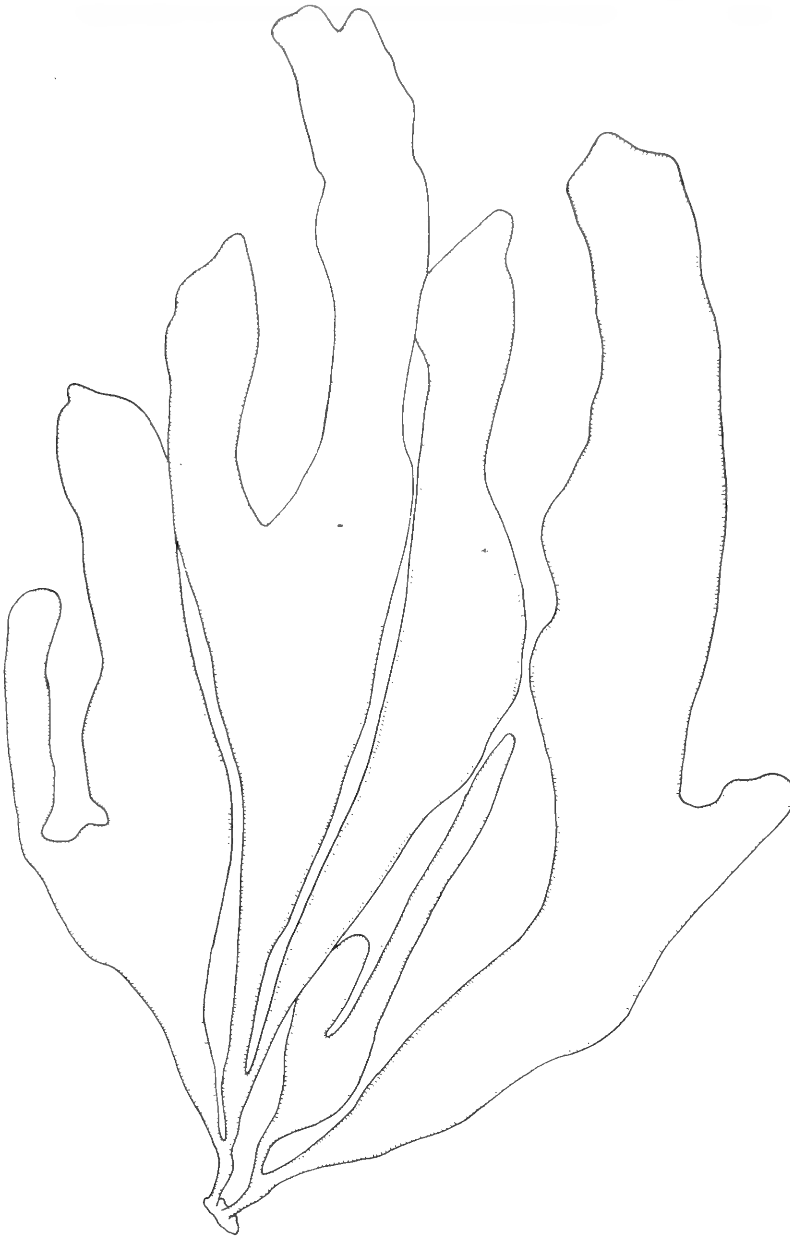

PLATE 11

Fig. -1. *Codium Palmeri.* Sketch from a tracing made in 1919 by F. S. Collins of the large plant of the type collection at that time in the D. C. Eaton Herbarium of Yale University. X ½.

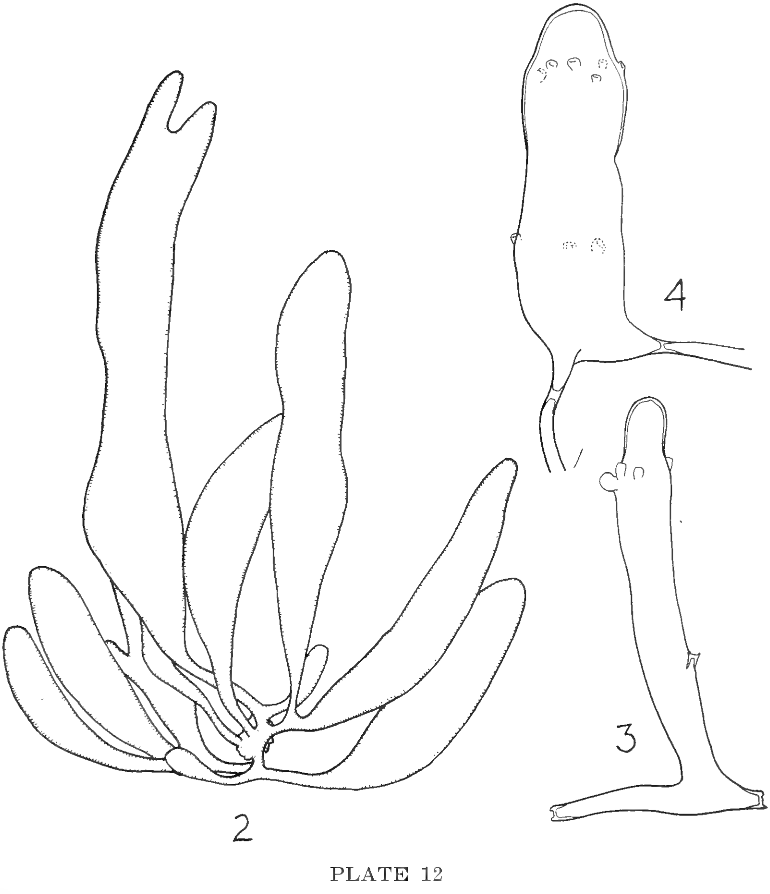

PLATE 12

Fig. 2. *Codium Palmeri.* Sketch of the type specimen, Herb. U. C. 207177. X ½.

Fig. 3-4. *Codium Palmeri.* Examples of both the robust and slender types of utricles. X 100.

THE ACTEOCINA OF SALTON SINK, COLORADO DESERT, CALIFORNIA

By G. Willett

Los Angeles County Museum

The fact that the Colorado Desert was formerly connected with what is now the Gulf of California is generally accepted by geologists. In the book "The Salton Sea," by D. T. MacDougal and collaborators (Carnegie Inst., Wash., 1914), W. P. Blake states (p. 3) that the Salton Sink and contiguous territory was covered by the ocean in Middle Tertiary. According to E. S. Free (op. cit.: 26), the sea was absent from the lower part of the sink in late Tertiary, and also just previous to the post-Tertiary uplift, but there was a long intermediate period of which nothing is known. During this latter period there may have been a marine occupation, followed by the building up of the Colorado River delta and consequent shutting out of the sea.

The Tertiary sea has left numerous Miocene fossil marine deposits in the Carrizo Creek region and other localities, but the common molluscan fossils (or subfossils) found in the immediate vicinity of the present Salton Sea are evidently of Quartenary age, and are almost entirely typical of fresh water.

R. E. C. Stearns (Proc. U. S. Nat. Mus., 24(1256), 1901: 287), in discussing this latter fauna, mentions having taken near Indio specimens of *Tagelus* and a single example of *Ocinebra (Tritonalia) poulsoni* Nuttall. Nothing is said regarding the condition or apparent age of these marine shells, but it would appear probable that they were not living at the same time and in the same locality as such fresh-water genera as *Anodonta, Helisoma* and *Paludestrina,* the common members of the fauna in the near vicinity of Salton Sea. It is entirely possible that the *Tagelus* and *Tritonalia* may have washed down from an earlier deposit at higher levels.

However, one supposedly marine genus has been found with the fresh-water genera by several collectors on different occasions, under conditions and in a state of preservation which appear to me to indicate that it might have been contemporaneous with the fresh-water fauna. This is the genus *Acteocina* (*Tornatina* of some authors, *Retusa* of others).

At least ten or twelve years ago the late Fred M. Reed, of Riverside, California, brought to me a small vial of specimens of *Acteocina,* stating that he had collected them on the shores of Salton Sea. As the locality was so unusual, I assumed (unjustifiably, it now appears) that Mr. Reed had made a mistake in his collecting data. Within the past year several collectors, including Miss Edna T. Cook and Dr. Wendell O. Gregg, have brought in specimens from Salton Sea similar to those of Mr. Reed, so there can now be no doubt as to the locality.

The fact that this supposedly marine genus is to be found in company with several fresh-water genera, apparently in the same state of preservation, poses an ecological problem that appears difficult to solve. If these genera were really contemporaneous—as I believe they were—the most reasonable explanation might be that *Acteocina* had lived through the change from salt to fresh (or brackish) water, a change that may have been very slow and perhaps interrupted one or more times by temporary invasion of the sea. If the marine mollusk had been transferred directly, by birds or other agencies, from the ocean to the ancient fresh-water lake (Blake Sea, of some authors; Lake Cahuilla, of others), it would seem unlikely that it could survive the sudden change in habitat.

As the little shell under discussion appears to differ somewhat from known members of the genus, it seems advisable to give it a name. Therefore, it may be known as:

Acteocina anomala sp. nov.—Shell of about 4 whorls, very small, cylindrical, white, smooth except for growth lines; spire varying from considerably elevated to only slightly so, with summits of whorls either tabulated or rounded; aperture five-sixths to seven-eighths the length of shell, narrow posteriorly, rounded anteriorly, with thin coating of enamel on inside border; outer lip thin, usually slightly constricted near widening of aperture; inner lip calloused, with slight fold at its insertion.

Type, No. 1082 Los Angeles County Museum; paratype, No. 1083 same collection. Both collected by Dr. Wendell O. Gregg, together with 50 additional specimens, near shore of Salton Sea, Imperial County, California. Paratypes also in collections of Dr. Gregg and Miss Edna Cook. The type, the largest specimen seen in the series examined, measures: length 3.8, diameter 1.8 millimeters. The paratype is more slender, with higher spire, and measures 3.5x1.4 mm.

This little shell is probably more like *Acteocina inculta* Gould than any other of its Recent relatives. It differs from that species in being smaller and more slender, with narrower aperture and thinner inner lip. Also, the sides of the body whorl are much more nearly parallel, rounding off abruptly anteriorly rather than gradually. The spire is usually shorter than that of *inculta,* but this feature is variable.

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VOLUME 44 - - - - - - - - - PART 2, 1945

NEW OR LITTLE-KNOWN CRANE-FLIES FROM CALIFORNIA

(TIPULIDAE, DIPTERA), I

By CHARLES P. ALEXANDER

In the present series of papers, I hope to consider certain of the rare and undescribed species of crane-flies that have been taken in California. During recent years there has been a vast increase in our knowledge of these flies in western North America and it is hoped that such studies may be continued during the future years and finally result in a comprehensive treatment of the group. A recent summary of the Tipuloidea of Northeastern North America* includes approximately 500 species of these flies. Due to its great size, and to the virtually unparalleled range both in altitude and latitude among our states, as well as a vast diversity in ecological conditions, it seems probable that California will be found to possess more species of these flies than occur in the above-mentioned section of North America. It will be many years before we have an adequate picture of the Tipulid fauna of California and to achieve such an end, it will require the co-operation and friendly interest of many entomologists and collectors. I would be most grateful for any specimens of these flies, particularly from the higher mountains and those pertaining to the spring fauna of the southern third of the state. The types of the new species here described are preserved in my collection.

1. TIPULA (LUNATIPULA) DIACANTHOPHORA sp. n.

Allied to *unicincta;* size large (wing, male, 19 mm.) ; general coloration of thorax light gray, the praescutum with four brown stripes, the narrow intermediate pair light reddish brown, the laterals slightly wider and darker brown; wings conspicuously patterned, the basal third chiefly yellow, the outer portions more grayish brown, patterned with darker brown and whitish subhyaline; outer radial field and a broad band before cord medium brown; a broad obliterative band before cord; male hypopygium with the tergal lobes slender, separated by a narrow U-shaped notch; inner dististyle with the dorsal and posterior crests long-extended, pale, the margin microscopically serrulate; gonapophysis with median arm expanded at apex and produced into two

*Alexander, Charles P. The Diptera or true flies of Connecticut. Tanyderidae, Ptychopteridae, Trichoceridae, Anisopodidae, Tipulidae, Conn. State Geol. and Nat. Hist. Surv. Bull. 64: 183-486, index 501-509; figs. 18-55 (with 389 individual illustrations) ; 1942 (published in 1943).

divergent spines; eighth sternite with lateral lobes extended into a single fasciculate bristle; central area of sternite with the anterior group of setae dilated on their outer ends.

Male: Length about 18 mm.; wing 19 mm.; antenna about 4.6 mm.

Frontal prolongation of head reddish brown, dusted with gray, especially above; nasus short and stout; palpi black, more or less pruinose. Antennae with scape brownish yellow, pedicel clearer yellow; first flagellar segment obscure brownish yellow, darker at near midlength; outer flagellar segments brownish black, the apices of the more proximal ones a trifle paler; flagellar segments weakly incised; longest verticils exceeding the segments in length. Head in front and on anterior vertex gray, on posterior vertex more brownish gray, with the faintest indication of a median capillary darker vitta.

Pronotum brownish gray. Mesonotum light gray, the praescutum with four brown stripes, the narrow intermediate pair light reddish brown, the laterals broader and darker brown; median gray stripe wider than the subtending intermediate brown lines, narrowed behind; scutal lobes each with two reddish brown areas. Pleura variegated with reddish brown and gray, the paler areas including most of the ventral sternopleurite and the narrower ventral anepisternum; dorsopleural region more buffy yellow. Halteres with stem obscure brownish yellow, brighter basally, the knob dark brown. Legs with the coxae light brown, sparsely pruinose; trochanters brownish yellow; femora and tibiae obscure yellow, the tips brownish black, more narrowly so on the latter; tarsi light brown, passing into black outwardly: claw (male) with a long tooth. Wings conspicuously patterned, the basal third chiefly yellow, the remainder with the ground grayish brown, patterned with darker brown and whitish subhyaline; the darker areas include the stigma, a small spot at end of Sc_2, and the arculus; outer radial field and a broad band before cord somewhat paler brown; a broad obliterative band before cord, reaching bases of cells M_3 and M_4 and thence more diffused to the posterior border; centers of outer medial cells slightly brightened; bases of cells *R* to *2nd A* narrowly pale; narrow pale streaks along vein *1st A* and at outer end of cell *1st A* near posterior portion; veins brown, more brownish yellow in the brightened fields. Venation: *Rs* a little more than twice *m-cu; m* longer than petiole of cell M_1.

Abdominal tergites chiefly gray, with a weakly indicated median brown stripe, the fourth segment darker brown; outer tergites more interspersed with yellow; lateral tergal borders broadly obscure yellow, the caudal margins more narrowly so; sternites reddish, the caudal borders narrowly yellow; hypopygium brownish yellow to light brown. Male hypopygium (Fig. 1) having the ninth tergite, *9t*, with the lobes unusually slender, lying subparallel, the median notch correspondingly narrow, deep U-shaped; dorsal surface of tergite with a deep median furrow extending the entire length. Ninth sternite, *9s*, with the appendage appearing as a large elongate cushion. Basistyle, *b*, entire; lower ventral angle produced into a short sclerotized blade. Outer dististyle at apex expanded into a broad spatula that is provided with numerous black setae, some of the outer ones very long. Inner dististyle, *id*, with the beak darkened, relatively narrow; lower beak expanded at apex into a rounded black knob; dorsal crest becoming high and much produced behind, the outer margin microscopically serrulate and very pale; outer basal lobe large and broad, the apex obtuse; sensory area placed near base of lobe; vestiture of lobe yellow, long and abundant, some of the apical and posterior ones very long. Gonapophyses, *g*, with the paired lateral rods acute; a shorter median structure has a stout, gently arcuated stem that is expanded at apex and produced into two strong divergent spines, their tips acute. Eighth sternite, *8s*, with the lateral lobes relatively slender, at tip extended into a single powerful reddish bristle, the elements comprising it so completely united that the fasciculate nature is virtually lost; on mesal face of lobe with two smaller flattened bristles; along mesal margin near base with a row of long bent setae that merge into a more numerous group at the midline; central area with the outer median lobe suboval, provided with two groups of setae that are remarkably expanded at their tips into flattened frond-like blades; posterior median lobe expanded outwardly, its apical border weakly emarginate; surface clothed and bordered by abundant long fimbriate setae.

Holotype, ♂, Strawberry, Tuolumne County, August 6, 1939 (T. H. G. Aitken).

The most similar described species are *Tipula* (*Lunatipula*) *bigeminata* Alexander and *T.* (*L.*) *unicincta* Doane, which agree rather closely in size and color. The present fly has the praescutal stripes differently colored and with the structure of the male hypopygium distinct. The differences in the hypopygial characters from *unicincta* are very marked and include almost every structure of the organ. The unpaired gonapophysis is somewhat as in the otherwise distinct *T.* (*L.*) *spatha* Doane.

2. TIPULA (LUNATIPULA) MODOC sp. n.

Size medium (wing, male, about 16 mm.); general coloration of thorax gray, the praescutum with four entire reddish brown stripes; nasus present; antennae with basal three segments yellow, the remainder very weakly bicolored; flagellar segments strongly incised; wings infuscated, with a restricted darker brown and more extensive whitish subhyaline pattern, the latter including a band before cord that reaches the posterior border of wing along vein M_4; abdomen yellow, the tergal stripes poorly defined, the median one virtually lacking; male hypopygium with the caudal margin of tergite produced into two submedian spines that are weakly divergent; outer dististyle strongly narrowed on distal third; inner dististyle with the beak very slender, lower beak lacking, dorsal crest very small, erect; outer basal lobe a large blade that is extended at tip into a long curved spine; eighth sternite narrowed outwardly, its caudal margin fringed with abundant long reddish setae.

Male: Length about 16 mm.; wing 16.5 mm.; antenna about 5 mm.

Frontal prolongation of head obscure yellow, slightly more darkened medially on sides; nasus long and slender; palpi with basal two segments obscure brownish yellow, outer segments black, incisures paler. Antennae moderately long; basal three segments yellow, remainder of flagellum weakly bicolored, the basal swellings more blackened than the remainder; flagellar segments very strongly incised, the outer swelling being virtually as prominent as the basal one; longest verticils exceeding the segments. Head light buffy gray in front, darker gray behind, the vertex with a conspicuous brown median vitta, this widest on the anterior vertex; vertical tubercle lacking or inconspicuous.

Pronotum brownish gray, darker brown and more bulbous at the midline. Mesonotal praescutum gray, with four entire reddish brown stripes, the intermediate pair only slightly narrowed behind; scutal lobes with similar reddish brown areas; scutellum more infuscated; mediotergite gray, with a vague central darkening. Pleura and pleurotergite more uniformly brownish gray; dorsopleural membrane buffy yellow. Halteres with stem yellow, knob dark brown, its apex paling to obscure yellow. Legs with coxae pale, sparsely pruinose; trochanters yellow; femora obscure yellow, the tips narrowly dark brown, the amount subequal on all legs; tibiae similar, the tips more narrowly darkened; tarsi passing into black; claws (male) toothed. Wings with the ground somewhat strongly infuscated, restrictedly patterned with darker brown and with extensive whitish subhyaline areas; prearcular and costal regions scarcely differentiated in color from the remainder; the darkest spots include the stigma and a confluent area over anterior cord, with small darkenings over origin of *Rs* and tip of *Sc;* some of the cells with somewhat differentiated centers in the infuscated ground; the whitish areas include major marks before cord and beyond stigma, the former reaching the posterior wing border as a seam along vein M_4; other white areas before origin of *Rs*, basal half of cell *R*, tip of vein *1st A*, a faint marginal area in cell *1st A* near vein *2nd A*, and major pale markings in bases of Anal cells; veins brown, more yellowed in the prearcular and costal fields. Venation: *Rs* about two and one-half times *m-cu*; R_{1+2} entire; *m* subequal to petiole of cell M_1.

Abdomen with tergites yellow, the first more brownish gray; median dark tergal stripe not or scarcely indicated, the sublateral pair present but much broken, chiefly represented by long brownish areas on basal portions of segments; lateral tergal borders gray; sternites more uniformly yellow; hypopygium relatively large. Male hypopygium (Fig. 2) having the ninth tergite, *9t*, entirely separate from the sternite; caudal margin with a deep V-shaped median notch, subtended by acutely pointed blackened submedian lobes and much broader and flatter blackened lateral lobes or flanges; submedian spines directed slightly laterad and thus appearing weakly divergent; dorsal surface of tergite with a membranous median furrow; on ventral face, on either side of midline, with a further blackened lobe or plate. Ninth sternite with the appendage small, conspicuously bilobed, the upper lobe with very long setae, the lower one with much shorter subappressed bristles. Basistyle, *b*, relatively narrow, entire, the inner and outer margins sinuous but not produced into lobes or spines. Outer dististyle, *od*, broad on more than the proximal half, the apex suddenly narrowed. Inner dististyle, *id*, with the beak unusually long and slender, blackened, the lower beak not developed; dorsal crest a small, elongate-triangular yellow blade that ends in an acute point; outer basal lobe very large, nearly as extensive as the main body of style, its proximal portion widely expanded, the apex produced into a long curved spine; outer margin of lobe, including the concave edge of the spine, conspicuously fringed with setae; sensory area comprised of rather numerous facets, placed on main body of style at base. Eighth sternite, *8s*, sheathing, the caudal border gently concave, fringed with abundant long reddish setae, the outermost of the series longest, their tips incurved toward the midline.

Holotype, ♂, Cedarville, Modoc County, May 29, 1939 (T. H. G. Aitken & Mont A. Cazier).

The specific name, *modoc*, is that of an important group of Indians of Lutuamian stock, inhabiting Oregon and northeastern California. The only allied species so far discovered is *Tipula (Lunatipula) perfidiosa* sp. n., which differs particularly in the details of structure of the male hypopygium, as described. The peculiar outer basal lobe of the inner dististyle is somewhat as in *T. (L.) retusa* Doane, but the general appearance and other structures of the hypopygium are entirely different in the two flies.

3. Tipula (Lunatipula) perfidiosa sp. n.

Allied to *modoc;* mesonotal praescutum brownish gray with four relatively narrow reddish brown stripes that are very narrowly bordered by slightly darker brown; wings conspicuously patterned with dark brown, pale brownish gray, and whitish subhyaline, the last including a complete band at cord and seams bordering most of the veins; abdomen obscure yellow, conspicuously trivittate with dark brown; male hypopygium with the lobes on ventral aspect of ninth tergite extended into acute points; basistyle on lower outer margin with a small spinous point; inner dististyle with the apex of the dorsal crest truncate; outer basal lobe a broadly flattened blade that extends into a slender spine; eighth sternite with the apical brush small, the setae continued basad as a narrow row adjoining the midline.

Male: Length about 15 mm.; wing 16 mm.; antenna about 5 mm.

Female: Length about 18 mm.; wing 16.5 mm.

Frontal prolongation of head brownish yellow, sparsely pruinose above at base; nasus small but distinct; palpi dark brown, the terminal segment blackened; incisures restrictedly pale. Antennae with the scape and pedicel yellow; first flagellar segment brown; remainder of flagellum brownish black to black, the stems of the more proximal segments being a little paler than the basal swellings; segments strongly incised. Head above dark gray, clearer gray in front and on the narrow posterior orbits, a narrow dark brown median vitta.

Pronotum brownish gray, patterned with darker brown, Mesonotal praescutum with the ground brownish gray, with four relatively narrow but conspicuous reddish brown stripes that are very narrowly bordered by slightly darker brown; posterior sclerites of notum with the ground color gray, the scutal lobes patterned with reddish brown; scutellum and mediotergite with a central brown vitta. Pleura brownish yellow, sparsely pruinose and very vaguely patterned with darker. Halteres with stem yellow, knob dark brown, its apex vaguely more brightened. Legs with the coxae pale brownish yellow, more darkened basally, especially the fore pair; trochanters yellow; femora brownish yellow, the tips brownish black, preceded by a subequal, somewhat clearer yellow ring; tibiae and proximal two tarsal segments brownish yellow, the tips narrowly darkened; remainder of tarsi brownish black; claws (male) toothed and conspicuously hairy. Wings conspicuously patterned with dark brown, pale brownish gray and whitish subhyaline; the darkest color includes the stigma, tip of *Sc,* origin of *Rs,* and a spot in cell *R* at near one-third the length; the slightly paler brown areas include much of remainder of wings, being broken by broad and conspicuous white seams to the veins and in the obliterative band at cord, the latter completely traversing the wing along vein M_4; wing margin in outer radial field narrowly whitened, cells R, R_1 and M more extensively whitened; veins dark brown, clear yellow in the brightened costal and prearcular fields. Venation: Rs somewhat less than three times $m\text{-}cu$; R_{1+2} entire; m subequal to or longer than the petiole of cell M_1.

Abdomen obscure yellow, both the tergites and sternites conspicuously trivittate with dark brown; lateral tergal borders yellow, the caudal margins narrowly silvery; male hypopygium chiefly yellow, the eighth segment more yellowish brown. Ovipositor (Fig. 3, *o*) with the cerci relatively stout, straight, the tips obliquely truncated and microscopically but evidently toothed; both dorsal and lateral surfaces of cerci with strong carinae; lower margin fringed with sparse long yellow setae; hypovalvae shorter, broadly compressed-flattened. Male hypopygium (Fig. 3) having the posterior border of ninth tergite, *9t*, with two divergent blackened lobes or spines that are separated by a deep V-shaped notch; ventral face near base of split with a sharp black spine that is directed laterad; on lateral portion of ventral face with a second, much longer and more slender spine. Ninth sternite, *9s*, with the appendage very unequally bilobed, the large dorsal portion with a brush of long yellow setae, the reduced subcylindrical lower lobe with small inconspicuous bristles. Basistyle, *b*, entire; outer border sinuous, opposite base of outer basal lobe of inner style produced into a small sharp spinous point. Outer dististyle flattened, the distal fourth narrowed, the entire style, but especially the outer margin and apex, with long coarse black setae. Inner dististyle, *id*, with the body heavily blackened, including the slender beak; lower beak lacking, as in the subgroup; dorsal margin and crest yellow, the latter erect, its apex truncate to broadly obtuse; near base of blade, immediately distad of the sensory area, with a conspicuous smooth-margined blackened flange; outer basal lobe a broadly flattened blade that extends into a long slender spine; inner portion of blade sclerotized and entirely glabrous; ventral portion. including the lower margin, with long coarse setae. Eighth sternite, *8s*, with the apical brush much smaller than in *modoc*, the series of setae continued basad as a narrow row of coarse punctures that are provided with large bristles; on the lateral side of this row with a large whitish subhyaline area.

Holotype, ♂, Old Fort Tejon, Kern County, May 15, 1939 (T. H. G. Aitken). *Allotopotype*, ♀.

The nearest ally is *Tipula* (*Lunatipula*) *modoc* sp. n., with which species it has been compared in the previous description.

The most conspicuous hypopygial differences are to be found in the tergite, inner dististyle, and eighth sternite. The somewhat peculiar structure of the cerci (Fig. 3, *o*) indicates a more distant relationship with *T.* (*L.*) *flavomarginata* Doane.

4. Tipula (Lunatipula) mono sp. n.

Allied to *barbata;* size small (wing, male, under 11 mm.); general coloration of mesonotum brownish gray, with four narrow, very distinct, dark brown stripes; femora obscure yellow, the tips narrowly darkened; wings with a strong and unusually uniform brown suffusion, restrictedly patterned with darker and with conspicuous obliterative areas; *Rs* not exceeding twice *m-cu;* abdomen yellow, the tergites trivittate with dark brown, the sternites with a similar very conspicuous median darkening; male hypopygium with the caudal margin of tergite bearing two very obtuse lobes that are separated from one another by a deep median split; outer dististyle long and narrow, pale; inner dististyle with the disk provided with unusually long and conspicuous tubercles that bear strong setae; outer basal lobe terminating in a narrow point or flange, with a second similar extension near the tip; appendage of ninth sternite bilobulate, its setae unusually short and strong; eighth sternite with the lateral lobes densely fringed with long yellow setae in various groups, including a very powerful roughened major bristle on either side.

Male: Length about 10 mm.; wing 10.5 mm.; antenna about 3.1 mm.

Frontal prolongation of head dark brown above, more brownish yellow on ventral third; nasus long and slender. Antennae with scape and pedicel yellow, flagellum brownish black; flagellar segments unusually simple, scarcely incised, the basal enlargement thus feebly developed; longest verticils a little shorter than the segments; scape elongate, equal to flagellar segments one and two combined. Head brownish gray, with a conspicuous narrow dark brown median stripe extending from the small vertical tubercle to the occiput.

Pronotum brownish gray, with a single narrow dark brown median spot. Mesonotum brownish gray, the praescutum clearer gray on sides, with four narrow but unusually distinct and clear cut dark brown stripes, the intermediate pair a little wider than the median ground vitta, narrowly united at their extreme posterior ends; besides the four primary stripes, the praescutum has paler brown clouds in the humeral and sublateral fields; posterior sclerites of notum gray, each scutal lobe with two separate dark brown areas; scutellum and mediotergite with a central dark brown vitta, on the latter narrowed to a point behind. Pleura and pleurotergite gray, restrictedly patterned with dark brown, most evidently so on the dorsal anepisternum, center of sternopleurite and on the pteropleurite; dorsopleural membrane clear light yellow. Halteres dark brown, the base of stem narrowly yellow, base of knob vaguely whitened. Legs with the coxae brownish gray, the fore pair somewhat darker; trochanters brownish yellow, the fore pair again slightly darkened on the outer face; femora obscure yellow, the tips narrowly darkened, the amount subequal on all legs; tibiae and basitarsi obscure yellow, the tips more narrowly more infuscated; outer tarsal segments passing into brownish black; claws (male) toothed. Wings with a strong and unusually uniform brownish suffusion, the stigma darker brown; obliterative areas restricted but conspicuous against this darkened ground, occurring as a small post-stigmal brightening and an extensive band at cord, the latter reaching the base of cell M_3; less evident pale streaks along certain of the veins, especially the distal half of *M*, all of vein *1st A* and in the bases of both cells *1st A* and *2nd A;* cell *Sc* more uniformly yellow; veins dark brown, more yellowed in the brightened fields. Venation: *Rs* relatively short, not exceeding twice the length of the relatively short *m-cu;* R_{1+2} entire; petiole of cell M_1 and *m* subequal in length.

Abdomen yellow, the tergites conspicuously trivittate with dark brown, the sternites with an even broader median brown stripe that is narrowed but scarcely interrupted on the basal rings of the segments; hypopygium chiefly obscure yellow or brownish yellow. Male hypopygium (Fig. 4) having the caudal border of ninth tergite, *9t,* produced into two stout lobes that are separated from one another by a very deep median notch or split; each lobe at apex more or less thickened and with the outer apical angle produced slightly laterad. Ninth sternite with the appendage bilobed, the margins fringed with unusually short strong spinous dark-colored setae. Basistyle entire, its posterior border unarmed. Outer dististyle, *od,* an elongate, very slender pale lobe that is provided with relatively short setae, the longest only about one-fourth as long as the lobe. Inner dististyle, *id,* complex, the main body with unusually conspicuous tubercles that bear short strong setae; lower beak blackened at tip, the beak more flattened; dorsal crest unusually extensive and conspicuous, pale, its surface with delicate microscopic parallel striolae; outer basal lobe terminating in a narrow point or flange, with a second similar extension on the margin before apex. Eighth sternite, *8s,* transverse, the lateral angles obtusely rounded, internally bearing smaller lobes that are fringed with long conspicuous setae, those of a smaller, more mesal lobe shorter and directed more toward the midline; near the lateral portion of the setiferous area on either side a single very powerful bristle that is covered with microscopic papillae, as in *barbata* and allies, these bristles strongly decussate.

Holotype, ♂, Bodie, Mono County, August 7, 1939 (T. H. G. Aitken & Mont A. Cazier).

The specific name, *mono*, is that of a Californian Indian stock of Shoshonean origin, the Eastern Monos inhabiting the general vicinity of Mono Lake. Although it differs in all details of structure of the male hypopygium, it seems apparent that the present fly is most nearly related to species such as *Tipula* (*Lunatipula*) *barbata* Doane and certain allies in the Rocky Mountain area. Details of structure of the inner dististyle and eighth sternite further this belief.

5. Tipula (Lunatipula) bisetosa Doane.

Davis Creek, Modoc County, altitude 5000 feet, July 6, 1922 (A. W. Lindsey).

6. Tipula (Lunatipula) lucida Doane.

Mount Shasta, Shasta County, east side, altitude 6000 feet, July 17, 1939 (Merton C. Lane).

7. Tipula (Lunatipula) megalabiata Alexander.

Miami, Mariposa County, June 7, 1940 (T. H. G. Aitken).

8. Tipula (Lunatipula) dorsimacula shasta Alexander.

Kingsbury Grade, Mono County, May 27, 1939 (Mont A. Cazier). Although the general appearance of this subspecies is very different from that of typical *dorsimacula* Walker, the structure of the male hypopygium is so similar that it seems best to assign it as above.

9. Elliptera astigmatica Alexander.

Sequoia National Park, Tulare County, June 6-8, 1942 (Otto Degener).

10. Elliptera clausa Osten Sacken.

Osten Sacken found numerous specimens in the wet moss in the spray of Vernal Fall, Yosemite, June 11, 1876. Although the fly is now known to have a wide range in California, I have no record of its occurrence outside the state.

Konocti Bay, Clear Lake, Lake County, May 10, 1926 (M. C. VanDuzee).

Berkeley, Contra Costa County, May 20-23, 1915 (M. C. VanDuzee).

Wildcat Cañon, Contra Costa County, April 30, 1939 (C. D. Michener).

Sunol, Alameda County, April 26, 1939 (T. H. G. Aitken).

Santa Cruz, Santa Cruz County, May 17, 1919 (E. P. Van Duzee).

Finch Creek, Hastings Reserve, Santa Lucia Mountains, Monterey County, April 29-May 21, 1943 (Jean Linsdale).

Wawona, Mariposa County, altitude 5000 feet, June 6, 1939 (Anthony Downes).

Sequoia National Park, Tulare County, June 6-8, 1942 (Otto Degener). Associated with the last species.

Herkey Creek, San Jacinto Mountains, Riverside County, altitude 5000 feet, June 10, 1940 (C. D. Michener).

Alpine, San Diego County, April 9, 1915 (M. C. VanDuzee).

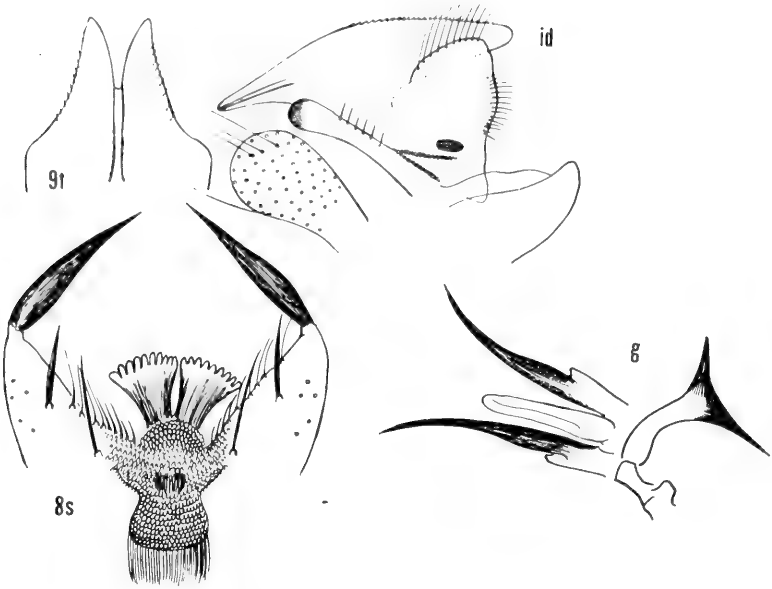

PLATE 13

Tipula (Lunatipula) diacanthophora sp. n.; details of male hypopygium. (Symbols: *g*, gonapophysis; *id*, inner dististyle; *s*, sternite; *t*, tergite).

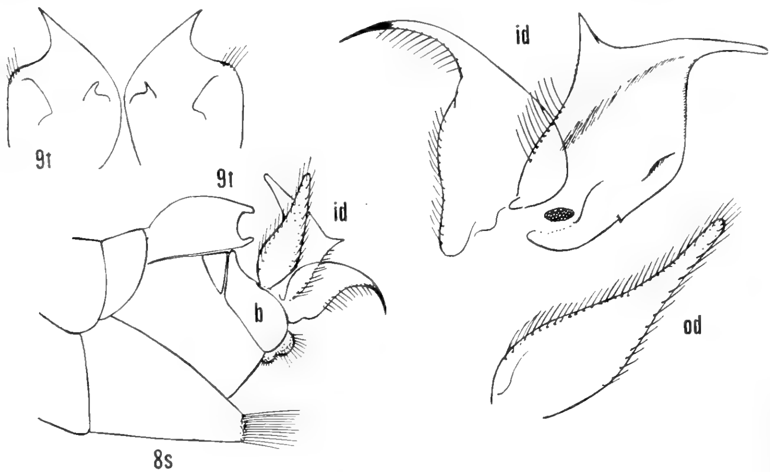

PLATE 14

Tipula (Lunatipula) modoc sp. n.; details of male hypopygium. (Symbols: *b*, basistyle; *id*, inner dististyle; *od*, outer dististyle; *s*, sternite; *t*, tergite).

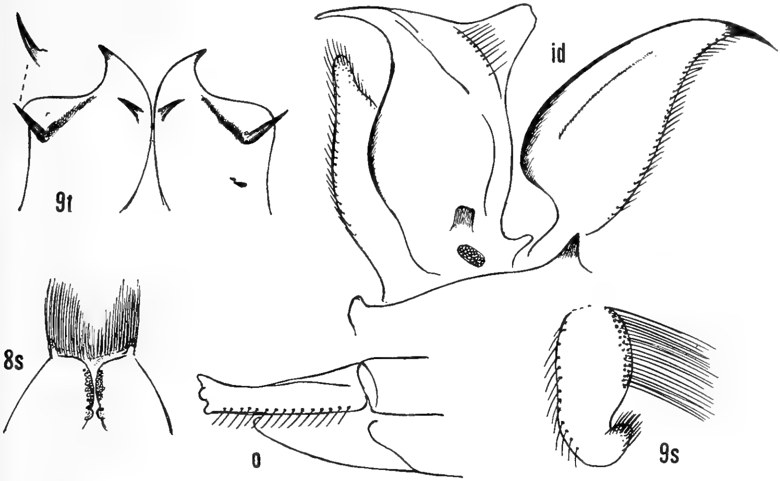

PLATE 15

Tipula (Lunatipula) perfidiosa sp. n.; details of male hypopygium. (Symbols: *id, inner* dististyle; *o*, ovipositor; *s*, sternite; *t*, tergite).

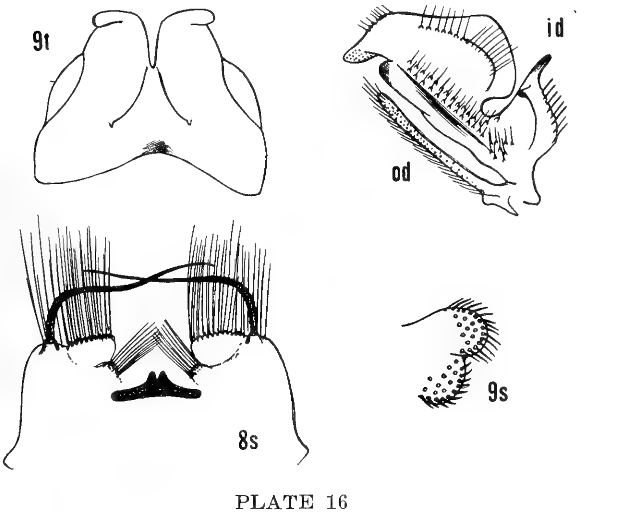

PLATE 16

Tipula (Lunatipula) mono sp. n.; details of male hypopygium. (Symbols: *id, inner* dististyle; *od*, outer dististyle; s, sternite; *t*, tergite).

A NEW GENUS, NEW SPECIES OF DERMANYSSID MITE (ACARINA) FROM TEXAS[1]

By G. F. Augustson[2]

A series of Mexican free-tailed bats *(Tadarida mexicana)* were recently received by the writer for examination. Among the ectoparasites recovered were a number of mites which an analysis proved new to science. It was found necessary to erect a new genus in the family Dermanyssidae to hold these interesting ectoparasites.

FAMILY DERMANYSSIDAE

Chiroptonyssus, new genus

Both chelae present, shearlike. Dorsal plate of both sexes entire, covering whole of dorsum in male, anterior one-third only, tapering posteriorly in female. Sternal plate small, with two pairs of setae. Genito-ventral plate small, not reaching anal plate, with two pairs of setae. Peritreme situated laterally, extending backward along rim of fourth coxal pit. Anal plate eggshape in female. Legs moderate, second pair stouter than others in both sexes. Coxa of leg II with a single spine on upper anterior angle in both sexes. Femora of leg III in males with a large, prominent spine.

Genotype: Chiroptonyssus texensis Augustson

Chiroptonyssus texensis n. sp.

Holotype female

Chelae shearlike, the movable blade rather broad (fig. 4); epistome straight, longer than the outwardly curved hypostome; palpi, and rest of mouth parts as in other members of Dermanyssidae; first pair of legs long and thin, femora of second pair as broad as long, caruncles pulvilliform, claws present on all tarsi, coxa of second leg (fig. 3) with a spine above; sternal plate (fig. 2) small, arched, with two pairs of setae; genito-ventral plate (fig. 2) with two pairs of setae, genital aperture situated well forward between coxae III, extending slightly under sternal plate; anal plate (fig. 2) eggshape, longer than broad, with three setae, posterior margin with a weakly chitinized edge; venter with numerous, scattered, equal, thin setae; peritreme long and thin, extending from coxae I to, and nearly surrounding, coxae IV; dorsal plate (fig. 1) broad anteriorly, covering anterior third

[1]Contribution from the Eighth Service Command Laboratory, Fort Sam Houston, Texas.

[2]Captain, Sanitary Corps, AUS, Entomologist.

of dorsum, tapered posteriorly, not reaching posterior margin of dorsum, numerous thin, scattered setae.

Allotype male

Male essentially the same as female, with the usual modification of the chelae, and the fused ventral plates as in other members of Dermanyssidae; femora of leg III (fig. 5) with a prominent spine, acuminate, at an angle to the segment; dorsal plate entire, covering most of dorsum.

Holotype: a female, collected from *Tadarida mexicana,* Fort Sam Houston, Texas, 21 August 1944. Deposited in the U. S. National Museum.

Allotype: a male, collected and deposited as above.

Paratypes: nine females, one male, collected as above, retained in the Eighth Service Command Laboratory.

Type Host: *Tadarida mexicana.*

Type Locality: Fort Sam Houston, Bexar County, Texas.

Remarks: this new mite is located close to *Liponyssus* Kolenati and *Neoliponyssus* Ewing, from which it can be separated, among other things, by the presence of only two pairs of setae on the genito-ventral plate of the female, and the large dorsal plate in both sexes. The majority of the specimens collected in this series were obtained from the wing membranes of the host, along with ticks, identified by the writer as *Ornithodoros stageri* Cooley and Kohls. As the host roosted in close proximity to military personnel, it would be of interest to know if they attack humans. It is known that the tick found with them does.

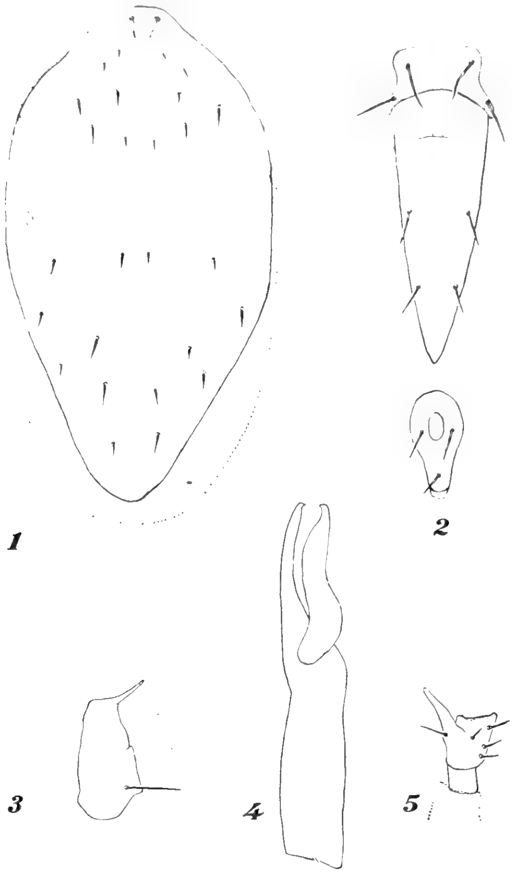

PLATE 17

Figure 1. *Chiroptonyssus texensis* Aug., dorsal plate, holotype, female.

Figure 2. *Chiroptonyssus texensis* Aug., ventral plates, holotype female.

Figure 3. *Chiroptonyssus texensis* Aug., coxa II, holotype female.

Figure 4. *Chiroptonyssus texensis* Aug., chela, a paratype female.

Figure 5. *Chiroptonyssus texensis* Aug., femur III, allotype male.

TWO NEW VARIANTS IN CALIFORNIA COLIAS EURYTHEME

(Lepidoptera, Pieridae)

ROBERT W. L. POTTS
University of California

Two apparently new variants of the highly variable *C. eurytheme* complex are deserving of description. Names have not been applied inasmuch as the author feels that it is not desirable to propose names which would inevitably be placed as synonyms since their grade would so definitely be below that of the subspecies, the lowest category recognized by the International Rules of Nomenclature.

An early spring variation as illustrated (see Plate 18), has the outer margin of the forewing reduced into triangular intervenal spots. Color is as in the so-called *ariadne* or vernal form, with the orange areas limited. Collected 1.5 miles northwest of Grayson, California on February 18, 1944 by Pedro Galindo and Ray F. Smith. Two other specimens taken on the same date are similar, one with slightly more, one with less border reduction. A specimen very nearly identical to the type was taken in the vicinity of Los Banos, California on March 30, 1944 by Pedro Galindo and W. C. Reeves. Eleven further specimens taken on the first date were generally typical of *ariadne,* while twenty additional specimens taken on the latter date were more typically *eurytheme,* the variant being the only vernal form taken on that day. Collecting on three other dates between these two yielded only typical *ariadne* and early typical *eurytheme.*

Another variant, possibly a true aberration, was taken by the author on July 7, 1944, 3.75 miles southeast of Tracy, California. This specimen is not illustrated as the habitus agrees with typical *eurytheme* except for the remarkable fact that the black maculations are replaced as follows: the fuscous scales of the basal area of the wings approximately normal in color, scales of the cell spot of the forewing dark grey-brown, scales of the outer margin light grey with a slight brownish cast. A small number of grey-brown scales are intermixed in the border. Beneath, the fuscous scales nearly normal, the cell spot and four spots near the outer border of the forewing are grey-brown. The general effect is of a normal *eurytheme* with a faint silver margin instead of the normal black margin.

The abnormal coloring of the specimen was noticeable in flight, although both the behavior and flight appeared to be normal. The wings of the specimen were in the condition of softness indicating the second or third day after emergence, and the presence of the occasional yellow scales in the margin would tend to substantiate a belief that the specimen had emerged the day previous to its capture, as these scales are almost invariably rubbed off during the first or second day of flight.

A brief microscopic examination of three selected at random from several hundred other males collected on the same day in the same area disclosed the fact that one had a few silver scales among the normal black. It is possible that a certain percentage of males have a few of these abnormally colored scales scattered through the black margins. Perhaps the silver is actually an "uncolored" condition, a stage through which the normal black scale passes, however, other explanations are also possible.

The aberration and the illustrated specimen are deposited in the collection of the California Academy of Sciences.

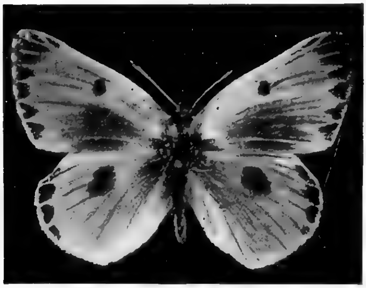

PLATE 18
Variant of *Colias eurytheme.*

CONTRIBUTIONS FROM THE LOS ANGELES MUSEUM CHANNEL ISLANDS BIOLOGICAL SURVEY

No. 30—REMARKS ON SOME RESIDENT BIRDS OF THE SANTA BARBARA ISLANDS

By G. WILLETT

Selasphorus sasin sedentarius. In the most recent distributional list of the birds of California (Grinnell and Miller, Pac. Coast Avif, No. 27, 1944: 221-224), the status of the resident hummingbirds of the northern Channel Islands was somewhat indefinite. The birds of Santa Cruz and Santa Rosa islands were only tentatively referred to *sedentarius,* the race of San Clemente and Santa Catalina; and two specimens from Anacapa were included with the mainland form, *S. sasin sasin,* but stated to be intermediate between that race and *sedentarius.*

Recently-secured specimens in the Los Angeles County Museum, although not as numerous from some islands as might be desired, throw considerable additional light upon this problem of distribution. Also used in this study were numerous specimens obtained from the Museum of Vertebrate Zoology, through Dr. Alden H. Miller, and from the D. R. Dickey Collection, through Mr. A. J. van Rossem, to both of which gentlemen my gratitude is expressed.

Since the principal characters cited (Grinnell, Condor 31, 1929: 226-227) as differentiating the two races of Allen Hummingbird are dimensional, most of this discussion will be founded on the following table of average measurements, in millimeters:

		Wing	Culmen		Wing	Culmen
San Clemente	3 ♂,	39.9	18.7 —	1 ♀,	43.2	20.6
Santa Catalina	18 ♂,	38.5	18.6 —	19 ♀,	43.0	20.4
Santa Rosa	6 ♂,	40.4	18.7 —	5 ♀,	42.4	19.5
Anacapa	9 ♂,	38.6	17.9 —	7 ♀,	42.1	19.1
Mainland	19 ♂,	38.8	16.1 —	19 ♀,	42.6	16.9

From the above measurements, it would appear that the longer wing ascribed to *sedentarius* by Grinnell is so feebly indicated as to be of little diagnostic value. The six island birds available to Grinnell were apparently somewhat above the average size and the mainland birds used were slightly below it. Length of culmen, on the other hand, seems an excellent racial character. Grinnell's statement that he found no over-lapping in size of mainland and island birds does not quite hold true in our larger series, but examples of such over-lapping are very few.

The culmen measurements appear to identify the Santa Rosa Island bird definitely as *sedentarius,* and the Anacapa bird as considerably closer to that form than to the one of the mainland. Unfortunately, I have only one bird from Santa Cruz Island, a female which measures: wing, 43.3; culmen, 18.0. One mainland female has a culmen as long as in this specimen, and one female from Catalina and another from Anacapa have one as short. Therefore, the identity of the race occurring on Santa Cruz cannot be definitely established at this time, but, when more specimens are available, it will probably prove referable to *sedentarius.*

The only color character ascribed by Grinnell to *sedentarius* that appears to be substantiated in the series at hand is the larger amount of green on the middle retrices of the female. While this is far from uniform, it holds true much more often than not. It is found in the one female from San Clemente, in all but three from Catalina, in all from Santa Rosa, but in only two out of seven from Anacapa. Two out of nineteen mainland birds also have it.

Summarizing, it would seem advisable to increase the known range of *sedentarius* to include Santa Rosa and Anacapa islands. Santa Cruz birds will probably also prove referable to the same race when more material becomes available.

Melospiza melodia subspp. Until recently, a large percentage of the island song sparrows in collections consisted of spring- or summer-taken birds, almost worthless in evaluating color characters. During the past few years the Los Angeles County Museum has secured on several of the islands a fair number of birds in fresh fall or early winter plumage, and these augmented by similar material in the D. R. Dickey Collection, probably provide the most satisfactory study series so far assembled. It is believed, therefore, that some of the results of a study of these birds may prove of interest.

One island race whose distinctness and range have not been questioned since its description is *M. m. graminea,* of Santa Barbara Island. That the short wing of this race is a good character is indicated in the following average wing measurements, in millimeters, of birds from different islands.

Santa Barbara....	6 ♂, 60.7;	5 ♀, 58.5
San Clemente.....	17 ♂, 65.4;	7 ♀, 63.0
Santa Rosa..........	15 ♂, 64.7;	7 ♀, 61.2
San Miguel..........	9 ♂, 63.6;	9 ♀, 60.1

In the series of males at hand, one from San Clemente, one from Santa Rosa, and none from San Miguel are as small as the Santa Barbara maximum. The females do not show as much difference in wing, as two from San Clemente, three from Santa Rosa, and six from San Miguel are within the maximum measurements of Santa Barbara specimens.

The name *clementae* is authoritatively used for the song sparrow of San Clemente, but the inclusion of the birds of Santa Cruz and Santa Rosa islands in this form has been questioned, mainly on geographical grounds.

As color characters are used in differentiating between some of the island races, it is important to recognize the fact that there is greater variation in color between different plumages of birds from the same island than there is between birds in comparable plumage from any two islands. Also, as the song sparrows, like most other species of the island land birds, breed early, the wear on their plumage is correspondingly early in the spring. Therefore, fall birds are quite different from those taken in February or later.

Most of the 64 skins at hand from San Clemente, Santa Rosa and San Miguel islands readily divide into two groups, one more gray, the other more brown. Unfortunately, however, both groups are represented from all the islands. From San Clemente there are six brown birds, six gray ones, and eleven more or less intermediate; from Santa Rosa, one brown, twenty-one gray; and from San Miguel, five brown, thirteen gray. To my eye, the brown specimens from the three islands are the same in color, as are the gray ones from San Clemente and Santa Rosa. The thirteen gray ones from San Miguel (twelve from Dickey Coll.) average very slightly lighter. The extreme of this lightness is found in a series of nine specimens taken by A. J. van Rossem December 28, 1930.

I am in doubt as to the meaning of the two color phases. The difference between them does not appear to be seasonal, as both have been collected on the same day. That one or the other phase might represent immature plumage has also been considered, but both have been collected from September through December, after which time plumage wear commences. Also in the Santa Rosa Island birds, all collected within a few days (November and early December), a ratio of 21 adults to one immature, or vice versa, would hardly be expected.

In addition to the slightly lighter color of the gray phase of the San Miguel Island bird, the following measurements of the hind claw substantiate Grinnell's claim (Proc. Biol. Soc. Wash., 41, 1928: 37-38) of shortness of that member in the race *micronyx*. (Birds with worn claws not considered).

San Miguel........	7 ♂, 8.0;	7 ♀, 7.8
Santa Rosa........	15 ♂, 8.7;	7 ♀, 8.7
San Clemente..	17 ♂, 9.0;	6 ♀, 8.9

After discarding specimens with badly worn tails, the following average tail measurements were secured:

San Miguel..........	8 ♂, 60.8; 4 ♀, 58.15
Santa Rosa	13 ♂, 60.7; 3 ♀, 56.7
San Clemente.....	11 ♂, 64.3; 5 ♀, 60.5

Without a larger series of specimens, it would be inadvisable to claim positive results from this study, but indications are that the song sparrow from Santa Rosa is nearest to *clementae* in color, and length of hind claw; nearest to *micronyx* in length of tail; and intermediate between the two in wing length. The culmen measures about the same in birds from all four islands.

It would appear wise to continue the use of the name *clementae* for the song sparrow of Santa Rosa Island, even though the geographical distribution is a strange one. The same treatment may well apply to the bird of Santa Cruz, at least until better comparative material is secured. Song sparrows are rare on the latter island, and the only specimens known (in California Academy of Sciences) are admittedly in too worn plumage to be of much use in evaluating racial characters.

No. 31—AN ANEIDES LUGUBRIS LUGUBRIS FROM CATALINA ISLAND, CALIFORNIA

By WILLIAM A. HILTON
Department of Zoology, Pomona College

This specimen collected by C. Henne March 5, 1941, at Middle Ranch, was with a lot of B.a. catalinae. It is from the collections of the Los Angeles County Museum, No. 13600. It was loaned me for study by Drs. J. A. Comstock and H. R. Hill of the Museum. It seems to be a new locality record for this species, in fact as far as I know it is the first account of *Aneides* from Catalina Island. Without doubt it is *A. l. lugubris* of the mainland with too few differences to justify it being called a subspecies.

GENERAL DESCRIPTION:

1. Size. Total length 99 mm, of which the tail is 47 mm.
2. Body flattened slightly from above downward, robust, a flattened cylindrical form.
3. Limbs well developed, front slightly smaller than the hind.
4. Appressed limbs overlap all but one or two costal grooves.
5. Four digits on front foot, five on the hind, well developed. Front toes from shortest to longest 1-2-4-3. Hind foot, 1-(2-5)-4-3.

6. Tail more slender than the body, well marked lateral grooves becoming fainter towards the end, about 28 in number.
7. Tail flattened latterly, higher than broad.
8. Costal grooves between the limbs 14.
9. Head moderately depressed broader than the body.
10. Eyes prominent, separated from the tip of the snout by about their length.
11. Distinct, light colored wide naso-labial lines.
12. Upper jaw overhangs the lower.
13. Line of the lip slants upward and back well behind the orbit.
14. Gular fold very marked.
15. Neck quite distinct.
16. Dorsal surface a uniform dark grey extending two thirds of the way down the sides of the body and a little farther down on the tail.
17. Tongue large fleshy, filling the mouth in front, margins thin, surface spongy, free at sides and behind.
18. Premaxillary teeth about six, smaller than the five maxillary on each side, the latter well spaced. Mandibular teeth larger, well spaced.
19. Vomerine teeth in two slender distinct patches running slantingly from the internal nares to near the middle line, a single row of 7 on each side.
20. Parasphenoid teeth in one patch well back in the mouth with about 80 well spaced teeth.

MEASUREMENTS:

Snout to anus 52 mm.	Axilla to groin 30 mm.
Anus to end of tail 47 mm.	Fore limb 17 mm.
Width of head 11.5 mm.	Longest front toe 3.5 mm.
Snout to orbit 4 mm.	Hind limb 20 mm.
Snout to gular fold 17 mm.	Longest hind toe 4 mm.
Snout to fore limb 21 mm.	Breadth of hand 6 mm.
Gular fold to anus 39 mm.	Breadth of foot 9 mm.

GENERAL REMARKS:

This specimen is uniformly dark above and much lighter below, there is no indication of spots or flecks of lighter on the back as is the case with young of this and other species. It was however smaller than the adults found on the mainland. Storer gives the length as up to 162 mm. Dunn gives 152 mm. as the length of the largest he examined. Slavin gives from 152 mm. down to 97 for adults. Bishop gives 162 mm. as the greatest length with 87 as the smallest with an average length of the adult as 118.

IMPORTANT REFERENCES:

Bishop, S. C. Handbook of Salamanders. Comstock Pub. Co. 1943.

Cope, E. D. The Batrachia of North America. U. S. Nat. Mus. Bul. 34. 1889.

Dunn, E. R. The Salamanders of the Family *Plethodontidae*. Smith College, Aniv. Pub. 1926.

Slevin, J. R. The *Amphibia* of Western North America. Occasional Papers, Calif. Ac. Sc. XVI. 1928.

Storer, T. I. A Synopsis of the *Amphibia* of California. Univ. Calif. Pub. Zool. V. XXVII. Berkeley, Calif. 1925.

PLATE 19

Aneides lugubris lugubris from California, Catalina Island. From above and below about natural size.

MARINE ALGAE ASSOCIATED WITH UPWELLING ALONG THE NORTHWESTERN COAST OF BAJA CALIFORNIA, MEXICO

By E. YALE DAWSON

The littoral marine flora of the coast of northern Baja California has heretofore received scant attention. Whereas the algae of the outlying island of Guadalupe are fairly well known through the work of Setchell and Gardner (1930) only a few species have been reported from the shores of the mainland, these collected by Gardner before 1927. The lack of information cannot be attributed to a paucity of species due to unfavorable habitats, for the coast of Baja California north of latitude 30° abounds in fine, alga-rich reefs more extensive than any of those on the California coast from San Diego to Point Conception. Although in Gardner's time, 20 years ago, the inadequacy of roads made collecting difficult in northern Baja California, recent highway improvements have been such that sites as distant as Rio San Telmo can be visited in the course of a single day.

During the spring of 1945 the author had opportunity to make several collections in the region of Punta Descanso not far below the International boundary, and one collection near the mouth of the Rio San Telmo more than 100 miles farther south. The study of this material has brought forth such interesting results that a brief introductory report on these two areas, heretofore unexplored for algae, seems desirable.

McEwen, 1916, in summarizing and interpreting hydrographic observations from the north coast of Baja California, has shown the presence of several areas of upwelling in the immediate coastal region between San Diego and Cerros Island. These areas of colder water are small and lie adjacent to the coast at, or slightly south of each of several projecting headlands. McEwen shows them present in August and September, 1908 near Punta Descanso, Punta San Jose, Cabo Colnett, and Punta San Antonio. Surface temperature observations taken at that time showed horizontal thermal gradients of 2-3° C. from the centers of upwelling to points about 10 miles seaward. The present collections were made in two of these areas of upwelling and contain, as will be shown, floral elements such as are more typical of areas of colder water several hundred miles to the north on the California coast. The great majority of the species obtained represent southward extensions of distribution, only a few being as yet unreported from California. Several undescribed species appeared in the collection and will be reported on in another paper.

The collections from the Cabo Colnett area were made March 11 between the mouths of the Rio San Telmo and Rio San Rafael. In this locality the ebbing tide exposes a small reef composed partly of large cobblestones, and partly of outcropping rock with a few small pools. Reflecting the coastal upwelling of cold water, the entire collection, but for a very few species heretofore known only from more southern areas, is composed of species typical of more northern waters of southern and central California. The following are particularly noteworthy: *Haplogloia Andersonii, Weeksia reticulata, Grateloupia californica, Gigartina volans, Platythamnion pectinatum*, and *Pterochondria Woodii*. Though it was not possible to make collections on the reefs at Cabo Colnett proper, to judge from the conditions found at Punta Descanso as described below, a much larger number of cold water elements should be expected there.

The collections made in the Punta Descanso area are of particular interest in their representation of a flora widely divergent from that of similar areas in nearby San Diego County, California. Reefs on either side of Punta Descanso to a distance of two miles were visited April 8 and 22 during lows of spring tides.

The reef at Punta Descanso proper slopes rather abruptly into the sublittoral. Only a few semi-protected areas are present and except at extreme low tide, pools are rare. On this out-jutting point, the colder upwelling water is brought into direct contact with the littoral zone, and its effect is strongly reflected in the prevalence of species typical of more northern California waters. The luxuriance of growth, moreover, is unusual compared to that of most southern California stations. Several species known in southern California typically as sublittoral plants are here conspicuous in the tidal zone: *Laminaria Farlowii, Desmarestia herbacea, Gigartina californica, G. Harveyana, Zanardinula Andersoniana, Asparagopsis hamifera.* Some species known heretofore only from the region north of Santa Barbara include *Gigartina papillata, Bossea frondifera* and *Ceramium pacificum.*

On the south of Punta Descanso is an area of exceedingly extensive, almost flat reefs, extending fully 200 yards seaward from the bluffs and covered at high tide only by 3-5 feet of water. On this reef the shallow, inshore water is somewhat more effectively warmed by insolation during the diurnal portion of the tidal cycle than is the water bathing the more abruptly sloping reef at Punta Descanso proper. Seemingly in response to this warming which counteracts in part the effect of the cold, upwelled water, a few species typical of warmer waters appear, including *Sargassum Agardhianum* and *Grateloupia prolongata.* Although the flat character and exposure of these reefs are essentially the same as of reefs at Point Loma and north La Jolla in

San Diego County, California, the absence of many species typical of the warmer waters of the latter region is fully as conspicuous as the presence of the several cold water elements. Principal among these absent species are *Dictyota Binghamiae, Zonaria Farlowii, Dictyopteris zonarioides, Gigartina serrata* and *Hypnea californica. Eisenia arborea,* so abundant in the littoral in San Diego County is present only in a few deep, well protected pools.

An additional point of correlative interest is the recent discovery by Carl L. Hubbs that the fishes inhabiting the area of upwelling at Punta Descanso are also characteristic of more northern waters of the California coast. In a list of the fishes collected in this region, he will specify the northern elements in the fauna.

The species whose names are listed and annotated below have been deposited in the Herbarium of the University of California. They may be identified by the author's collection numbers that accompany them and to which references are made opposite the species names in the list.

Station I—near the mouth of Rio San Telmo, 2 miles south of Cabo Colnett (N. Lat. 30° 57′)

March 12, 1945

Ulva taeniata (Setchell) Setchell & Gardner. 50-45.

The specimens are typical in habit but show little evidence of the marginal dentations said to be common on southern California plants.

Enteromorpha tubulosa Kützing. 58-45.

Chaetomorpha antennina (Bory) Kützing. 56-45.

The exceptionally long filaments, 25cm., grew in small groups of 4-10.

Chaetomorpha clavata (C. Agardh) Kützing. 33-45.

A few solitary filaments 5-7cm. long were detected among specimens scraped from rocks. The short, strongly inflated cells up to 500 μ in diameter, with conspicuous intercellular constrictions serve easily to identify this species, hitherto not reported from this coast. See Punta Descanso material below.

Cladophora microcladioides Collins. 57-45.

Haplogloia Andersonii (Farlow) Levring. 15-45.

Ilea fascia (Müller) Fries. 31-45.

Macrocystis pyrifera (Linnaeus) C. Agardh. observed.
Cast ashore.

Egregia laevigata Setchell. 53-45.
Cast ashore. A few small plants in lower littoral tideways.

Laminaria Farlowii Setchell. 55-45.
Cast ashore.

Cystoseira neglecta Gardner(?). 52-45.
Cast ashore.

Porphyra perforata J. Agardh. 45-45.

Acrochaetium Amphiroae (Drew) Papenfuss. 35-45.
Monosporic plants in the genicula of *Bossea Orbigniana*.

Cumagloia Andersonii (Farlow) Setchell & Gardner, 32-45.

Gelidium pulchrum Gardner. 7-45.

Gelidium cartilagineum (Linnaeus) Greville. 51-45.

Leptocladia Binghamiae J. Agardh. 37-45.
Although a southward extension of range on the Baja California coast, Taylor has reported this species from the Galapagos Archipelago.

Weeksia reticulata Setchell. 38-45.
A single cystocarpic specimen 7 cm. high was found in beach drift. Its venation and internal structure are in close agreement with the original description of the species from Monterey. The distribution of this uncommon plant is extended far south of its previously known limit.

Bossea Orbigniana (Decaisne) Manza. 17-45.

Corallina gracilis var. *densa* Collins. 40-45.

Callophyllis pinnata J. Agardh. 44-45. (Fig. 8-9).

Grateloupia californica Kylin. 28-45.

Grateloupia filicina (Wulfen) C. Agardh, f. 30-45.
This variable species has been reported from our coast by Taylor, 1945, from Bahía Petatlán, Guerrero. The present carposporic plants (Fig. 10-11) are similar to some of the forms of

this species known from Japan and China (Okamura, 1937; Howe, 1924). The author was at first so struck by their dissimilarity in form to other American grateloupiae that like Howe, was tempted to consider them of an undescribed species. Further study of the cystocarpic plants, however, seems to indicate relationship to the exceedingly variable and widespread *G. filicina* from which it would at present be unwise to distinguish them. See Punta Descanso material.

Zanardinula Andersoniana (Eaton) Papenfuss. 36-45.

Agardhiella Coulteri (Harvey & Bailey) Setchell. 61-45. (Fig. 2).

Agardhiella mexicana Dawson. 24-45.

This species was described from sterile material collected in the sublittoral in the northern Gulf of California (Dawson, 1944) and is here reported for the first time on the Pacific side of the peninsula. Taylor, 1945, did not accept *Agardhiella mexicana* as distinct from *A. tenera* which occurs on the outskirts of the Gulf of California and southward along the Mexican coast. The plants of the present collection (Fig. 3-7) however, which seem to be the same as the original Gulf of California material, are easily distinguished from *A. tenera* by their cystocarps. In *A. tenera* the cystocarps are small, 1 mm. or less in diameter, and only slightly projecting (Taylor, 1937, p. 59, Fig. 9). Those of *A. mexicana* are 1.25-1.75 mm. in diameter and protrude very conspicuously from the slender branches. Characteristic of all the present specimens, as also of the original ones from the Gulf of California, are the abundant, short, acutely pointed ultimate branches. Ecologically, the two species seem very distinct. *A. tenera* is known to be quite strictly a warm water species while *A. mexicana* has been found only in waters of less than 15° C.

That *Agardhiella mexicana* is distinct from *A. Coulteri* is demonstrated by the occurrence of plants of typical *A. Coulteri* in the Rio San Telmo collection (Fig. 2). The cystocarps of *A. Coulteri* are usually well embedded in the robust branches and project little. The lax, sparsely branched habit is also distinctive.

Gardneriella tubifera Kylin. 61-45.
Parasitic on *Agardhiella Coulteri.*

Choreocolax Polysiphoniae Reinsch. 16-45.
Cystocarpic plants parasitic on *Polysiphonia Collinsii.*

Plocoamium pacificum Kylin. 10-45.

Gymnogongrus leptophyllus J. Agardh. 8-45.

Gracilaria Sjoestedtii Kylin. 22-45.

Gracilaria Andersonii (Grunow) Kylin. 34-45.

Gracilariophila oryzoides Setchell & Wilson. 23-45.
Parasitic on *Gracilaria Sjoestedtii.*

Gigartina leptorhynchos J. Agardh. 5-45.

Gigartina californica J. Agardh. 6-45.

Gigartina canaliculata Harvey. 47-45.

Gigartina volans (C. Agardh) J. Agardh. 49-45.

Rhodymenia palmettiformis Dawson. 39-45.

Gastroclonium Coulteri (Harvey) Kylin. 48-45, 59-45.

The specimens under 59-45 are dwarfed, short-stiped plants resembling Japanese material identified as *Gastroclonium ovatum.*

Platythamnion pectinatum Kylin. 4-45.

The specimens seem more like the species as it occurs in California than like Taylor's variety *laxum* described from Clarion Island, Colima. They agree with material from Monterey, but are more densely branched, the short branches being longer and more nearly approaching the length of the long branches. The main axis is branched at every second cell.

Ceramium zacae Setchell & Gardner. 12-45.

A single small plant that agrees fairly well with the original description was found epiphytic on *Pterochondria. Ceramium zacae* heretofore was reported only from Bahia San Bartolomé, Baja California.

Ceramium Eatonianum (Farlow) DeToni. 13-45.

Ceramium Evermannii Setchell & Gardner. 29-45.

Specimens in close agreement with the description of the type from Guadalupe Island occurred epiphytically in considerable abundance on several algae. Both antheridial and cystocarpic plants are present. In antheridial plants the apices are forcipate as described for tetrasporic individuals, but in cystocarpic plants the tips are little curved and rarely forcipate. The antheridia, 8-10 μ long, confined to the younger, smaller branches, are compactly clustered over the whole surface of the nodal cortications. Cystocarps are terminal and are usually surrounded by 5-7 finger-like branches such that the maturing structure resembles a plum being held in the palm of the hand with the fingers arched inward.

Centroceras clavulatum (C. Agardh) Montagne. 18-45.

Phycodrys Setchellii Skottsberg (?). 1-45.

A single specimen cast ashore may be of this species but is much more abundantly branched and of smaller proportions than plants from southern California and from Cerros Island, Baja California.

Anisocladella pacifica Kylin. 2-45.

Acrosorium uncinatum (J. Agardh) Kylin. 21-45.

Cryptopleura violacea (J. Agardh) Kylin. 9-45.

Polysiphonia Collinsii Hollenberg. 3-45.

Pterochondria Woodii (Harvey) Hollenberg. 26-45.
Epiphytic in abundance on an old blade of *Macrocystis.*

Pterosiphonia dendroidea (Montagne) Falkenberg. 14-45.

Chondria californica (Collins) Kylin. 11-45.

Chondria nidifica Harvey. 27-45.

Laurencia splendens Hollenberg. 19-45.
(*Laurencia Maxineae* Dawson).

The present collection includes specimens of a slender, finely branched, flattened *Laurencia* which is in closest agreement in size and habit with *L. splendens.* Cystocarpic and tetrasporic specimens up to 6 cm. high were epiphytic on several algae, particularly *Chondria nidifica.* Large plants, over 12 cm. high (some over 20 cm. high taken at Punta Descanso—see Fig. 5-7) were taken from tide pool rocks.

Laurencia Maxineae was described from La Jolla, California (Dawson, 1944a) from fully mature sexual and asexual specimens all of which were under 6 cm. in height. At La Jolla, *L. Maxineae* is always small and delicate. Saxicolous individuals have never been found. Smith, 1944, states that *L. splendens* grows on rocks, whereas the type was described, Smith & Hollenberg, 1943, as epiphytic on corallines. The present collections, including the Punta Descanso material, suggest that these plants are all identical, that their distribution is extensive on this coast, that they are variable in size at maturity and equally capable of growth on rocks or on other algae. In consideration of this new material which so enlarges our view of these slender, flattened laurenciae, the author is willing to reduce his recently proposed name, *L. Maxineae,* to synonymy, pending the more complete mapping of the distribution of these plants and the further study of their variability.

Laurencia diegoensis Dawson. 20-45.

Janczewskia Gardneri Setchell. 19a-45.
Parasitic on *Laurencia splendens.*

Janczewskia lappacea Setchell. 27a-45.
Parasitic on *Chondria nidifica.*

Station II—Reefs at Punta Descanso (N. Lat. 32° 16′). and two miles to the north and south

April 8, 22, 1945

Ulva Lactuca Linnaeus. 165-45.

Ulva taeniata (Setchell) Setchell & Gardner. 94-45.

Chaetomorpha clavata (C. Agardh) Kützing. 85-45.

In great abundance in middle littoral tide pools north of Punta Descanso. In most cases the plants formed dense, rope-like colonies up to 40 cm. long. The plants are 300-400 μ in diameter in upper parts and are identical with the specimens from Rio San Telmo. (Fig. 12).

Cladophora trichotoma (C. Agardh) Kützing. 154-45.

Cladophora graminea Collins. 80-45; 124-45.

Cladophora microcladioides Collins. 121-45.

Codium fragile (Suringar) Hariot. 126-45.

Ectocarpus variabilis (Saunders) G. M. Smith. 65-45.

Ectocarpus confervoides var. *pygmaeus* (Areschoug) Kjellman 119-45.

Ectocarpus granulosus (J. E. Smith) C. Agardh. 112-45.

Exceedingly abundant on rocks and algae on the flat reef south of Punta Descanso.

Haplogloia Andersonii (Farlow) Levring. 178-45.

Desmarestia herbacea (Turner) Lamouroux. 105-45; 177-45.

Juvenile specimens up to 25 cm. long were frequent in shaded places among lower littoral rocks. Large, mature plants cast ashore.

Scytosiphon Lomentaria f. *typicus* Setchell & Gardner. 169-45.

Abundant on flat reefs south of Punta Descanso.

Laminaria Farlowii Setchell. 97-45.

Abundant in rocky tide channels at Punta Descanso. Large plants up to 2 meters high and with stipes 25 cm. long were cast up from the sublittoral, but the littoral specimens were all under 1.3 meters and had stipes 5-10 cm. long.

Macrocystis pyrifera (*Linnaeus*) C. Agardh. observed.

Egregia laevigata Setchell. 119-45.

Pterygophora californica Ruprecht. 156-45.
A single juvenile specimen from the lower littoral.

Pelvetia fastigiata (J. Agardh) DeToni. 144-45.
Dominant rock cover in upper littoral zone.

Hesperophycus Harveyanus (Decaisne) Setchell & Gardner. 160-45.

Cystoseira osmundacea (Menzies) C. Agardh. observed.

Halidrys dioica Gardner. 176-45.

Sargassum Agardhianum Farlow. 155-45.
Occasional on flat reefs south of Punta Descanso.

Erythrocladia subintegra Rosenvinge. 87-45.
On *Cladophora graminea*. Up to 250 μ in diameter.

Porphyra naiadum Anderson. 111-45; 159-45.
Abundantly epiphytic on *Phyllospadix* .

Porphyra perforata J. Agardh. 91-45.
Exceedingly abundant and dominant on many upper littoral rocks. An equal abundance of this species was observed April 23 at Point Loma, but in other parts of San Diego County it is generally uncommon and rarely conspicuous.

Acrochaetium plumosum (Drew) G. M. Smith. 64-45.
Growing on an old *Rhodoglossum* fragment.

Asparagopsis hamifera (Hariot) Okamura. 104-45; 172-45.

Gelidium Coulteri Harvey. 120-45.

Gelidium pulchrum Gardner. 131-45.

Gelidium cartilagineum (Linnaeus) Greville. 114-45.

Pterocladia pyramidale (Gardner) Dawson. 130-45.

Leptocladia Binghamiae J. Agardh. 129-45.

Bossea Orbigniana (Decaisne) Manza. 102-45.

Bossea frondifera Manza. 108-45.

Corallina gracilis var. *densa* Collins. 113-45.

Corallina chilensis Decaisne, f.

Lithothrix Aspergillum J. E. Gray. 78-45.

Callophyllis violacea J. Agardh. 182-45; 99-45.

Callophyllis megalocarpa Setchell & Swezy. 181-45.

Callophyllis pinnata J. Agardh. 109-45.

Grateloupia filicina (Wulfen) C. Agardh, f. 174-45.
Identical with the Rio San Telmo material.

Grateloupia prolongata J. Agardh. 93-45; 161-45.

Abundant in little pools on the flat reefs. (Fig. 1).

Grateloupia californica Kylin. 92-45.

Zanardinula linearis (Kylin) Papenfuss. 145-45.

Zanardinula Andersoniana (Eaton) Papenfuss. 106-45.

Lobocolax deformans Howe. 146-45; 106a-45.
Parasitic on *Zanardinula Andersoniana* and *Z. linearis.*

Schizymenia pacifica Kylin. 166-45.

Gigartina canaliculata Harvey. 123-45.

Gigartina papillata (C. Agardh) J. Agardh. 117-45; 162-45.
The specimens available (Fig. 14) are in close agreement with the figure of the type and the description by Setchell and Gardner, 1933.

Gigartina Harveyana (Kützing) Setchell & Gardner. 118-45.

Gigartina spinosa (Kützing) Harvey. 134-45; 168-45.

Gigartina californica J. Agardh. 135-45; 167-45.

Gigartina leptorhynchos J. Agardh. 95-45.

Gigartina cristata (Setchell) Setchell & Gardner. 150-45.
Abundant in the middle littoral. Blades extremely variable in breadth, from 3-4 mm. to more than 2 cm. (Fig. 13).

Rhodoglossum affine (Harvey) Kylin. 101-45.

Agardhiella Coulteri (Harvey & Bailey) Setchell. 67-45.

Gardneriella tubifera Kylin. 88-45.
Parasitic on *Agardhiella Coulteri.*

Plocamium pacificum Kylin. 90-45.

Gracilaria Andersonii (Grunow) Kylin. 71-45.
North of Punta Descanso the plants are exceedingly large and luxuriant, often more than 20 cm. high. Elsewhere they are smaller in size and more like plants found in the La Jolla region.

Gracilaria Sjoestedtii Kylin. 96-45.

Gracilaria linearis Kylin. 89-45.

Gracilariophila oryzoides Setchell & Wilson. 72-45.
Parasitic on *Gracilaria Sjoestedtii.*

Rhodymenia palmettiformis Dawson. 116-45.
Scarce and atypical.

Gastroclonium Coulteri (Harvey) Kylin. 103-45; 86-45.

Spermothamnion Snyderae Farlow. 122-45; 76-45.

Ceramium pacificum (Collins) Kylin. 171-45.
Common on the flat reefs south of Punta Descanso.

Ceramium Eatonianum (Farlow) DeToni. 77-45.

Ceramium codicola J. Agardh. 122-45.

Centroceras clavulatum (C. Agardh) Montagne. 128-45; 133-45.

Pogonophora californica J. Agardh. 82-45.

Microcladia Coulteri Harvey. 102-45.

Nienburgia Andersoniana (J. Agardh) Kylin. 73-45; 170-45; 125-45.

Cryptopleura crispa Kylin (?). 84-45; 98-45.

Cryptopleura violacea (J. Agardh) Kylin. 158-45.

Acrosorium uncinatum (J. Agardh) Kylin. 81-45.

Anisocladella pacifica Kylin. 74-45.

Polysiphonia Collinsii Hollenberg. 132-45.

Pterosiphonia dendroidea (Montagne) Falkenberg. 83-45.

Pterosiphonia Baileyi (Harvey) Falkenberg. 79-45.

Laurencia splendens Hollenberg. 68-45; 175-45; 100-45. (Fig. 5-7).

Laurencia diegoensis Dawson. 115-45.

Laurencia pacifica Kylin. 164-45 (juvenile).

Chondria californica (Collins) Kylin. 75-45.

Janczewskia Gardneri Setchell. 115a-45.

Parasitic on *Laurencia diegoensis* and *L. splendens.*

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EXPLANATION OF PLATES 20, 21, 22

Fig. 1. *Grateloupia prolongata* (Dawson 93-45) X 1/3

Fig. 2. *Agardhiella Coulteri* (Dawson 61-45) X ½

Fig. 3-4. *Agardhiella mexicana* (Dawson 24-45) X ½

Fig. 5-6. *Laurencia splendens* (Dawson 68-45) X 2/5

Fig. 7. *Laurencia splendens* (Dawson 175-45) X 2/5

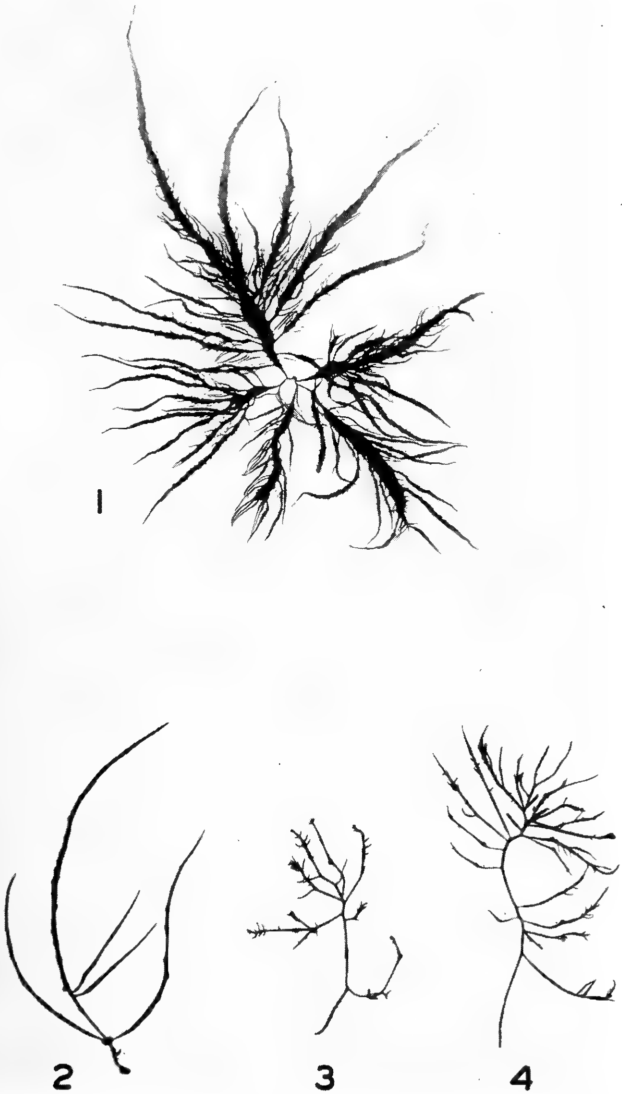
Fig. 8-9. *Callophyllis pinnata* (Dawson 44-45) X 1/3

Fig. 10-11. *Grateloupia filicina* (Dawson 30-45) X 2/3

Fig. 12. *Chaetomorpha clavata* (Dawson 85-45) X 1/3

Fig. 13. *Gigartina cristata* (Dawson 150-45) X 1/3

Fig. 14. *Gigartina papillata* (Dawson 117-45) X 1/3



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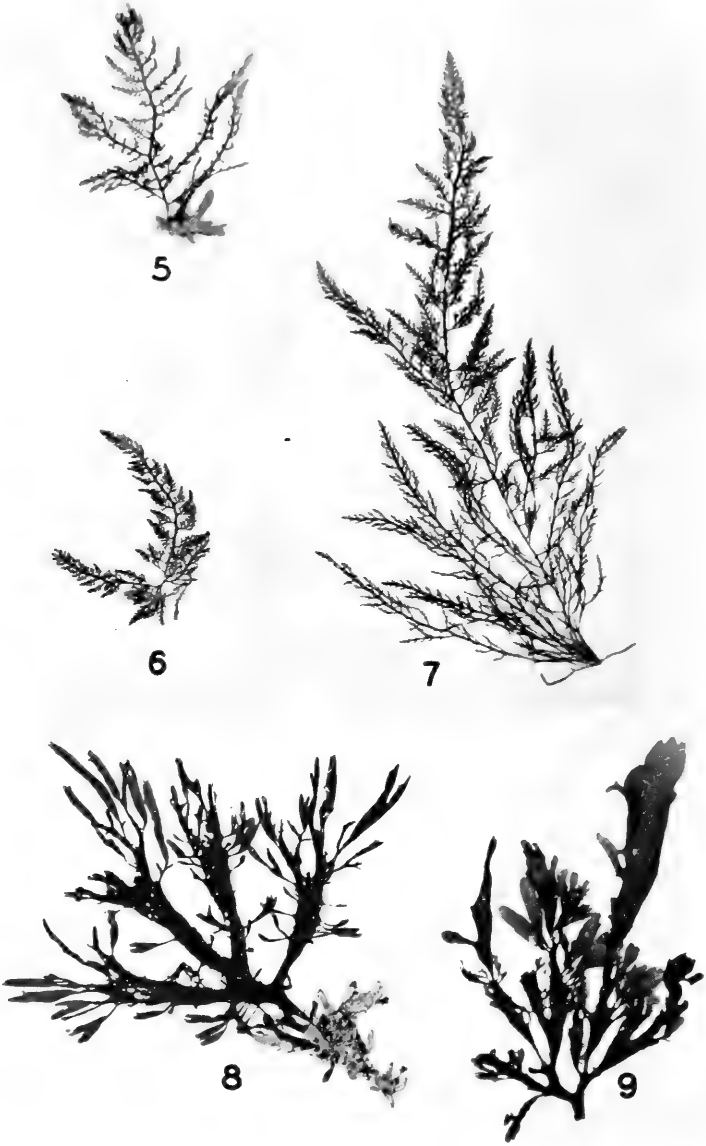

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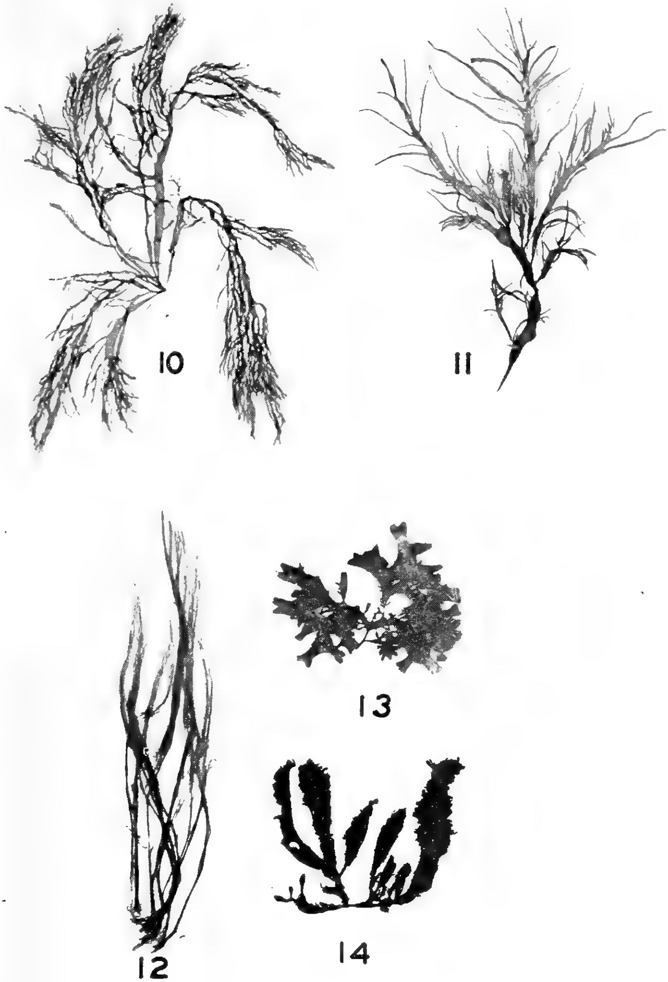

PLATE 22

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Vol. XLIV   September-December, 1945   Part 3

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Bulletin, Southern California Academy of Sciences
VOLUME 44 - - - - - - - - PART 3, 1945

NEW AND UNREPORTED MARINE ALGAE FROM SOUTHERN CALIFORNIA AND NORTH-WESTERN MEXICO

By E. YALE DAWSON
Allan Hancock Foundation, Univ. of Southern California

In the collections of marine algae recently reported from the northwestern coast of Baja California (Dawson, 1945) three undescribed species were reserved and several other species left undetermined to be reported on at the present time. In the interim, a few other undescribed species and some interesting distribution records have turned up for consideration here.

The specimens cited are all deposited in the Herbarium of the University of California, Berkeley, California.

Dr. Leon Croizat has kindly prepared the Latin diagnoses.

Besides the common and widespread *Rhodoglossum affine*, several collections of broad, flat species of *Rhodoglossum* were obtained along the northwestern coast of Baja California. Dawson 62-45 from the reef at Rio San Telmo near Cabo Colnett, March 12, 1945 has proved to be *Rhodoglossum americanum* Kylin, previously unreported south of Coronado, California. Dawson 153-45 from the wave beaten rocks 2 miles north of Punta Descanso, Baja California, April 24, 1945 is *Rhodoglossum roseum*, a distinct, cold water element of the areas of upwelling along the Baja California coast, heretofore reported only from the Monterey Peninsula, California. A few specimens of a large, broad, coriaceous plant which was at first taken for *Iridophycus coriaceum* were found on the rocks at Punta Descanso. An examination of the tetrasporic sori showed that these plants represent an undescribed species of *Rhodoglossum* which may be characterized as follows:

RHODOGLOSSUM CORIACEUM sp. nov.

Figs. 1, 10, 11

Frondibus ad 50 cm. longis, laminibus plurimis stipitatis integris 1-vel 2-dichotomis, apice arctioribus, acuminatis rotundatisve, 3-6 cm. latis, pro more quam 1 (ad 1.4 mm.) crassioribus; tetrasporangia e cellulis corticalibus intimis, cruciatim partita, in soris compressis globosis ca. 400 μ diametro disposita, dense partem totam expansam laminae tegentia.

Fronds up to 50 cm. tall, the younger parts deep rose in color, the older, thicker parts progressively darker, with one to several blades from a small, disc-shaped holdfast; blades stipitate, the lower, cylindrical portion of the stipe about 5 mm. long, merging into a flattened portion 4-5 cm. long and 3-5 mm. broad beneath the expanded blade; blades entire, once or twice dichotomous, if twice, the first dichotomy usually in or just above the flattened portion of the stipe, up to 15 cm, broad, the terminal portions of the blades narrower, tapering to an acute or to a rounded apex, 3-6 cm. broad coriaceous except for young parts, mostly more than 1 mm. thick (to 1.4 mm.); tetrasporangia developing from the innermost cortical cells, cruciately divided, forming compressed globose sori about 400 μ in diameter, densely scattered over the entire expanded part of the blade.

TYPE: Dawson 97-45. Tidal channels on the reef two miles north of Punta Descanso, Baja California, Mexico. April 8, 1945.

Additional material: Although the five specimens from the type collection happen to be tetrasporic, several cystocarpic examples of this species were obtained from an agarophyte fisherman's refuse pile on the outer coast of Punta Banda, about 50 miles south of the type locality. These plants, Dawson 138-45, February 27, 1945, were taken from about 6-8 meters of water, growing with *Gelidium cartilagineum.* They are of the same thick, coriaceous texture as the tetrasporic plants from Punta Descanso. The cystocarps, usually 1.5 mm. in diameter, but sometimes up to 2.2 mm., are scattered densely over the entire blade.

The large size and coriaceous character of this species mark it as distinct from all others thus far known from Pacific North America. Its nearest relative would seem to be *Rhodoglossum Hancockii* from the upper Gulf of California.

GIGARTINA MULTIDICHOTOMA sp. nov.
Fig. 14

Planta ad 8 cm. longa vel longior, complanata, crebre divaricatim ramosa, ramulis vario modo contortis; haustorio disco minuto quam 1 mm. minore, stipitem singulam cylindricam endente, in frondibus sat latis per dichotomian plurimas abeuntem; articulis inferioribus 2.5-3.0 mm. latis, superioribus quam 1 mm. minoribus subcanaliculatis vel subsulcatis; dichotomiis supremis brevissimis processus digitatos simulantibus, ramulis accessoriis acuminatis crebris, articulis valde immaturis exceptis, articulis adultioribus ramulis accessoriis totis armatis; fabrica interna e medulla ecolori filamentosa cellulis plus minusve sphaericis in seriebus 10 ordinatis circumdata.

Plants up to 8 cm. high (or more) flattened throughout, abundantly, divaricately, dichotomously branched, the branches variously twisted and disarranged; holdfast a minute disc less than 1 mm. in diameter, giving rise to a single slender, cylindrical stipe 0.6 mm. in diameter which begins to expand 2-3 mm. above the disc and by repeated dichotomies bears the relatively large frond; lower segments less than 1 mm. broad and about 350 μ thick, somewhat channeled or sulcate; terminus of each branch with 2-3 short, spreading digitate points representing the ultimate dichotomies; entire plant except for very young segments provided with pointed, cylindrical or compressed marginal accessory branchlets, these mostly 0.5-1.0 mm. long, 250 μ in diameter on upper segments; older segments with such branchlets also on flattened surfaces, some becoming 5-7 mm. long and bearing secondary accessory branchlets; internal structure consisting of a colorless, filamentous medulla surrounded by a dense pigmented cortex of about 10 layers of small, more or less spherical cells 4-8 μ in diameter.

TYPE: Dawson 163-45, growing on middle littoral rocks among other algae on the reef 1 mile south of Punta Descanso, Baja California, Mexico. April 24, 1945.

Additional material: Fork 115, at base of sea wall near the "Beach Club," La Jolla, California, November 4, 1944.

Gigartina multidichotoma, from its repeatedly dichotomous branching character belongs in the subgenus Mastocarpus, seemingly near *Gigartina Agardhii* and *G. Jardinii.* In habit, size, abundant dichotomies and character of the marginal outgrowths it agrees, however, with none of the previously described species.

CHONDRIA TELMOENSIS sp. nov.

Figs. 3, 18

Planta ad 30 cm. alta vel altior laxe diffuseque ramosa, axi primario inconspicuo ramos longos alternatos irregulatiter edente 4-6 mm. distantes; ramis primaris ca. 1 mm. diametro, secundariis polystichis vel aggregatis, brevibus, basi contractis, ramulis tertiariis paucis quam 1 cm. brevioribus, 7-800 μ crassis. apice alavatis obtusis foveola ornatis cum trichoblastiis; cellulis corticalibus externis de supra visis arcte oblongis, in seriebus longitudinalibus bene dispositis; tetrasporangiis numerosis in ramulis secundariis tertiariisque, 140-165 μ diametro.

Plants to 30 cm. high (or more) abundantly but loosely and openly branched throughout, dull rose in color; main axis inconspicuous and bearing irregularly alternate long branches at intervals of 4-6 mm.; primary long branches about 1 mm. in diameter, bearing irregularly polystichous secondary branches, or some of these clustered; secondary branches short, contracted at their bases, usually bearing a few tertiary branchlets, usually under 1 cm. in length, 700-800 μ in diameter, clavate, obtuse at the apex, with an apical pit bearing a small tuft of inconspicuous, slightly protruding trichoblasts; outer cortical cells in surface view narrow-oblong and arranged in very definite longitudinal rows; tetrasporangia borne abundantly in secondary and tertiary branchlets, 140-165 μ in diameter.

Type: Dawson 43-45, growing on rocks on the reef at Rio San Telmo, 2 miles south of Cabo Colnett, Baja California, Mexico, March 12, 1945.

Additional material: Fork 524, growing on rocks at low tide near foot of Pearl Street, La Jolla, California, February 10, 1945.

See discussion under the following species.

Chondria oppositiclada sp. nov.

Figs. 2, 13

Planta ad 15 cm. alta vel altior, crebre at sat laxe ramosa, stipitibus 1 vel ultra e ultra e disco in hospite imposito orientibus, discis e stolonibus natis interdum plurimis; axi primario ca. 1 mm. diametro; ramulis secondariis brevibus, 600-800 μ diametro, oppositis, binatis ternatisve, clavatis, basi contractis, apice obtusis, foveola apicali ornatis cum trichoblastiis; ramulis tertiariis paucis nullisve; cellulis externis corticalibus isodiametricis, in seriebus longitudinalibus haud dospositis; cystocarpiis urceolatis, 550-650 μ diametro, sessilibus, in ramulis primariis secundariisque sparsis.

Plants to 15 cm. high (or more) abundantly but rather openly branched, cylindrical throughout, 1 to several main axes arising from a small discoid attachment to the host, this usually supplemented by other discs on semi-prostrate or arching stolons; main axes about 1 mm. in diameter, bearing pairs or triplets of ascending primary branches at intervals of about 3-4 mm.; short, secondary branches 600-800 μ in diameter, also in opposite pairs or triplets, clavate, all with contracted bases, obtuse at the apex, with an apical pit bearing a small tuft of inconspicuous, slightly protruding trichoblasts; tertiary branchlets few or none; outer cortical cells more or less isodiametric, with no arrangement in longitudinal rows; cystocarps urn-shaped, 550-650 μ in diameter, sessile, sparsely developed on primary and secondary branches.

Type: Dawson 184-45, epiphytic on *Egregia* among other algae dredged from a depth of 10 meters, La Jolla Bay, California, April 10, 1945.

Both *Chondria telmoensis* and *C. oppositiclada* are members of the subgenus Coelochondria. They are similar in size, habit and gross structure, but very different in mode of branching and in structural details. In *Chondria oppositiclada* the branching is mainly opposite and tertiary branching is poorly developed, while in *C. telmoensis* branching is rarely opposite and tertiary branching well developed. In *C. telmoensis* the surface cells are arranged in very definite longitudinal rows while there is no such arrangement in *C. oppositiclada.*

These species seem most closely related to *Chondria dasyphylla* which occurs in the Gulf of California, but are readily distinguishable from that plant. Figures 18 and 19 compare the habit of *C. telmoensis* with a specimen of *C. dasyphylla* from Woods Hole, Massachusetts. Figures 12 and 13 compare *C. oppositiclada* with a specimen of *C. dasyphylla* from the Gulf of California.

CHONDRIA CUSCUTOIDES sp. nov.

Figs. 6, 7

Planta e ramulis perdelicatis, gracilibus, cylindricis, filamentosis cum algis caeteris intermixtis, totis 7 cm. longis; parte basali ignota, ramis cum hospite haustoriis accessoriis conjunctis; ramis primariis 185-225 μ diametro, distanter irregulariterque ramosis, ramis constrictis 90-100 μ basi crassis, acicularibus, apice acuminatis, acumine trichoblastiis praedito caducis; cellulis in superficie thalli valde axialiter elongatis ca. 9-10 μ diametro, 4-10-cies longioribus ac latis.

Plants epiphytic, consisting of very delicate, slender, cylindrical filamentous branches entangled among other algae, 7 cm. long when disentangled, attached and held in place by numerous tendril-like branches encircling parts of the host and adhering by accessory, wart-like holdfasts; main branches 185-225 μ in diameter, distantly, irregularly branched; branches constricted to 90-100 μ diameter at their bases, slender, acicular, terminating in a slender, apical point provided with early deciduous trichoblasts; surface cells of the thallus very much axially elongated, about 9-10 μ in diameter, 4-10 times as long as broad, arranged as a pigment-bearing palisade in cross section; reproduction unknown.

TYPE: entangled among the branches and stolons of *Gelidium* and *Plocamium* found in beach drift at "Casa Cove," La Jolla, California, June, 1945. Collected by Mrs. T. W. Case.

The twining, dodder-like character of this tiny, delicate plant distinguishes it sharply from all other Pacific species of *Chondria* with emergent apices. It seems somewhat closely related to *C. acrorhizophora* from the Gulf of California, but differs markedly in diameter and in branching habit.

Lomentaria caseae sp. nov.

Fig. 8

Planta adulta 2.4 cm. longa, e disco haustoriali ramis delicatis, compressis 300-400 μ latis ortis efformata, disco 1.2 mm. diametro; axibus plus minusve bilateraliter ramosis, suboppositis alternatisve; segmentibus base excepta cavis; ramis ex axi primatio elongato-clavatis, basi constrictis, apice obtuso-rotundatis; tetrasporangia tetrahedraliter divisis, ca. 50 μ diametro, in soris irregularibus elongatis secus ramos primarios dispositis, in cavitatem frondis intrudentibus.

Plants to 2.4 cm. high when mature, composed of several delicate, linear, compressed branched axes 300-400 μ broad arising from a disc holdfast 1.2 mm. in diameter; branching of axes more or less bilateral, subopposite to alternate; segments hollow except at bases of branches, composed of a loose external layer of small cells mostly 7-8 μ in diameter beneath a gelatinous envelope, and a dense inner layer (or two layers) of oblong cells 12-15 μ in smallest dimensions; branches of main axis elongate-clavate, narrow at the base and with bluntly rounded apices; tetrasporangia tetrahedrally divided, about 50 μ in diameter, arranged in irregular, usually elongated sori along the primary branches of an axis, protruding into the cavity of the frond.

Type: Epiphytic on old leaves of *Phyllospadix* cast ashore at Del Mar, California, September, 1944. Collected by Mrs. T. W. Case.

This species is the smallest and most delicate thus far known from the Pacific American coast. It shows some resemblances to both *Lomentaria hakodatensis* reported from the Gulf of California (Dawson, 1944) and to *L. Baileyana,* an Atlantic species reported by Taylor (1945) from the Revillagigedo Archipelago and from Costa Rica. From the former it is distinguished by its smaller size, more delicate form, and rounded branch apices; from the latter, by the same characters as well as by its bilateral, subopposite branching and absence of curved branches.

The species is dedicated to its collector, Mrs. Theano W. Case of San Diego, California, who, in her 92nd year is still active in the collection and examination of marine algae.

In collecting specimens of the Least Perch, *Micrometrus minimus*, Dr. Carl L. Hubbs noticed the presence on the caudal fins of several of these fish of parasitic isopods. In seven of ten cases the isopods bore tufts of a finely branched brown alga which proved to be a species of *Ectocarpus*. The epizoan grew in most cases from the cracks between the segments of the exoskeleton. In older isopods on which an abundant algal growth had developed, plants were found both on the upper and lower sides of the animal and formed tufts nearly a third as large as the host (fig. 20). Although in gross morphology and in reproductive characters it shows nothing unusual, its cytological characters seem highly specialized, and together with its peculiar habitat make it very distinctive among known species of *Ectocarpus*.

ECTOCARPUS ISOPODICOLA sp. nov.

Figs. 4, 5, 9, 20

Thallis epizoicis in piscium parasita isopodis, 2-4 mm. longis, e basi pulvinata dense ramillosa radiantibus; filamentis erectis incorticatis, apice attenuatis, sub apice parcius irregulariterque ramosis; cellulis in filamentis primariis 45-55 μ latis; chromatophoris gracilis, numerosis; sporangiis plurilocularibus in parte extrema apicali, 70-80 μ longis, 25-30 μ latis, interdum 100 μ longis, pedicello in speciminibus juvenilibus e cellulis 3-4 constantibus, in adultis l-cellularibus vel sessilibus, dense aggregatis.

Thalli epizoic on fish parasitizing isopods, 2-5 mm. high, arising from a low, pluvinate base composed of densely branched, radiating, prostrate filaments which adhere to but do not penetrate the host; erect filaments uncorticated, attenuated at the apices, often into a slender hair, mostly simple below, sparingly, irregularly branched above, the branches mostly becoming long; cells of main erect filaments 45-55 μ broad, mostly as long as broad or somewhat shorter, with slight but conspicuous intercellular constrictions; chromatophores numerous in each cell, band-shaped, very narrow and often as thick as broad, frequently lobed, with abundant pyrenoides; plurilocular sporangia borne on upper parts of erect filaments, conical to fusiform, usually 70-80 μ long, 25-30 μ broad but sometimes 100 μ long, commonly with 3-4 celled pedicels on young reproductive plants, but on older plants mostly with 1 celled pedicels or often with none, becoming very dense and closely spaced on old plants until there may be half as many sporangia as vegetative cells on the upper parts of the filaments.

TYPE: Hubbs 45-70, epizoic on a parasitic isopod. attached to the base of caudal fin of *Micrometrus minimus*, Newport Bay, California, May 9, 1945.

In gametangial structure and in the attenuation of the branches, this species is closely related to the *Ectocarpus confervoides* complex. It differs markedly in cytological characters, particularly in the structure of the chromatophores. In all of the *E. confervoides* specimens examined by the author, both European and American, the chromatophores were large and few in number in the cells. The very abundant, slender chromatophores with many conspicuous pyrenoids mark *E. isopodicola* as very distinct and easily recognized.

At least four species of the genus *Hypnea* appear in collections from southern San Diego County, California. Of these Kylin (1941) identified two as *Hypnea californica* and *Hypnea adunca*. The other two have as yet remained unnamed in collections.

Figure 15 shows a typical specimen of the small, delicate species which in size, habit and branching is best classified with the group of plants known as *Hypnea Esperi,* widely attributed to warm temperate waters throughout the Pacific. It is usually less than 5 cm. high, but in extreme cases may reach 7 cm. in height. Specimens from La Jolla, California, Case, February, 1945 and from 1 mile north of Ensenada, Baja California, Fork 647A, July 19, 1945, are typical of the plant as it occurs in the southern California region.

Of less common occurrence in San Diego County is the larger, coarser *Hypnea* with markedly compressed axes and main branches. A few imperfect specimens of this plant were found by Mrs. Case in beach drift at La Jolla, California in March, 1945, but it was not until the ample material collected by Fork was examined, no. 661A, 1 mile north of Ensenada, Baja California, that the species could be identified with any certainty. The specimens shown in figures 16 and 17 are both mature and tetrasporic. In their size, complanate characters, mode of branching and arrangement of tetrasporic sori, these plants are in agreement with the descriptions and illustrations of *Hypnea variabilis* Okamura (Tanaka, 1941, Okamura, 1912) heretofore known only from the Pacific shores of southern Japan.

Pleonosporium dasyoides (J. Ag.) DeToni has heretofore been reported only between Monterey and San Pedro, California. Dawson 173-45 from tide pools on the flat reef 1½ miles south of Punta Descanso, Baja California, April 24, 1945, includes luxuriant specimens of both polysporic and spermatangial plants. This is another northern species seemingly favored by the cooler, upwelling water of this region.

Membranoptera Weeksiae Setchell & Gardner was found by Edna N. Wilson growing on *Stenogramme interrupta* cast ashore at Mission Beach, California, March, 1945. Identical material has also been examined by the author from dredgings made in June, 1943 off Point Loma, San Diego County, California. It has previously been reported only from between San Francisco and Carmel, California.

Egregia laevigata Setchell (The Feather Boa) is one of the most familiar kelps of the southern California coast. Except for the northern "island" colony at Pebble Beach, Monterey County, this species is essentially continuous through its range from Point Conception to at least as far south as Rio San Telmo, Baja California (Dawson, 1945).

Up to the time of writing *The Marine Algae of the Gulf of California* (Dawson, 1944) no specimens of any member of the Laminariales had been found in collections from the Gulf of California. It was supposed that the extreme temperature fluctuations were prohibitive to the development of certain stages in the life cycle of members of this group which are present in abundance on the Pacific side of Baja California as far south as Bahía Magdalena. It is not a little surprising to receive from Mr. W. E. Naylor of San Diego, two collections of marine algae from Bahía Los Angeles in the upper Gulf of California, each containing specimens of *Egregia laevigata.* The specimens collected August 1, 1944 and June 30, 1945 respectively, are both portions of the main stipes, bearing abundant, finely dissected, filiform lateral outgrowths representing the blades, and very narrowly ellipsoidal pneumatocysts.

Although the specimens were obtained from beach drift, there is little doubt that they were torn from plants growing in the near vicinity. It would be most interesting to examine the habitat for ecological conditions permitting this typically cool water species to persist over the excessively warm summer season. It might be suspected that upwelling in the region keeps the water temperatures below the upper limit of tolerance of the species.

But two collections of *Gigartina pectinata* have heretofore been reported, from Puerto Refugio, Isla Angel de la Guardia in the Gulf of California and from Punta Peñasco, Sonora. All were sterile. Additional material of this species was obtained in July, 1944 by W. E. Naylor at Bahía Los Angeles in the Gulf of California. The specimens are tetrasporic. Some are up to 15 cm. long and 7 cm. across the broadest parts. The tetrasporangial mass is borne in a smooth bulge, often nearly hemispherical, on the ultimate pinnules. Tetrasporangia are subspherical to ellipsoidal, measuring about 25 μ in greatest dimension.

Gracilaria veleroae was described from cystocarpic material dredged in the upper Gulf of California. Material in close agreement with this species has recently been found in beach drift 1 mile north of "Bird Rock," south La Jolla, California, Fork 585, February 11, 1945. Fork 673 from beach drift at Coronado, California, August 12, 1945 is also of this species. Examples over 20 cm. in height occur in both collections.

Taylor (1945) in describing *Gracilaria tenuifolia* from the Revillagigedo Islands appended the statement: "Dawson's *Gracilaria veleroae* may represent a less luxuriant phase of the same plant, but one cannot be sure from his description, particularly since the orientation of the cortical cells is not clearly stated."

The structure of the type of *Gracilaria veleroae* has been re-examined and the cortical cells are found most frequently to be 8-9 μ deep and up to 13 μ broad. This is in close agreement with Taylor's measurements of *G. tenuifolia*. The material from the Gulf of California averages 300-400 μ thick; that from La Jolla, 300-400 μ thick in younger parts, somewhat thicker in older. Taylor's plant was described as 130-260 μ in thickness, but since it was dredged from more than 25 meters of water it probably represents only a thinner deep-water form of *C. veleroae*. In structure and in habit these four collections seem indistinguishable and all may best be referred to *G. veleroae*.

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EXPLANATION OF FIGURES

PLATE 23

Fig. 1. *Rhodoglossum coriaceum*. Portion of a transverse section of a blade to show position and origin of young tetrasporangia, X 225.

Fig. 2. *Chondria oppositiclada*. Portion of a plant to show opposite branching, X 1¼.

Fig. 3. *Chondria telmoensis*. Portion of a plant to show alternate branching, X 1¼.

Fig. 4-5. *Ectocarpus isopodicola*: 4, habit of a young gametangial plant, X 50; 5, detail of a portion of a filament to show chromatophores and pyrenoids, X 400.

Fig. 6. *Chondria cuscutoides*. Habit of the type specimen, X 1.

PLATE 24

Fig. 7. *Chondria cuscutoides*. Detail of a branch-tip to show papillate attachment organs, X 30.

Fig. 8. *Lomentaria Caseae*. Habit of the tetrasporic type specimen, X 5.

Fig. 9. *Ectocarpus isopodicola*. Detail of a cell from an older, axial portion of a plant, showing narrow, ribbon shaped chromatophores, X 400.

PLATE 25

Fig. 10. *Rhodoglossum coriaceum*. The type specimen, X ½.

PLATE 26

Fig. 11. *Rhodoglossum coriaceum*. Habit of two specimens from Punta Banda, Baja California, X ⅓.

Fig. 12. *Chondria dasyphylla*. Habit of a specimen from the Gulf of California, X ½.

Fig. 13. *Chondria oppositiclada*. Habit of the type specimen, X ½.

PLATE 27

Fig. 14. *Gigartina multidichotoma*. Habit of the type specimen, X ⅔.

Fig. 15. *Hypnea Esperi*. Habit of Fork no. 647a from near Ensenada, Baja California, X ⅔.

Figs. 16-17. *Hypnea variabilis*. Habits of two specimens of a collection, Fork no. 661A, from near Ensenada, Baja California, X ½.

PLATE 28

Fig. 18. *Chondria telmoensis*. Habit of the type specimen, X ¼.

Fig. 19. *Chondria dasyphylla*. Habit of a specimen from Woods Hole, Massachusetts, X ¼.

Fig. 20. *Ectocarpus isopodicola*. Habit of specimens growing on fish parasitizing isopods, X 1½.

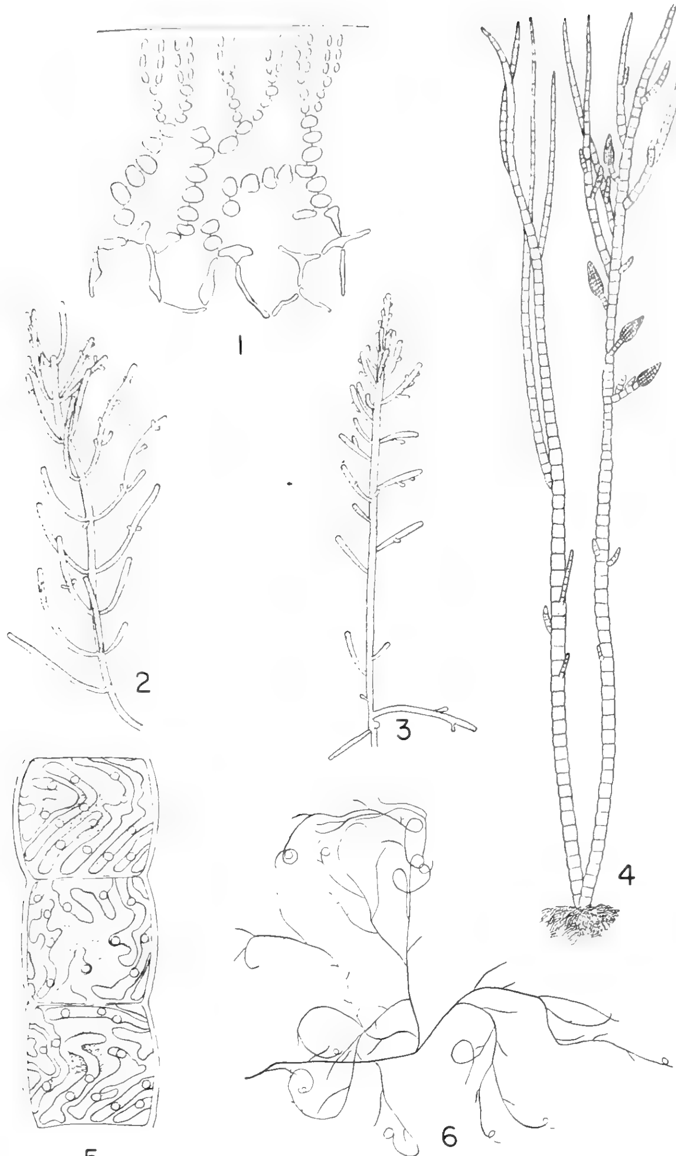

Plate 23

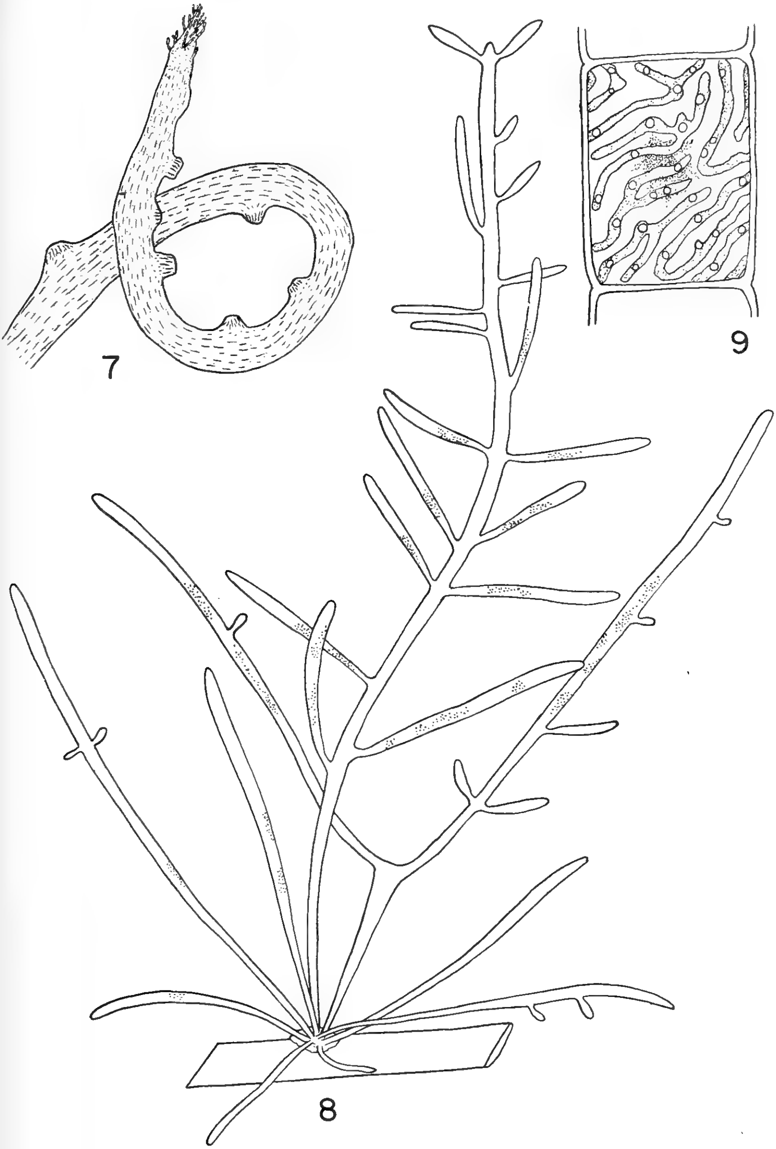

PLATE 24

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Plate 25

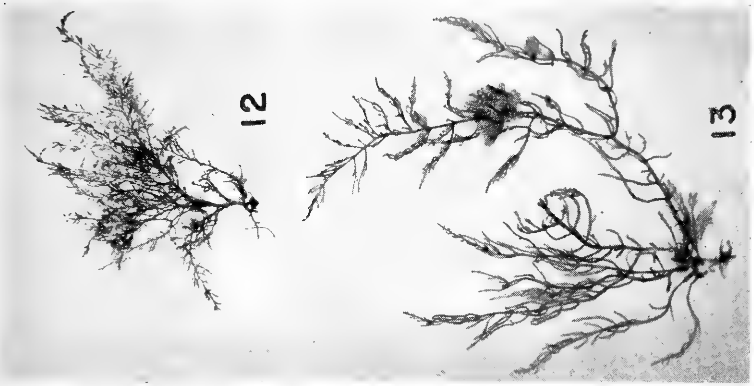

Plate 26

Plate 27

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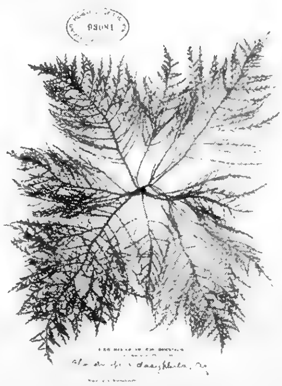

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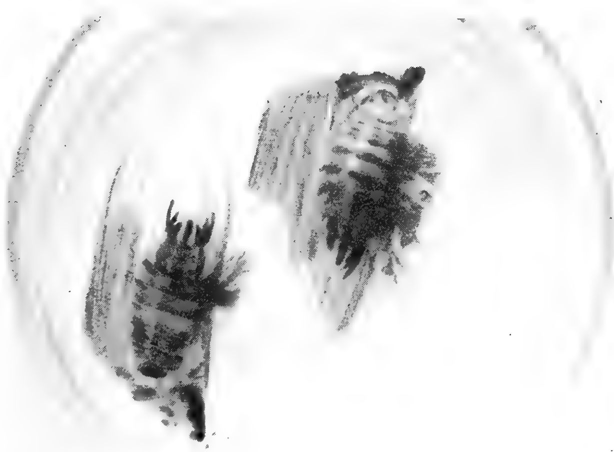

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PLATE 28

EARLIER NAMES FOR SEVERAL CALIFORNIAN VASCULAR PLANTS

LOUIS CUTTER WHEELER

WOODWARDIA FIMBRIATA J. E. Smith in Rees, Cyclopaedia 38: *Woodwardia* No. 6 1818[1]. As was noted in a brief synopsis (Amer. Fern Journ. 24: 48. 1934), according to Alston (Philip. Journ. Sci. 50: 181. 1933) *W. fimbriata* is an earlier name for *W. Chamissoi* Brackenridge in Wilkes, U. S. Explor. Exped. 16: 138. 1854, under which name the plant of the Pacific States has long been known. Some authors, as Jepson, Man. Fl. Pl. Calif., 34. 1925(?), have called the Pacific Coast plant *W. radicans* (L.) J. E. Smith, but pteridologists now confine that species to the Old World.

Alston gives a transcription of Smith's description so it will be unnecessary to repeat it here. The type, in Smith's herbarium at the Linnean Society in London, bears, according to Alston, the data "Western North America, Menzies 1803" and an isotype at British Museum "Northwest coast of America: New Georgia. Mr. Menzies." According to Lippincott's Gazateer, 1303. 1856: "New Georgia . . . is a name applied to the coast-line of North America, on the Pacific, comprising Vancouver Island and the adjacent mainland, with the Oregon territory, as far S. as the river Columbia."

There is nothing in Rees' Cyclopaedia to indicate definitely which of the three botanical collaborators listed in vol. 1: v. 1802 wrote the article on *Woodwardia.* However, Jackson, Journ. Bot. London 34: 308. 1896, gives sufficient evidence to indicate that Sir James Edward Smith must have been the author.

LILAEA SCILLOIDES (Poiret) Hauman, Pub. Inst. Invest. Geogr. Buenos Aires 10: 26. 1925; based on *Phalangium scilloides* Poiret in Lamarck, Encyc. Meth. Bot. 5:251. 1804. *Lilaea subulata* Humboldt & Bonpland, Plantae Aequinoctiales 1: 222, t. 63. 1808[2]. This curious plant of western North America, and South America is almost always known by the latter name. As the journal in which the earlier name was revived is not generally available to North American botanists it is worth while to repeat the evidence. Hauman should know whereof he speaks regarding the identity of his plant for he has evidently seen the type. His own statement

[1]Title page date is 1819 but according to Jackson, Journ. Bot. London 34: 311. 1896, this volume was actually issued in 1818.

[2]See Journ. Bot. London 39: 203. 1901 as to date.

concerning this is worth quoting: *"Phalangium scilloides* Poir., leg. Commerson à Buenos Aires (type dans l'herbier du Museum de Paris!), n'est autre chose que *Lilaea subulata* H. B. K. et lui est antérieur." (The "K." is an error, for Kunth had nothing to do with this work.)

CORYLUS CALIFORNICA (A. DC.) Rose, Gardner & Forest, 8: 263. 1895, based on *C. rostrata* Aiton B *californica* A. DC., in DC., Prod. 16(2): 133. 1864. Type "In sylvis prope Santa Cruz," Santa Cruz County, California, *Hartweg* 1860 (herb. DC., not seen; isotype herb. Gray!) *C. californica* has been considered a variety of *C. rostrata* Aiton in some recent floras of various areas in the Pacific States. As noted by Rehder (Man. Cult. Trees & Shrubs, 155. 1927), *C. cornuta* Humphrey Marshall (Arbustum Americanum, 37, 1785), is the same as, and prior to *C. rostrata* Aiton (Hortus Kewensis 3: 364. 1789). Those who consider *C. californica* as only a variety of the eastern American shrub will need to make a new combination under the earlier name. However, the shrub of the Pacific slope seems sufficiently distinct.

There are a few points of nomenclature which must be clarified here. *C. californica* C. Koch, Dendrol. 2A: 15. 1873 is a *nomen nudum,* and if it were not, the continued use of that binomial would very likely be justified since there is only one species of *Corylus* in California. The only change necessary would be a change in the author of the name.—*C. cornuta* Yong, Catalogue D'Arbres, Arbustes & Herb. D'Amerique, 7, 1783, might seem to preoccupy Marshall's use of the same name. Yong's plant is probably identical with Marshall's. In view of the fact that Yong's work is not consistently binomial and employs some long polynomials as, for example, the following on page 17. *"Pinus foliis ternis, conis longioribus squamosis, minor,"* chance binomials occurring in the work cannot be used since they are specifically stated in the International Rules of Botanical Nomenclature, ed. 3, Article 68 (4), to be invalid. (The fact that some modern authors, e.g., *Pinus ponderosa scopulorum nana* Beissner, Mitt. Deutsch. Dendr. Ges. 1912: 365. 1912, employ polynomials makes their names invalid rather than any other effect.) Marshall's nomenclature is not strictly binomial in that there were many trinomials proposed without any indication of the rank of the third name. In the text below the name at least one was mentioned as a "variety." But Marshall, so far as I have discovered, employed nothing more than trinomials. If we reject his work we must reject the work of many modern American authors who have used trinomials without statement of the rank of the third name. It is sad to see modern authors deliberately using trinomials when it is so easy to be definite and state the category. For further confusing discussion of trinomials and their status see the two following articles by C. X. Furtado in 1939: Binary, binomial, and biverbal names; Philip. Journ. Sci. 69(4): 467-469; Triverbal specific names; op. cit. 70(2): 197-199.

STYRAX REDIVIVA (Torrey) comb. nov., based on *Darlingtonia rediviva* Torrey, Proc. Amer. Assoc. Adv. Sci. 4: 191. 1851. The common styracaceous Californian shrub which has long been known as *Styrax californica* Torrey, Smithsonian Contributions to Knowledge 6(Art. 4): 4. 1853, considered as worthy of only varietal rank by some authors, then bearing the name *S. officinalis* L. var. *californica* (Torrey) Rehder, Mitteil. d. D. Dendrol. Gesell. 1915: 226. 1915, has the earlier specific name cited above. There are three references in literature which lead to this overlooked name: 1. Torrey, Smithsonian Contr. Knowl. 6(4): 4. 1853, in his article, "On the Darlingtonia californica, a new pitcher-plant," in describing *Styrax californica* in one of the lengthy footnotes typical of the period, mentions at the top of the page that his earlier *Darlingtonia* was *Styrax*. 2 Sereno Watson, Smithsonian Miscellaneous Collections 258: 447. 1878 (Bibliographical Index to North American Botany, Part I, Polypetalae), in "Additions and Corrections," cites as a synonym of *Darlingtonia californica* Torrey, 1853, "*D. rediviva*. Torrey, Proc. Am. Assoc. 4. 191" 1851. This citation of synonymy was a gross taxonomic error but furnished the needed reference. 3. J. M. Macfarlane, in Engler, Pflanzenreich IV. 110: 25. 1908, mentions, under *Darlingtonia* Torrey, 1853, (Sarraceniaceae) that *Darlingtonia* Torrey, 1851, is *Styrax californica*.

Torrey, Proc. Amer. Assoc. Adv. Sci. 4: 190-193. 1851, has under the title "On some new plants discovered by Col. Fremont, in California" a summary of his Plantae Fremontianae which appeared in Smithsonian Contr. Knowl. 6(2):—1853 (? no date, the next article, which was accepted for publication on the same date, bears "April, 1853" on the last page of text). It has been very generally overlooked that the genera customarily taken as from this publication of 1853 were published in the summary in 1851.

After describing the plant rather thoroughly, Torrey, Proc. Amer. Assoc. Adv. Sci. 4: 191. 1851, made the following statement:

"I have dedicated this fine new genus to the veteran botanist, Dr. William Darlington, whose valuable works have contributed so much for the scientific reputation of our country. The old genus given to this botanist by De Candolle having been reduced to a mere section of *Desmanthus* by Bentham, I propose to call the present plant *Darlingtonia rediviva*."

For those who may wish to protest this form of publication, a similar case can be cited which they choose to accept even though its publication was invalidated by the statement that it was a provisional name. *Canotia holacantha* Torrey, Expl. & Surv. Rail. Route Miss. River Pacific Ocean 4(5): 68. 1857[3], was published in these words after the description of the plant: "We must wait for other observations on this strange shrub, and especially for its flowers, before assigning it a place in the system. As, however, there can be little doubt of its constituting an undescribed genus, we may bestow upon it the provisional name of *Canotia holacantha*." The rule providing that provisional names are not validly published (See Journ. Bot. London 74: 75. 1936; Proc. Zesde Internat. Bot. Congr. 1: 365. 1936; & Contr. Gray Herb. 127: 53. 1939), and consequently have no status in botanical nomenclature, obviously invalidates *Canotia holacantha* since the name was specifically stated to be provisional. Yet authors in general choose to accept publication of *Canotia* as of 1857. (There is no need for concern over the fate of *Canotia holacantha;* it was validated by A. Gray, Ives Report, 15. 1860, and so may be used.) Some may claim that Torrey did not mean "provisional name" when he wrote it. That would be going behind an unequivocal statement and entering into the realm of metaphysics. If authors accept as valid, save for the fact that it was a provisional name, the publication of *Canotia holacantha,* they must accept as valid the publication of *Darlingtonia rediviva* under the provisions of the International Rules of Botanical Nomenclature, ed. 3, Art. 43. 1935, which provides that a monotypic new genus may be published with a combined generic and specific description provided the species were new, as it was in this case.

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[3]Date according to I. M. Johnston, Journ. Am. Arb. 24:242, 1943.

DEPARTMENT OF BOTANY
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NEW TINGIDAE (Hemiptera)

By Carl J. Drake
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The present paper contains the descriptions of three new genera and five new species of lace bugs from widely separated regions. A question is also raised regarding the type locality and distribution of *Caloloma uhleri* Drake and Bruner from the West Indies. Unless otherwise designated under the descriptions, the types are in my collection.

Euaulana, n. gen.

Head moderately long, with five spines, the median arising between the eyes, the tylus and bucculae projecting beyond base of antennae; eyes transverse. Bucculae long, closed in front. Antennae short, widely separated at base, moderately stout, shortly pilose; segments I and II very short, moniliform, swollen; III slenderest; IV short, subclavate. Rostral channel long, deep, the basal four or five abdominal segments deeply furrowed along median line for reception of rostrum. Rostrum very long, extending on abdomen. Metasternal orifice indistinct. Hypocostal ridge uniseriate. Pronotum moderately narrowed anteriorly, truncate or subtruncate in front, longly transversely convex, finely pitted, tricarinate; collar distinct, closely reticulate, slightly more elevated along median line; paranota narrow, slightly wider in front, finely areolate. Elytra divided into the usual areas, rather closely reticulate, extending a little beyond apex of abdomen; discoidal area large, very long, extending considerably beyond middle of elytra. Legs short, moderately stout, shortly setose.

Generotype, Euaulana ferritincta, n. sp.

This genus may be separated readily from the genus *Tingis* Fabr. and closely allied genera by the much longer head and bucculae. The rostrum is extremely long in the two species described below. Although the genus *Euaulana* resembles somewhat certain genera of the subfamily Cantacarinae the absence of clavus of elytra and longly produced hind margin of pronotum place it in the subfamily Tinginae.

Euaulana ferritincta, n. sp.

Moderately large, obovate, brownish, variegated with black-fuscous spots. Head rugulose, with five, short spines. Antennae brown, short; segment I very short, thicker and a little longer than II; III cylindrical, yellowish brown, twice as long as IV; IV subclavate, clothed with longer hairs, about as long as I and II conjoined. Rostrum extremely long, brown, reaching on fourth segment of venter. Legs short, dark brown, shortly pilose, the femora moderately stout.

Pronotum moderately convex, closely pitted, distinctly tricarinate; all carinae slightly more raised posteriorly, there finely areolate, non-reticulate on disc and in front; lateral carinae broadly concave within on disc, slightly converging posteriorly; paranota narrow, uniseriate, slightly wider in front; collar low, areolate, the anterior margin somewhat concave. Elytra narrowed posteriorly, sutural areas completely overlapping behind in repose; costal area rather narrow, mostly uniseriate, some of the areolae irregularly divided; subcostal area wider, mostly triseriate, quadriseriate in widest part; discoidal area large, about three-fourths as long as elytra, bounded by a costate nervure, with the outer margin sinuate, widest near middle, there six areolae deep; sutural area closely areolate.

Length, 3.45 mm.; width, 1.20 mm.

Type (male), Burleigh, Queensland, Australia, Sept. 1, 1928, H. Hacker; allotype (female), Tugun, Queensland, Jan. 24, 1929, collected by H. Hacker. Paratypes, 3 specimens from Queensland (Hacker), one from Cheltenham, Victoria, Oct. 7, 1921 (J. Dixon) and two specimens from Hobart, Tasmania, taken by A. M. Lea. The color varies slightly in the type series.

Euaulana tasmaniae, n. sp.

Separated from *E. ferritincta,* n. sp. by the larger cephalic spines, longer and more slender antennae, distinctly more elevated, uniseriate pronotal carinae, the wider paranota and wider costal area. Antennae shortly pilose; segment III slender, two and one half times as long as IV. Paranota irregularly biseriate, also costal area of elytra; discoidal area seven-ninths the entire length of elytra, with eight rows of cells at widest points; subcostal area 4- to 5-seriate. Color light brown. Other characters very similar to *ferritincta,* n. sp.

Length, 3.55 mm.; width, 1.20 mm.

Type (female) and paratype, Hobart, Tasmania, collected by A. M. Lea.

Idiostyla, n. gen.

Head short, with five spines. Rostrum moderately long, extending beyond middle of mesosternum. Rostral channel parallel and not constricted on mesosternum; subquadrate and closed on all four sides on metasternum. Bucculae broad, moderately long, reticulate, closed in front. Eyes transverse. Antennae long, slender indistinctly pilose; segment I very long, moderately stout, distinctly longer than width of head across eyes; II very short, III very long, slenderest; IV long, scarcely swollen; antenniferous tubercles very broad, lamina-like, reticulate. Orifice present, very small, margined with narrow rim. Pronotum moderately, transversely swollen, closely pitted, tricarinate; calli deep; collar sharply raised, reticulate, slightly more raised at middle, there slightly obtusely produced forward, anterior margin bisinuate; hind triangular part reticulated; paranota rather narrow, moderately reflexed, reticulate, almost rectangular in outline. Elytra very long, rather narrow, extending considerably beyond apex of abdomen, distinctly divided into the usual areas; discoidal area elongate, not reaching middle of elytra; male and female genital segments narrow, the claspers of male strongly curved, the last abdominal segment of female terminating on each side above in a small stylet.

Generotype, *Idiostyla (Tigava) anomae* (Drake and Hambleton) from Brazil.

This genus belongs to the distinctly lacy genera of lace bugs. The lacyness of the elytra and paranota, narrow genital segments, high collar and small orifice separate it from the genus *Tigava* Stal. It is probably more closely allied to certain groups of the composite genus *Leptopharsa* Stal. *Tigava rollinae* Drake & Hambleton from Brazil is also transferred to the new genus *Idiostyla*.

Genus Caloloma Drake & Bruner

Caloloma Drake & Bruner, Mem. Soc. Cubana Nat. Hist. "Felipe Poey," Vol. VI, Nos. 3 and 4, 1924, p. 152. (reprint, p. 11).

This genus was erected by Drake and Bruner for *C. uhleri* from the specimens in the late Uhler Collection, taken in the Lesser Antilles (San Juan). Both the genus and the species are valid and, as stated by the describers, belong to the distinctly lacy group of tingid genera.

A few years ago the writer received several undetermined lace bugs from the Vienna Museum. The Australian material in this collection included three typical specimens of the genus *Caloloma* Uhler, all mounted on one rectangular card with the pin bearing the label "Fischer Austra. Post 1, 1878." These specimens now raise a serious question regarding the type locality and distribution of *C. uhleri*. Although I have studied many collections of lace bugs from neotropical America and Australia, these are the only known records for this species. It seems advisable at this time simply to raise a question regarding the distribution and type locality of *C. uhleri* and then wait until more specimens are collected before making correction relative to distribution. The species is not represented in the large Hacker Collection of Australian Hemiptera.

ETEONEUS INOPINUS, n. sp.

Elongate-ovate, smooth, reddish brown, the areolae of elytra hyaline. Head short, rugulose; spines greatly reduced. Antennae rather stout, moderately long, longly setose, the terminal segment dark fuscous; segments I and II stout, short, the latter slenderer and shorter; III less than twice as long as IV, the latter fusiform. Rostrum long, extending on metasternum, testaceous, dark at apex; laminae thick, brown, obliquely converging and nearly meeting on metasternum. Legs moderately stout, the tibiae becoming lighter in color. Abdomen brown, lighter in color than sternum.

Pronotum moderately convex, finely pitted, unicarinate; collar raised, areolate, truncate in front; paranota represented by very low, ridge-like carinae. Elytra long, ovate, overlapping and jointly rounded behind in repose; costal area moderately wide, uniseriate, the areolae subquadrate; subcostal area wider, mostly quadriseriate; discoidal area moderately large, narrowed at base and apex, with the outer boundary arcuate, widest beyond middle, there four areolae deep; sutural area more widely areolate, with fuscous spot (veinlets) near base. Male genital segment concave along outer margins, the claspers strongly curved.

Length, 3.00 mm.; width, 1.30 mm.

Type, male, Bulamayo, Southern Rhodesia, June, 1917. This is the first record of the genus *Eteoneus* Distant from Africa.

TIGAVARIA, n. gen.

Separate from *Tigava* Stal. by the unicarinate pronotum and strongly convex dorsal surface of head. Head with five spines, the median arising between the eyes, the front pair placed a little in front of eyes, and the hind pair as in *Tigava*. Paranota scarcely distinct, represented by low carinae. Rostrum moderately long, the channel wide, cordate on mesosternum, closed behind. Bucculae closed in front. Orifice indistinct. Hypocostal ridge wide, biseriate. Female genital segment very broad, with a blunt tubercle on each side of hind margin. Elytra long, narrow, divided into the usual area; discoidal area extending beyond middle of elytra. Legs long, slender.

Generotype, TIGAVARIA (*Tigava*) UNICARINATA (Hacker) from Australia

The location of median and frontal cephalic spines, unicarinate paranota and biseriate hypocostal laminae are distinguishing structures.

FROGGATTIA HARGREAVESI, n. sp.

Very similar to *F. olivina* Horvath, but easily separated from it by the distinctly shorter antennae, narrower costal area, narrower paranota, shorter cephalic spines, and less raised pronotal carinae. Head brown, with five short, testaceous spines. Antennae rather short, indistinctly pilose; segment I and II stout, short, brownish black, the latter slightly shorter and obconical; III testaceous, straight, practically twice the length IV; IV fusiform, clothed with long scattered hairs. Pronotum rather strongly convex; lateral carinae distinct, only slightly convex within in front, the median more elevated. Costal area of elytra uniseriate, the areolate small. Other characters very similar to *F. olivina.*

Length, 3.35 mm.; width, 1.45 mm.

Type (male) allotype (female), Kampala, Uganda, Oct., 1933, collected on Jasminum dichotomum, by H. Hargreaves, in British Museum. Nine paratypes, bearing same data as above.

URENTIUS VEPRIS, n. sp.

Small, testaceous, some of the veinlets embrowned, the spines rather long, distinctly more numerous than in *U. euonymus* Distant and *U. maculatus* Drake. Antennae testaceous, longly setose, the last segment dark fuscous. Legs testaceous, distinctly setose. Rostrum reaching between intermediate legs, yellowish brown, becoming much darker distally; rostral laminae white, foliaceous, spinose along lower margins, open behind. Bucculae broad, closed in front, brown, margined with testaceous, distinctly setose. Body beneath brown, sometimes almost fuscous, clothed with numerous white setae. Head brown, setose, with five, long, slender, testaceous spines. Eyes reddish, strongly transverse.

Pronotum strongly convex; collar raised, slightly expanded and raised at middle; paranota large completely reflexed, with margins touching median carina, with a raised, longitudinal vein within on each side; median carina foliaceous, uniseriate, more raised posteriorly; lateral carinae short, visible on triangular process, convex within. Elytra strongly, closely spinose; costal area rather narrow, uniseriate; the areolae moderately large, the outer margins beset with numerous long spines; discoidal area separated from subcostal area by a raised nervure. Wings longer than abdomen.

Length, 2.10 mm.; width, 0.90 mm.

Type (male), Commando Nek, Pretoria, Transvaal, Nov. 22, 1928, breeding on *Hermannia micropetela,* British Museum, London. Paratypes, 5 specimens taken with type. In one paratype the basal half of the costal area is biseriate. This species is distinctly more closely spined than other species having uniseriate costal area.

CONTRIBUTIONS FROM THE LOS ANGELES MUSEUM CHANNEL ISLANDS BIOLOGICAL SURVEY

NO. 32—DISTRIBUTION OF THE GENUS BATRACHOSEPS, ESPECIALLY ON THE COSTAL ISLANDS OF SOUTHERN CALIFORNIA

By WILLIAM A. HILTON

This study is based primarily upon a large collection of salamanders loaned me by the Southern California Academy of Sciences and the Los Angeles Museum. I have especially to thank Drs. J. A. Comstock and H. R. Hill for the privilege of examining this fine series. Other specimens of the genus are included for comparison.

There are differences noted in the species from different localities, but there is much overlapping of characters. It seems evident that there is but one species with in some cases rather doubtful subspecies of *Batrachoseps attenuatus.* I have on hand numerous examples of the five recognized subspecies, but none as yet of the form B. caudatus described by Cope from Alaska. Distinctions between the subspecies are at times difficult if not impossible for there is not a single character that is sharply defined. All show intergradations in one or more ways. In the following, general descriptions are given based upon the literature as well as from numerous specimens examined for the first time.

BATRACHOSEPS

1858 Boneparte, Faun. Ital. Hallow, Jour. Acad. Phila. Iv.
Tongue attached in front. Digits four on all feet. Large fontanelle in the top of the skull. One premaxilla. Nasal spines not fused. Prefrontals lacking. Vomerine and parasphenoid teeth not continuous. Larvae not aquatic. No marked sexual dimorphism.

BATRACHOSEPS ATTENUATUS ATTENUATUS (Eschscholtz)

1833 *Salamandra attenuata* Eschscholtz, Zoo. Atl., Pt. 5.
1839 *Batrachoseps attenuatus* Boneparte, Fauna Itl. 26.
1843 Fitzinger, Syst. Rep.
1849 Baird, Jour. Ac. Nat. Sci. Phila. (2).
1850 Gray, Cat. Bat. Grad. Brit. Mus.

1858 Cooper, Pacific R. R. Rep., 12, 13—Hallowell, Jour. Sci. Phila. (2).

1869 Batrachoseps nigriventris Cope, Proc. Ac. Nat. Sci. Phila.

1870 Cooper, Am. Nat. 4. Strauch, Mem. Acad. Imper. Sci. St. Petersb. Ser. 7, XVI, No. 4.

1875 Cope, Bull. U. S. Museum No. 1.

1877 Smith, The tailed Amphibia. Wiedersheim, Morph. Jahrb. 3. (skull).

1880 Lockington, Am. Nat. XIV.

1882 Boulenger, Cat. Batr. Grad. Brit. Mus. (2).

1883 Yarrow, Bull. U. S. Nat. Mus. No. 24. Cope, Proc. Acad. Nat. Sc. Phila.

1888 Cope, Jour. Morph. 2 (otic region).

1889 Cope, Bull. U. S. Nat. Mus. 34.

1895 Van Denburg Proc. Calif. Ac. Sci. Ser. 2, V.

1896 Wilder, Anat. Anz. 12 (lungless condition).

1897 Eisen, Proc. Calif. Ac. Sc., 3, 1. (blood).

1900 Eisen, Jour. Morph. 17 (testis).

1903 Jannsens and Dumez, La Cellule, 20 (testis).

1904 Snyder, Biol. Bull. 7 (physiology).

1905 Van Denburg, Proc. Calif. Ac. Sci. Ser. 3, Zool. 4, No. 1.

1909 Hilton, Am. Nat. 43.

1910 Jacob, Blatt. Aqua. Terr. Kunde, 21 (habits).

1911 Burke, Am. Nat. 45 (eggs).

1914 Van Denburg and Slevin, Proc. Calif. Ac. Sci. Ser. 4, 4.

1915 Camp, Univ. Calif. Pub. Zool., 12, No. 12. Ruthing, Copeia No. 25.

1917 Grinnell and Camp, Univ. Calif. Pub. Zool., 17, No. 10.

1917 Stejneger and Barbour, Check list. Fowler and Dunn, Ac. Nat. Sci. Phila.

1918 Dunn, Bull. Mus. Comp. Zool., 62.

1920 Emmel, Anat. Rec., 18 (blood).

1921 Noble, Bull. Am. Mus. Nat. Hist. 44 (septomaxilla).

1921 Steiner, Anat. Anx. 53 (tarsus).

1921 Stephens, Trans. San Diego Soc. Nat. Hist. 3. Nelson, Mem. Nat. Ac. Sci. 16.

1922 Schmidt, Bull, Am. Mus. Nat. Hist. 46.

1923 Snyder, Copeia 121 (eggs). Stejneger and Barbour, Check list.

1924 Emmel, Am. Jour. Anat. 33 (eggs, blood, young).

1924 Grinnell and Storer. Yosemite Fauna (eggs).

1926 *Batrachoseps attenuatus attenuatus* Dunn, Salamanders of the Family Plethodontidae. Smith College.

1928 Slevin, Occasional Papers, Calif. Ac. Sci. 16.

1943 Bishop, Handbook of Salamanders.

General Characters

(1) Small size, up to 136 mm. in length.
(2) Cylindrical, worm-like, body less than 10 mm. in diameter.
(3) Limbs very small, the front limbs slightly smaller than the others.
(4) Limbs widely separated, each one extends over four costal folds. Appressed toes may have 12 folds between them.
(5) Four digits on each foot, the first toe on each small.
(6) Tail more slender than the body, well-marked lateral grooves, 17 to 63, average 49.
(7) Tail cylindrical, equal to or slightly longer than the body.
(8) Costal grooves between the limbs, 18 to 20.
(9) Head depressed, narrow.
(10) Eyes prominent, separated in front by a little more than the eye opening.
(11) Indistinct naso-labial groove.
(12) Upper jaw overhanging the lower.
(13) Line of the lip straight to the posterior end of the orbital slit, then deflected downward.
(14) Gular folds distinct.
(15) Neck not distinct.
(16) Dorsal surface above lighter, red-brown, dark below, small flecks of white, especially ventrally.
(17) Tongue thin, rounded, its diameter about half the width of the mouth at the angle of the jaws, attached along the median line, free laterally and posteriorly.
(18) Maxillary teeth often large, scattered.
(19) Vomerine teeth in two separate but convergent patches.
(20) Parasphenoid teeth do not extend as far as the nares in the two closely applied patches or one that is notched in front.

In connection with the above characters represented by those I have examined the following conditions were found:

(1) Size. Adults.
Pudding Stone Dam, Claremont, April 15-20.
Length 66 to 117 mm., average 86.
Santa Ana Mts., April.
Lot 1. Length 69-93, average 79 mm.
Lot 2. Length 43 to 81, average 78 mm.
Ventura County, April.
Length 47 to 105 mm., average 75 mm.
Berkeley, Calif., Feb.

Length 42 to 105 mm., average 73 mm.
Crescent City, Calif., April.
Length 60 to 85 mm., average 77 mm.

(7) Length of tail.
Pudding Stone, Calif., April.
33 to 75 mm., average 52 mm. Proportion to body length 1 to one to 1 to 1.9 tail.
Santa Ana Mts., April.
16-67 mm., average 37 mm. Proportion of tail to body, 1.8 to 1 body.
Ventura County, April.
15 to 65 mm., average 36 mm. Proportion of tail length to body, shortest .5 or one half to 1.3 tail, to 1 body length.
Berkeley, Feb.
Tail length 19 to 65 mm., average 45 mm. Proportion of tail to body, 1 to 1 up to 1.6 tail to 1 body,
Crescent City, Calif.
Average length of tail 40 mm. Tail to body 1 to 1 up to tail 1.5 to 1 body.

(8) Costal grooves.
Pudding Stone. One lot 20 in all specimens. Another mostly 19.
Santa Ana Mts., 18 to 19.
Ventura County, 19.
Berkeley, Calif., 19 to 20, average 19.
Crescent City, mostly 20, a few 19.

(16) In most specimens the dorsal surface is lighter, a red or chestnut, the sides and lower surfaces darker to almost black. very often the darker margin along the lighter back appears as a dark line. In some the whole body is nearly black in the living with slight indications of a lighter back. This was true of a number from Berkeley.

(18) Maxillary teeth are especially large in some specimens, probably a sexual character.

(19) The vomerine teeth usually in two patches with a few teeth in each, in a row and several irregularly placed teeth. There were many variations.
Pudding Stone. Vomerine teeth, each patch a row of four teeth or a row of six and one out of line or six teeth in two irregular rows or eight teeth in two irregular rows.
Santa Ana Mts. Vomerine teeth in two patches nearly touching caudally. In some eight in two rows or fifteen in two rows, one of seven in each patch in two irregular rows.
Ventura County. Vomerine teeth in two rows eight in each patch.

Berkeley, Calif. Vomerine teeth in two patches sometimes nearly joining caudally each patch eight teeth in two rows also twelve in each patch, thirteen in each patch and fifteen in each patch.

(20) Parasphenoid teeth.
Pudding Stone. In two patches close together or in one partly separated at the cephalic or caudal end or both. Narrower at the forward end, broader behind.
Santa Ana Mts. Parasphenoid teeth in two patches or two areas near each other with about 100 teeth, forward ends pointed, separate and narrower than the caudal end.
Ventura County. Two patches slightly separated.
Berkeley. Two patches slightly separated or one patch more or less notched or separated in front. Narrower in front.

Range. From Oregon to San Diego County, California, especially towards the coast.

Distinctive characters. In general these have a lighter dorsal surface and darker sides. The costal grooves varied in number from 18 to 20 in the specimens I have examined, with an average of 19. In most the tail tapers somewhat. It varies in length from about the length of the body to nearly twice its length. The vomerine teeth are in two patches which nearly always touch, with a few to several teeth in one or two irregular rows. In the specimens I have examined there were from 8 to 15 teeth in each patch. The parasphenoid teeth were found in two patches which may nearly touch or be slightly separated.

Life History. The eggs were first discovered by T. Kimura January, 1906. Dunn January 5, 1907 found 21 eggs in one group and 10 in another and 4 farther along. The eggs were spherical or slightly oval, about 6 mm. in diameter and the development well advanced. The first to hatch came forth January 28. They were 17 mm. long of a dull black. By May 22 some were 35 mm. long. Burke in 1911 found eggs near Stanford with a maximum of 21 in a group. Snyder, 1923, described a batch of eggs at Palo Alto, each egg 6.3 mm. in diameter. The capsule was almost transparent of a pale amber color. The embryo at the stage described was 10 mm. long when stretched out. When it grew to 13 mm. the yolk was much reduced, the gills much shortened. When it was 16 mm. long the remnant of the yolk was inclosed in the body and the gill slits had disappeared. April 3, one hatched at 16.3 mm. length with no gills visible. Emmel, March 7, 1920, obtained eggs near Berkeley in a moist depression in the hillside, a group of 53 eggs. They were clumped together in a shallow groove about 6 inches long. Each egg was in a gelatinous capsule the whole with a diameter of 5 to 6 mm. The egg capsules were either attached by a narrow pedicle to small pieces of wood or other solid objects or attached to small thread-like rootlets. In about a week the embryos had lengthened to 13 or 14 mm. with the fore and hind limbs equal in length. Grinnell and Storer, 1924, reported on eggs found at Smelling, Jan. 8, 1915.

I have specimens collected at Laguna Beach August 27, 1943 from 30 to 35 mm. in length with an average of 33 mm. of which the tail is 11 to 16 mm. or an average of slightly more than the body length. All were dark below. From San Francisco some of 60 mm. had the tail about one half the total length. These were light below.

Batrachoseps attenuatus major (Camp)

1883 *Batrachoseps attenuatus* Cope,, Proc. Ac. Nat. Sci. Phila.
1915 Batrachoseps major Camp, Univ. Calif. Pub. Zool., 12, No. 12.
1917 Fowler and Dunn, Proc. Acad. Nat. Sci. Phila. Grinnell and Camp, Univ. Calif. Pub. Zool. 17, 10 Shufeldt, Aquatic life. Steineger and Barbour, Check List.
1921 Noble, Bull. Am. Mus. Nat. Hist. 44 (skull).
1924 Emmel, Am. Jour. Anat. 33 (blood).
1925 Storer, Univ. Calif. Pub. Zool., 27.
1926 *B. a. major* Dunn, Anniv. Pub. Smith College.
1928 *B. a. major* Selvin, Occasional Papers, Calif. Acad. Sci. 16.
1943 Bishop, Handbook of Salamanders.

General Characters

(1) Size up to 162 mm. in length.
(2) Cylindrical body, a little flattened.
(3) Limbs very small, front limbs slightly smaller.
(4) Appressed limbs widely separated. Hind legs extending over four costal folds. 11 costal folds between appressed toes.
(5) Four digits on each foot, first finger and toe normal.
(6) Tail cylindrical, about one and one third the length of the body. Caudal grooves well marked, from 38 to 50 with an average of 44.
(7) Tail large, cylindrical, often larger than the body.
(8) Costal grooves usually 18, occasionally 20.
(9) Head depressed.

(10) Eyes prominent, separated by the length of the orbital slit.
(11) Indistinct naso-labial groove not extending to the margin of the lip.
(12) Upper jaw overhanging the lower.
(13) Line of lip straight to a point below posterior end of orbital slit, then deflected downward.
(14) Gular fold quite prominent.
(15) Neck not distinct from body with 3 to 4 longitudinal grooves.
(16) Color above dark grey to reddish above, lighter on the sides and below becoming greyish yellow.
(17) Tongue large oval, not emarginate, attached in middle line, free laterally and posteriorly.
(18) Maxillary teeth usual.
(19) Vomerine teeth irregular patches on each side, nearly reaching to the internal nares.
(20) Parasphenoid teeth patches separated by narrow space posteriorly, confluent anteriorly reaching nearly to the vomer.

The following conditions were found in material I have studied:

(1) Size of adults Claremont, 80 to 121 mm. with an average length of 100 mm.

(6) The tail is often large and about the same diameter as the body for much of its length, however specimens of this sort kept several months without food come to have a much more slender tail.

(7) The tail is more cylindrical in specimens collected in winter. The average length of body 43 to average length of tail 60. The longest tail was 66 mm. or 1.5 the body length. The shortest tail was the same length as the body.

(8) Costal grooves 18 to 20, average in Claremont specimens 19 grooves.

(16) The color above was dark grey often with a reddish brown coloration especially in the young. Lower parts lighter not usually reticulated. Now and then there were some that were darker below.

(19) Vomerine teeth. Quite a little variation was noted in animals from same region. Usually the two patches were small and well separated from each other. In one large specimen the vomerine teeth were continuous with the parasphenoid. The number of teeth, usually irregularly

arranged, were found in the following numbers in each patch, 5, 6, 10, and 12.

(20) The parasphenoid teeth were usually in one patch with about 120 teeth on a side. There are usually a lobing at the ends suggesting two patches and in some there were two slightly separated patches. The forward end of the area was narrower than the back part and in some cases much narrower. In one case mentioned in (19), long bands of vomerine teeth in two irregular rows with twelve teeth in each patch, were continuous with the narrowed end of the vomerine teeth.

Distinctive characters. Usually these are with more massive tails than B. a.a., they are seldom dark below, the dorsal region may be red-brown, but its area is usually not so well marked as in B.a.a. The costal grooves and teeth cannot be said to be distinctive.

Range. These have been reported from Los Angeles, Riverside and Orange counties in California. They seem to be a little more inland and at higher elevations than B.a.a.

Life History. Little is known of their life history. One collected at Claremont Feb. 1944 is about the smallest I have seen. Its total length was 20.5 mm. with the tail less than half the length or 8 mm. Another lot collected Jan. 1, 1943, showed lengths from 25 to 29 mm. with an average length of 27 mm. The tail was from 9 to 11.5 mm. long or less than half the length in every case. The smallest of these could not have been hatched long judging from the known lengths of just hatched B.a.a.

Batrachoseps attenuatus leucopus (Dunn)

1880 Batrachoseps attenuatus Lockington, Am. Nat. 14.
1895 Van Denburg, Proc. Calif. Acad. Sci. (2).
1905 Gadow, Proc. Zool. Soc. London.
1909 Hilton, Am. Nat. 43.
1914 Van Denburg and Slevin, Proc. Calif. Acad. Sci. (4)4.
1922 Batrachoseps leucopus, Dunn, Copeia, 109.
1923 Stejeneger and Barbour, Check List (2).
1926 Batrachoseps attenuatus leucopus Dunn, Ann. Pub. Smith College.
1927 Klauber, Zool. Soc. San Diego, Bull. 3.
1928 Slevin, Occasional Papers, Calif. Acad. Sci., 16.
1943 Bishop, Handbook of Salamanders.

General Characters

1) Small size, up to 90 mm. in length, Slavin; 101 mm. Dunn, 127 Bishop.
(2) Body cylindrical, slightly flattened.
(3) Limbs very small, the front slightly smaller.
(4) Appressed toes widely separated. 12 costal folds between appressed toes.
(5) Four digits on each foot. First toe not free from the next on all feet (Dunn).
(6) Tail more slender than the body, well-marked lateral grooves, 17 to 50, average 31 grooves on the tail.
(7) Tail slender, usually a third longer than the body.
(8) Costal grooves between the limbs 18 to 20.
(9) Head depressed, narrow.
(10) Eyes prominent, separated anteriorly by a little more than the length of the orbital slit.
(11) Very indistinct naso-labial groove.
(12) Upper jaw overhangs the lower.
(13) Line of the lip straight to the posterior end of the orbital slit then deflected downwards.
(14) Gular fold distinct.
(15) Neck not distinct from the body, a longitudinal line from the eye to the fore limb.
(16) Dorsal surface above red-brown, lower surfaces dark much flecked with small white spots. Tail dark dorsally and on sides, lighter below.
(17) Tongue moderate, somewhat rounded, attached along the median line free on the sides and back.
(18) Maxillary teeth small.
(19) Vomerine teeth in two patches reaching almost to the internal nares.
(20) Parasphenoid teeth in a single patch, divided behind. Beginning opposite the eye socket.

Notes on My Specimens:

(1) Mine from San Diego were from 40 to 83 mm. long with an average length of adults of 60 mm. Those from Lower California, the longest were 78 mm., the smallest 21 mm., collected the first week in April. Average length of adults 60 mm.

(7) In San Diego specimens the longest tail was 44 mm., in the Lower Calif. specimens the longest tail was 48 mm. In proportion to body length the longest tail was 1.7 to the body, the shortest 1.2 to body length in San Diego specimens. In Lower California specimens it was 1.6 tail length to the body and 1.2 tail to body length in the shortest adult.

(8) Costal grooves between the legs in San Diego specimens from 18 to 20 with an average of 19.2. In Lower California specimens it was 19 to 20 with an average of 19.

(16) In many the dorsal surface was lighter, the lower sides black or darker with many minute flecks of white extending on to the legs and upper parts.

(19) The vomerine teeth in San Diego specimens were 5 on each side in a small patch. In Lower California specimens there was one irregular row on each patch with three to ten teeth in each patch. One had three on one side and four on the other.

(20) The parasphenoid teeth in Lower California specimens were in one patch deeply lobed and narrower in front. In a Lower California specimen a single patch had a bare spot in its upper middle line and above this teeth were found across from side to side. The San Diego specimens had one patch as far as studied. One Lower California specimen had 110 teeth on a side. One San Diego specimen had 75 teeth on a side.

Distribution

These have been described as from the Coronado Islands, Lower California, and San Diego County, California.

Those I have examined from the last two locations seem nearer B.a.a. than B.a. major.

Distinctions

These average smaller than the last two sub-species. They have reddish backs with the under sides darker in most cases. There are many flecked with white on the lower as well as upper sides, usually more so than in B.a.a. Their vomerine teeth are usually not numerous, the palatine usually one patch deeply notched.

BATRACHOSEPS ATTENUATUS PACIFICUS (Cope)

1865 Hemidactylum pacificum Cope, Proc. Acad. Nat. Sci. Phila.
1869 Batrachoseps pacificus Cope, Proc. Acad. Nat. Sci. Phila.
1875 Cope, Bull. U. S. Nat. Mus., No. 1.
1877 Smith, The Tailed Amphibians.
1882 Boulenger, Cat. Batrac. Grad. Brit. Mus.
1883 (3) Yarrow, Bull. U. S. Nat. Mus., No. 24.
1889 Cope, Bull. U. S. Nat. Mus., No. 34.
1905 Van Denburg, Proc. Calif. Acad. Sci., Ser. 3, Zool., 4, No. 1.
1917 Camp, Univ. Calif. Pub. Zool. 17. Steineger and Barbour. Check List.
1918 Dunn, Bull. Mus. Comp. Zool., 62, No. 9.
1923 Stejneger and Barbour, Check List.
1924 Emmel. Am. Jour. Anat., 33 (blood).
1925 Storer, Univ. Calif. Pub. Zool., 27.
1926 *Batrachoseps attenuatus pacificus* Dunn, Ann. Pub. Smith College.
1928 Slavin, Occ. Papers Calif. Acad. Sci. 16.
1943 Bishop, Handbook of Salamanders.

GENERAL CHARACTERS

(1) Total length not over 115 mm. (Storer).
(2) Cylindrical, worm-like.
(3) Limbs small, front smaller.
(4) Appressed limbs widely separated extending over 4 to 6 costal folds mostly 6.
(5) Four digits on each foot, first toe on front feet not free.
(6) Tail often not much more slender than the body, well-marked lateral grooves. Specimens from Santa Rosa Island 25 to 62, Anacapa 25 to 55, Santa Cruz Island 14 to 26. Averages 37, 33, 38.
(7) Tail cylindrical, usually tapering somewhat.
(8) Costal grooves between the limbs 16-20 (Dunn). Usually 17, occasionally 16-18 (Slavin). 17, rarely 16 or 18 (Storer).
(9) Head depressed, often wider than the body, rather broad, nearly circular in outline. Snout truncate above.
(10) Eyes prominent, large, separated by about the length of the orbital slit.
(11) Very indistinct naso-labial grooves.
(12) Upper jaw overhangs the lower.

(13) Line of the lip nearly straight to below the eye and then deflected downward.

(14) Gular fold distinct.

(15) Neck not distinct from the body, several vertical and two longitudinal grooves.

(16) Dorsal surface yellowish brown above, paler on the head and limbs to a fawn color on the tail. Upper lip and all lower surfaces dull yellow.

(17) Tongue large, oval not emarginate, attached along the median line, free laterally and posteriorly.

(18) Maxillary teeth usual.

(19) Vomerine teeth series separated by the width of the nares. Twice that distance separates the vomerine from the parasphenoids (Dunn).

(20) Parasphenoid teeth in two patches beginning at the middle of the eye socket.

Special points in material examined

(1) West Anacapa adults. Length 63-130 mm. 93 mm. average.
Middle Anacapa, 91-105 mm., average 97.5 mm.
Another lot Anacapa, 74-118 mm., average 94.5 mm.
Average from Anacapa 93-97.5 mm.
Santa Rosa Island, from 47-119.15 mm., averages 56 to 80 mm.

Santa Cruz Island:

Ranch Creek	Lot. 1.	Length	35-90 mm.	average 47.7 mm.
	Lot. 2.	"	41-51 mm.	average 45 mm.
	Lot. 3.	"	35-52 mm.	average 49 mm.
	Lot. 4.	"	27-43 mm.	average 30.1 mm.
	Lot 5.	"	48-64 mm.	average 53 mm.
	Lot 6. (all dark)	"	30-47 mm.	average 32 mm.
	Lot 7.	Length	40-50 mm.	average 46 mm.

Pelican Bay and Middle Ranch Length 51-103 mm. average 72 mm.

Average of all that seem to be adults 48 mm.

(8) Costal grooves between the limbs 16-19, average 17.

(16) Most of these from the three islands are a light grey above, much pailer below. In a number of young and some half grown or more, they are very dark both dorsally and ventrally. I saw no sign of a dorsal reddish brown back area in any, such as found in *B.a.a., B.a.l.* and occasionally in *B.a.m.*

Several full grown specimens were uniformly dark on all parts of the body and limbs, much like the younger ones.

(19) Vomerine teeth. Anacapa Island; two patches distinct from each other and from the parasphenoid. Number of teeth 7, 9, 10 and 11. These were in one row except with the larger numbers which were in two irregular rows or with an irregular arrangement. One specimen had 10 teeth on one side and 7 on the other.

Santa Rosa Island; vomerine teeth, 4, 5, 6 or 10 on a side in one row.

Santa Cruz Island; vomerine teeth, 3, 5, 7, 10, 11 or 12, mostly in one row in each patch except those with the higher numbers where there are two rows. One almost totally black specimen had 12 in each patch, irregularly arranged.

(20) Parasphenoid teeth. In all specimens examined there was one patch narrow and deeply notched in front. Some from Santa Cruz had less indication of lobing or partial division in front although most have most of the teeth on the sides with a region bare of teeth down the whole length of the patch.

Distribution. Anacapa, San Miguel, Santa Rosa, Santa Cruz and Santa Barbara Islands.

Distinctive features. Dark above, lighter below. Some specimens are uniformly dark both above and below. Little indication of a chestnut colored or lighter band on the back or lateral side lines of black as in *B.a.a.* Young are dark below as well as above. The tail is usually large and long, but I have not found it as swollen as in some *B.a.m.* or *B.a.c.* Dunn found the average costal grooves 16 to 20. I found an average of 17. The head is usually broader and the limbs heavier in proportion in this subspecies than in any of the others.

Life History. Little is known. Ovarian eggs from a specimen from San Miguel Island were 2 mm. in diameter May 20, 1919. Calif. Acad. Coll., No. 45226.

BATRACHOSEPS ATTENUATUS CATALINAE (Dunn)

1905 *Batrachoseps attenuatus* Van Denburgh, Proc. Cailf. Acad. Sci. (3)4.

1922 Batrachoseps catalinae, Dunn, Copeia 109.

1923 Stejneger and Barbour, Check List (2).

1926 *Batrachoseps attenuatus catalinae* Dunn, Anniv. Pub. Smith College.

1928 *B.a. attenuatus* Slevin, Occ. Papers Calif. Acad. Sci. 16.
1943 *B.a. catalinae* Bishop, Handbook of Salamanders.

General Characters

(1) Total length 80 to 121 mm.
(2) Body cylindrical, worm-like.
(3) Limbs small, front smaller. Leg extending over four costal grooves.
(4) Four digits on all feet, 1 of front foot not free, much reduced.
(5) Tail longer than head and body, terate (Dunn).
(6) Tail not much smaller than the body in many cases, well-marked grooves, 25 to 65, average 48.
(7) Tail cylindrical, may be large.
(8) Costal grooves between the limbs 19 to 21 (Dunn).
(9) Head depressed, about as wide as the body.
(10) Eyes prominent, eyelids fitting under a fold of skin behind.
(11) Naso-labial grooves faint.
(12) Upper jaw overhangs the lower. Angle of the jaw back of hind angle of the eye (Dunn).
(13) Line of lip sinuous.
(14) Gular folds distinct.
(15) Neck not distinct.
(16) Dark purplish above fading into a dull brownish below, no distinct line of demarkation between regions. (Dunn).
(17) Tongue free at sides and back.
(18) Maxillary teeth small.
(19) Vomerine teeth in two patches behind the inner corner of the nares, extending in and back, separated from its fellow by the width of the nares and from the parasphenoids by twice that distance. (Dunn).
(20) Parasphenoid teeth two incompletely separated patches, beginning opposite the middle eye socket. (Dunn).

General Features in Specimens Studied

(1) Length of adults 34 to 132 mm., average 101 mm.
(4) The first toe of the front feet is smaller than the average of most others but not of all. There is little difference in any case.
(5) The tail is about the same length as the body up to 1.6 the body length.
(6) Lateral grooves of the tail 25 to 63 with an average of 45.

(8) Costal grooves 20 to 22, an average of 21.

(16) Light grey above or light brown above, much lighter below both body and tail. Very little sign of red brown bands or areas on the back in specimens examined.

(19) Vomerine teeth in two well separated patches, 10 to 11 in each patch, teeth irregularly arranged.

(20) Parasphenoid teeth in one patch, narrow in front, may be indented in front. Middle line of patch bare of teeth.

Range. Catalina Island.

Distinctive Characters. These are paler below than on the back with little indication of a chestnut colored dorsal region in most. Many have very large thick tails in the collection. The first toe of the first leg may be slightly less distinct than in other forms. 20 to 22 costal folds with an average of 21 is rather distinctive.

Life History. Nothing known.

Specimens from Catalina Island, J. C. von Bloeker. All are from the Los Angeles County Museum with the following dates and numbers:

A. 4616.

Johnson's Landing, No. 13443-13447, Feb. 21, 1941.
No. 13467-13472, Feb. 23, 1941.
No. 13485-13488, Feb. 24, 1941.
No. 13507-11, Feb. 26, 1941.
No. 13529-34, Feb. 26, 1941.
No. 13547, 13559, 13562-3, Feb. 27-28 and March 1, 1941.
No. 13576-7, 13615, March 3 and 6, 1941.

Howland's Landing, No. 13566-8, March 2, 1941.

Little Harbor, No. 13587-8, March, 1941.

Avalon, No. 13590-1, March 4, 1941.
No. 13614, March 6, 1941.
No. 13707, March 13, 1941.

Middle Ranch, No. 13601, No. 13609, March 6, 1931.
No. 13621, March 7, 1941.
No. 13646-8, March 9, 1941.
No. 13675-3, March 11, 1941.
No. 13686-9, March 12, 1941.
No. 13699, 13700, March 13, 1941.

Ironwood Grove, north side Black Jack Peak, 1600 ft. elevatoin.
No. 13624, March 8, 1941. Black Jack Peak.
No. 13625. Fire control tank, Black Jack Peak, March 8, 1941.
No. 13639-41, Echo Lake, 1100 ft. S. Catalina I., March 8, 1941.

Discussion

Length

Batrachoseps attenuatus attenuatus. The greatest length given by Dunn was 145 mm. of which the tail was 86 mm. Burke gave 136 mm. Storer 130 mm. with the tail 78 mm. Slavin 93 mm., the tail 50 mm. The longest I have from southern California is 120. Average length, Bishop 89 mm. My average was 88 mm.

Batrachoseps a. major. Camp gives 162 as the longest, Storer 155 tail 94. Dunn 147 tail 87. Slavin 140 tail 81. The longest I have found in Claremont 121 with an average of 100. Bishop's average length was 117 mm.

B.a. leucopus. Bishop gives 127 as the longest. Dunn 101 with the tail 54. Slavin 90 tail 46. The longest I have is 83. Bishop's average length 87 mm., mine 60 mm.

B.a. pacificus. Bishop gives 129 as the longest, tail 70. Storer 115, tail 59. Slavin 115, tail 63 and 59. The longest I have seen was 130 tail 70. Bishop's average was 95.5 mm., mine about 90.

B.a. catalinae. Bishop gives 133 as the longest, tail 78. Dunn 121, tail 68. In a large series I have examined the longest was 132. Bishop's average 105.7, my average 101.

B. caudatus. Bishop 172 tail 107. Dunn 165, tail 110. Cope 160 tail 103. All from the same specimen at different times!

As may be noted my lengths are usually less than some of the others but in most cases I have examined fully as many specimens as any of the others. All mine were taken from preserved specimens.

Toes

In all but a few exceptions there are four toes on each foot. In one Catalina specimen, *B.a.c.*, the left front foot had but three toes, in order of length from the shortest to the longest, 3-1-2. The length of this specimen was 115 mm. (No. 13614).

In a specimen of 33 mm. *B.a.a.*, the left hind foot was deformed, the toes 1-3-2. Five specimens from Claremont B.a.m. had five toes on the hind feet. In order of length they were: 1-5-2-4-3 in three and 5-1-4-2-3 in the others. They were 46, 77, 77, 74, and 89 mm. long.

The first toe of the front leg is given by Dunn as not free in *B.a. cat.* as compared with other forms. This seems to be generally true in the specimens I have examined. The toes are also shorter and less slender on both feet.

TAIL

The tail is more slender than the body in all forms examined except in *B.a. major* and *B.a. catalinae.* In these it is often quite thick. Its size varies according to the physical condition of the individual. Members of the first group at least when first captured may have very thick tails, but after a few months in the laboratory these become as slender as any. The length of tail is somewhat a matter of age. Younger smaller specimens in various groups have tails as short as or shorter than the body. *B. caudatus* seems to have the longest tail, from 1.64 to 2 times the rest of the body.

According to various data the length of tail to the rest of the body is as follows:

B.a.a. 1 to 1.6.
B.a. major, 1.39 to 1.54.
B.a. catalinae, 1.3 to 1.4.
B.a. leucopus, 1 to 1.4.
B.a. pacificus, 1 to 1.2.

The number of grooves in the tail depends largely upon its length:

B.a. attenuatus, 17 to 63, average 44.
B.a. catalinae, 25-63, average 45.
B.a. major, 38-50, average 44.
B.a. pacificus, 25-55, average 37.
B. a. leucopus, 17-50, average 31.

COSTAL GROOVES:

B.a. pacificus: Slavin, usually 17, occasionally 18 or 20.
Dunn, 17-18.
Bishop, 17-20, usually 19.
Mine, 16-19, average 17.

B.a. leucopus: Dunn, 18-20.
Bishop, 18-20, usually 19.
Mine, 18-20, average 19.

B.a. major: Dunn, 18-20.
Storer, 17 or more, average 18.
Slavin, sometimes 20, usually 18.
Bishop, 18-20, usually 19.
Mine, 18-20, average 19.

B.a. attenuatus: Dunn, 18-21.
Storer, rarely 18 or 20, usually 19.
Slavin, occasionally 20 or 21, usually 19.
Bishop, occasionally 18 or 21, usually 20, many 19.
Mine, some 18 or 20, mostly 19.

B.a. catalinae: Storer, 19-21.
Dunn, 21.
Bishop, 20-21.
Mine, 20-22, average 21.

B. caudatus: Dunn, 21.
Bishop, 21.

Width of Head:

The head is not usually wider than the body but in a number of larger specimens of B.a. pacificus the head is wider than the body.

Markings and Pigmentation:

There is much variation but the following is generally true: *B.a. attenuatus* and *B.a. leucopus* seem darker below as well as above. There is little difference in the colors and markings in individual cases. Both may have a chestnut back with a dark line at the side making the ventral side darker than the dorsal. This last is especially true of *B.a. attenuatus.* As a rule *B.a. pacificus B.a. major* and *B.a. catalinae* are lighter below with a darker back. There are some that show a chestnut back like that of *B.a. attenuatus* but these are mostly younger.

Specks of white are especially marked on B.a. leucopus, both above and below in the living condition but they may also be seen on others, especially B.a. attenuatus.

Although most *B.a. pacificus* seem to be lighter below there are exceptions. Most of the young are darker below and a few of adult size are also almost black below. They are uniformly dark all over with no hint of lateral lines or a lighter dorsal region.

Shades and colors differ greatly in *B.a. attenuatus, B.a. major* and *B.a. leucopus.* They may be red-brown to almost black on the back, often in a variegated pattern in lighter colored forms. The color of most of the preserved adults of *B.a. pacificus* was light below, slightly mottled below due to scattered black pigment cells and light brown or fawn-color above. *B.a. catalinae* were for the most part in adults a dark grey above with a tinge of brown which seems to be somewhat characteristic and light grey below. In *B.a. major* some have red-brown backs but they are almost always lighter below. Usually the back is a uniform grey.

The dark colors in all have a reticulated pattern. On the ventral side of many light ones the reticulation is slightly indicated.

Teeth in the mouth

The descriptions by various authors is somewhat confusing. This is no doubt due in large part to the great individual variation.

Vomerine Teeth

B. caudatus:

Cope figures these as two elongate patches passing back from the internal nares in a V-shaped arrangement to nearly meet the two similar separate patches of the parasphenoids.

Dunn: 7 teeth in series beginning behind inner edge of nares, running back, separated from its fellow by two thirds the length of the series and from the parasphenoids by the length of the series.

Bishop: In short double series which arise behind inner margin of inner naris and slant inward and backward towards the middle line, where they are narrowly separated.

Slavin: In two nearly straight very oblique series which nearly meet on the middle line posteriorly, and anteriorly do not extend to the internal nares.

B.a. attenuatus:

Storer: Two separate but convergent patches posterior to the internal nares.

Dunn: In an irregular patch; this runs back from the inner edge of the nares, separated from its fellow by twice the width of the nares and from the parasphenoids by four times the width of the nares.

Slavin: In an irregular patch reaching almost to the internal nares.

Bishop: In two short patches of two to three rows, the patches separated at the middle line by about the width of an inner nares and widely divergent anteriorly. They are behind and wholly between the internal nares and are widely separated from the parasphenoids.

I have found great variation in these. The two patches usually have few teeth, often 4 to 6 or 8 in two rows. In some there are twelve teeth in a patch with two irregular rows of teeth.

B.a. major:

Storer: As in *B.a.a.*

Slavin: In a somewhat irregular patch nearly reaching internal nares.

Dunn: Irregular patch beginning behind inner border of nares, running in and a little back; separated from its fellow by the width of nares and from the parasphenoids by the same distance.

Bishop: Teeth small, in short patches of 1-3 rows, narrowly separated at the mid-line and lying wholly between and slightly behind the inner nares.

Here I found considerable variation. In one specimen the teeth were continuous with the parasphenoids. The number of teeth in the patches were 5, 6, 10 or 12. The last two had teeth roughly in two rows in most cases.

B.a. leucopus.

Slavin: In two series reaching almost to the internal nares.

Dunn: 8 in series, beginning behind the inner edge of the nares, running nearly straight back and slightly in, separated from its fellow by the width of the nares and from the parasphenoids by the same distance.

Bishop: Short irregular patches or in series consisting of 2 imperfect rows of 5-8 teeth which arise within or behind the inner margin of the inner naris and slant inward and backward toward the mid-line.

With these I often found 5 teeth each side, others had 3-10 on a side.

B.a. pacificus.

Storer: Teeth as in *B.a.a.*

Slavin: Teeth in two nearly straight, very oblique series which nearly meet on the median line posteriorly, and anteriorly do not extend to the internal nares.

Dunn: Teeth 8 in series beginning at inner edge of nares, running in and back, separated from its fellow by twice the width of the nares and from the parasphenoids by the width of the nares.

Bishop: Teeth often in a single row of 7-10 teeth, sometimes in short double series or irregular patches which arise behind the inner margin of the inner naris and slant inward and backward toward the mid-line, where they are narrowly separated. I found much variation in the number of teeth, 3, 5, 7, 10 or 11 in a patch with the larger number often in two irregular rows.

B.a. catalinae.

Storer: Not described.

Dunn: Teeth in two patches, beginning behind the inner border of the nares, extending in and back, separated from its fellow by the width of the nares, and from the parasphenoids by twice that distance.

Bishop: Teeth of vomer in short irregular patches, rarely in fairly regular rows of 6 or 7, which lie between the inner nares, narrowly separated from the middle line, and about 3 times the diameter of a naris from the parasphenoids. Those I examined had 10 to 11 teeth in each patch.

PARASPHENOID TEETH

B. caudatus.

Cope: His figure shows two distinct narrow patches.

Dunn: Two patches beginning opposite first quarter of eye-socket.

Bishop: Two elongate separate patches.

B.a.a. attenuatus.

Storer: Parasphenoid teeth separated from the vomerine by short interval one broad patch widest posteriorly.

Dunn: Two patches beginning at the middle of eye socket.

Slavin: Separated by a narrow space posteriorly but confluent anteriorly, extending nearly to the vomerine patch.

Bishop: May form a single patch, broad behind and slightly narrowed anteriorly or there may be two patches narrowly separated.

I have some with two patches close together, some partly separated at the anterior end and fused behind, or slightly separated behind. There were about 100 teeth on a side.

B.a. major.

Storer: As in *B.a.a.*

Dunn: Two patches beginning opposite the middle of the eye socket.

Slavin: Separated by a narrow space posteriorly but confluent anteriorly extending nearly to the vomerine patch.

Bishop: Often forming a single patch, broad and rounded behind, slender and tapering anteriorly, or in 2 patches narrowly separated behind, united anteriorly; separated from the vomerine teeth by about 3 times the diameter of an inner naris.

I found one, sometimes two patches, narrow in front, often forked in front and fused behind or the caudal region one piece. I counted about 120 teeth on a side.

B.a. leucopus.

Dunn: Single patch, divided behind.

Slavin: Separated by a narrow space posteriorly but confluent anteriorly, extending nearly to the vomerine series.

Bishop: Variable, in some a single patch broad behind narrowed anteriorly, in others two imperfectly separated patches; in some females the patches in contact anteriorly, divergent posteriorly.

Those I have seen have one patch deeply lobed and narrow anteriorly. In one there was a bare spot near the middle. I found one patch in most, a few with two. I counted about 75 teeth on a side.

B.a. pacificus.

Storer: Same as *B.a.a.*

Dunn: Two patches beginning at middle of eye socket.

Slavin: Separated by a narrow space posteriorly, confluent anteriorly, extending nearly to the vomerine series.

Bishop: Sometimes in two slender elongate patches narrowly separated or in a single broad patch narrowed anteriorly and separated from the vomerine teeth series by about 3 times the diameter of the naris.

In all I examined I found one patch, narrowly lobed in front.

B.a. catalinae.

Dunn: Two incompletely separated patches, beginning opposite the eye socket.

Bishop: Two long, slender, club-shaped patches which may be narrowly separated or contiguous anteriorly.

I found one patch in all I examined, forked in front, broad behind. In some the middle line was bare of teeth.

REVISED KEY TO BATRACHOSEPS

A. Tail especially long, 1.64 to 2 times the body. Dark color. 21 costal grooves. Parasphenoid teeth in two narrow, well-separated patches. *B. caudatus* Cope.

AA. Tail not so long. Often dark color, usually less than 21 costal grooves. Parasphenoid teeth in a single patch or in two closely placed wide patches.

B. Undersides in most cases lighter than above, in the adult. Usually uniform coloration above, little indication of side line. Seldom flecks of white above or below.

C. Head often broader than the body, tail always tapers somewhat. Costal grooves 17 to 20, 17 to 19 usual. Color adults red-brown above, uniform; lighter below. *B.a. pacificus.*

CC. Head not wider than the body. Tail often as thick or thicker than in other subspecies, depending upon nutritional conditions.

D. Toes usually short and thick. One of the front foot especially reduced. No individuals reported dark below. Tail 1.3 to 1.4 to the rest of the body. Vomerine teeth quite numerous in each patch, 10 or 11 as far as examined. Costal folds usually 21. *B.a. catalinae.*

DD. Toes usually fairly well developed, 1 of the front feet about as in other forms but *B.a.c.* Tail length to body 1.4 to 1.5 Costal folds 18 to 20. Usually 18-19. Light below, above grey to brown, sometimes red-brown especially often on the tail. Often uniform above, sometimes with a pattern. *B.a. major.*

BB. Under sides of the body usually dark. Often with a lighter back with a dark line down the sides. Tail usually not greatly swollen.

C. Usually many fine flecks of white on sides, back and below. Body slender. Average length 60 to 87 mm. Costal grooves average 19. Vomerine teeth 3 to 10 on a side. Palatine teeth about 70 on a side. Dark line on side of the body not as well marked as in many of the following group. *B.a. leucopus.*

CC. Flecks of light not always found, seldom numerous, seldom many dorsally. Tail length 1.6 to body length. Costal grooves usually 19. Vomerine teeth usually a few in each patch, 4, 6, 8 sometimes 12. Palatine or parasphenoid teeth often of two patches, may be 100 on each side. *B.a. attenuatus.*

COMPARISON OF THE SKELETON OF FOUR SUBSPECIES OF BATRACHOSEPS ATTENUATUS

The skull is a little longer in proportion in B.a. major and B.a.a. In B.a. pacificus the skull is larger in proportion to the body length than the others. Skulls of other subspecies differ slightly. In B.a.c. the skull is shorter and broader proportionately as compared to the rest.

The vertebrae are much alike in all with minor differences of size and proportion. These last are more evident in the atlas. In none of the vertebrae are there marked dorsal ridges in trunk vertebrae. In B.a.p. vertebrae 2 to 20 have on the dorsal side, caudal margin, a small central lobe better seen than in any others. This is more or less the continuation of a low central dorsal ridge. In B.a.m. two or three of the vertebrae after the first one have this lobe slightly shown. In B.a.l. the third vertebrae has such a lobe slightly shown. This is true of the specimens examined, but this character may be subject to variation and is probably of little significance.

In all, vertebrae 20 or 21 and on to about 26 are modified and their ribs variable, usually small. In most cases vertebrae 23 is the one connected with the pelvic girdle. Transverse processes of 24 are usually strongly developed with or without a small rib. In the 25th vertebra of all species there may be rods on the ventral side of the body of the vertebra which represent the beginnings of the haemal arch. In the 26th in most the haemal arch is well formed.

The pectoral and pelvic arches are similar in all, but in B.a.m. as a rule they are a little stronger than in B.a. or B.a.l. The fore and hind legs of B.a.p. are the heaviest and longest of all. The bones of the extremities are about the same in all. In some the digits may be spatulate on their ends, but this is not constant. Carpals and tarsals are about the same in all subspecies. Carpale or tarsale 3 are often small. The terminal joint of the first digit of both front and hind feet of B.a.c. are reduced to a very small point of bone, much less than in any of the other forms.

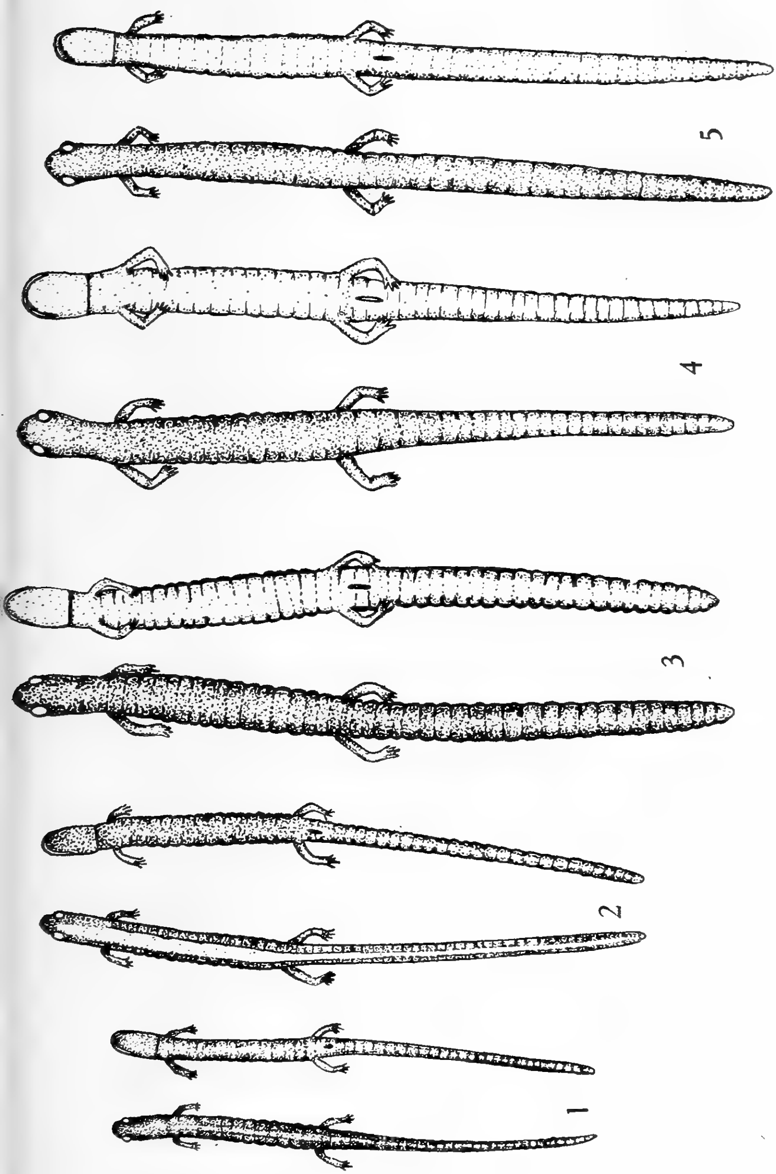

PLATE 29

Diagrams of the subspecies of Batrachoseps attenuatus drawn from photographs. Each is shown from above and below.
1. B.a. leucopus. 2. B.a. attenuatus. 3. B.a. major. 4. B.a. pacificus. 5. B.a. catalinae.

Plate 30

Photographs of B.a. pacificus. Above, below, head end enlarged and one dark specimen from below.

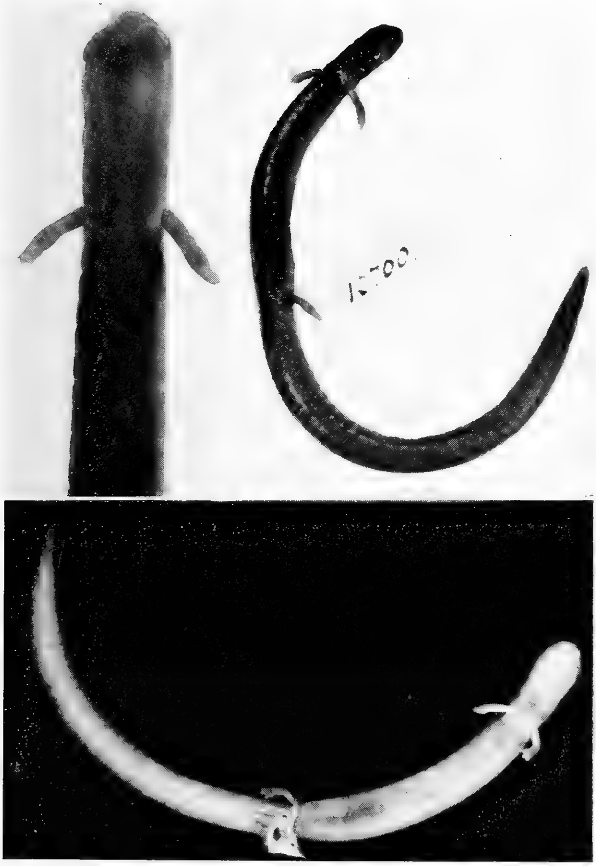

Plate 31

Photographs of B.a. catalinae, above, below and head end enlarged.

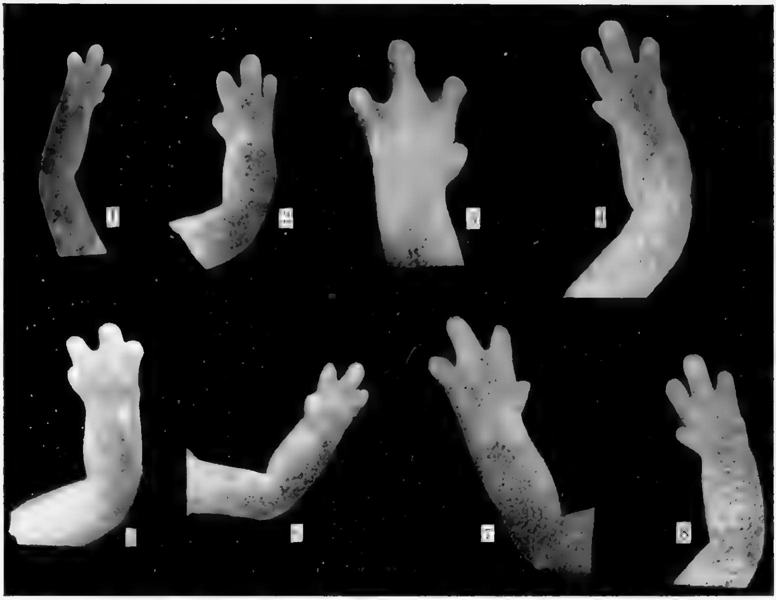

Plate 32

Hands and feet of various subspecies of Batrachoseps attenuatus, much enlarged. 1. Left front foot B.a.l. 2. Right front foot B.a.a. 3. Right hind foot B.a.p. 4. Left hind foot B.a.m. All in the first row are from above. 5. Right front foot B.a.c. 6. Left front foot B.a.c. from below. 7. Left front foot B.a.p. 8. Right front foot B.a.a. All in the second row but 6 from above. Finger or toe 1 is the smallest in each.

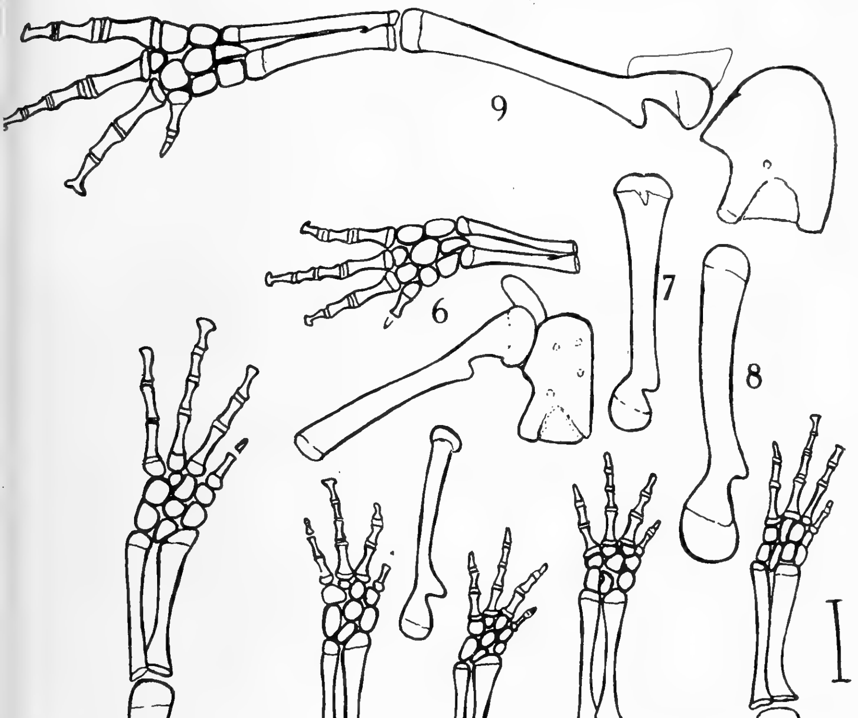

PLATE 33

Pectoral and pelvic regions with appendages of the various subspecies of Batrachoseps attenuatus. 1 to 5. shoulder girdles and appendages. 1. B.a.m. of 90 mm. body length. 2. B.a.a. of 106 total body length. 3. B.a.l. of 76 mm. body length. 4. B.a.c. of 105 mm. body length. 5. B.a.p. of 104 total length. 6. Part of the pelvic region with appendage of B.a.p. 7. Femur of B.a.a. 8. Femur of B.a.m. 9. Part of the pelvic region and appendage of B.a. catalinae. Scale at the right equals one mm.

MINERALOGY OF CALICHE FROM SAN DIEGO COUNTY, CALIFORNIA

K. O. Emery

Distribution of Caliche

In the vicinity of San Diego, California there are numerous outcrops of a crumbly, white, highly calcareous material—a type of caliche. It is described by Hanna (1926) as follows: "The upper part of the Eocene Poway conglomerate is often of soft, white, chalky caliche . . . found over rather extensive areas." No other formations are reported to contain caliche and the writer has found caliche associated only with the Poway formation. Caliche in outcrops is discontinuous and variable in thickness and purity.

The purest caliche is that just underlying the thin dark soil. With increasing depth, the caliche grades into shale or less commonly into sand or conglomerate at a depth of 2 to 15 feet. A similar variation of purity with depth was noted by Rothrock (1925) for caliche in Oklahoma. The layer of caliche is independent of the roughly horizontal stratification of the shale and sandstone, but closely follows the undulations of the surface topography (Pl. 35, fig. 1), like caliche in Arizona described by Blake (1901). Examination of the outcrops shows that the original bedding is generally destroyed and that numerous high angle joints or fissures are present. The material is softest and whitest where it fills these fissures. Elsewhere in the mass it serves as a matrix surrounding breccia-like fragments of the shale or sandstone (Pl. 35, fig. 2). Samples were collected from what seemed to be the purest portions of fifteen outcrops and mineralogical studies were made of some of them, using equipment made available by Scripps Institution of Oceanography.

Physical Properties

Microscopic examination of the white material shows that it consists largely of grains less than 0.01 mm. in diameter. The indices of refraction and the high birefringence indicate that most of the grains are calcite. Several of the samples were dried at 110° C., weighed, and treated with cold 2 N. HC1. The acid-soluble fraction varied between 43 and 88 per cent by weight.

A mechanical analysis was made of the acid-insoluble fraction of several of the samples. The size grades larger than 1/16 mm.

diameter were determined by sieving, using a nest of screens shaken mechanically for three hours. Smaller grades were determined by the standard pipette method with suspension in 0.01 N. $NaCO_3$.

Microscopic examination of the different grade sizes of the insoluble residue from Sample A, collected at the outcrop of Pl. 35, fig. 1, shows that it consists of three types of material, chief (87.4 per cent) of which are fresh angular grains of shale. Next in abundance (12.6 per cent) and present only in the coarser sizes, Pl. 34, fig. 1, is a white mineral mostly of tubular shape (Pl. 35, fig. 3). This mineral was separated from the heavier shale grains by flotation on a bromoform-alcohol solution having a specific gravity of 2.2, just sufficient to float the grains. Studied by oil immersion methods, the white mineral proved to be opal, being isotropic and having an index of refraction of 1.460 ($\pm$0.005). Very small inclusions of anisotropic grains of high index of refraction, probably calcite, are present within the opal. The third type of material in the insoluble residue consists of small brown fibers, some of which are enclosed within tubes of opal. These fibers represent only an insignificant percentage of the weight of the insoluble residue.

As shown in Table 1, the median diameter of the total insoluble residue from Sample A is 0.135 mm. However, when the opal tube fragments which are present only in the larger sizes are excluded, the shale grains alone have a smaller median diameter, 0.068 mm., and are slightly better sorted. Omission of opal fragments also changes the skewness from 0.63 to 1.07, shifting the grade of maximum sorting to near the median diameter.

A similar examination of the insoluble residue from Sample B showed it to be somewhat coarser and better sorted than that from Sample A. Most of the grains are clearly of detrital origin, consisting of sub-round to sub-angular grains of feldspar and various heavy minerals. However, this residue also contains brown fibers and tubes of opal.

ROOT FRAGMENTS

In all the insoluble residues small brown fibers are present. Some are partly enclosed within tubes of opal. Microscopic examination showed them to be roots of plants. The following description was kindly prepared by Dr. E. Yale Dawson:

"Roots exhibiting both primary and secondary growth were present. Some, measuring 250-500 μ diameter were provided with exceedingly abundant root hairs which were short, mostly 30-40 μ long, and arising from almost every epidermal cell. The shortness of the abundant root hairs reflect growth in quite dry soil. All roots were found in a natural growing position, in clearly defined fissures and between harder soil parts. An abundance of septate rhizoids, presumably of a bryophyte were found in two instances. A carbonized fragment of what appeared to belong to a resupinate liverwort was also detected."

TABLE 1

GRAIN SIZE CONSTANTS

	SAMPLE A		SAMPLE B
	Total Insoluble Residue	Shale Grains of Insoluble Residue	Total Insoluble Residue
First Quartile	0.016 mm.	0.012 mm.	0.031 mm.
Median Diameter	0.135 mm.	0.068 mm.	0.23 mm.
Third Quartile	0.72 mm.	0.41 mm.	0.38 mm.
Sorting	6.7	5.8	3.5
Skewness	0.63	1.07	0.22

SAMPLE A—From road-cut 6 miles west-southwest of Santee; caliche constitutes a six foot layer overlying green and brown shale; insoluble residue equals 51.9 per cent of original sample.

SAMPLE B—From road-cut on grade near Mercy Hospital; caliche forms a fifteen foot layer overlying sand; insoluble residue 56.4 per cent of original sample.

CHEMICAL ANALYSIS

A partial chemical analysis of Sample A was made through the kindness of Mr. P. F. Tapp. His analysis is shown in Table 2. Silica was determined as material insoluble in hot concentrated HC1 and may not be pure $S:O_2$. It is probable that soda and potash make up part of the undetermined 3.6 per cent of the sample.

On the assumption that in the insoluble residue the shale fragments have approximately the composition of an average shale as given by Clarke (1920), that the opal is $S:O_2$, and that the material soluble in dilute HC1 was $CaCO_3$ alone, a chemical composition was computed from the insoluble residue study. The computed analysis shows a rough consistency with the actual chemical analysis as shown in Table 2. Differences may be due to sampling errors or to inadequacy of the above assumptions.

TABLE 2

CHEMICAL ANALYSIS

	Per cent weight of original sample	Per cent weight of dry sample	Estimated from Insoluble residue
Ignition loss	26.1		
$CaCO_3$	......	50.0	50.5
$MgCO_3$	......	2.1	2.3
Fe_2O_3	......	2.1	1.8
Al_2O_3 (R_2O_3 minus Fe_2O_3)	......	4.4	7.1
Silica	......	37.8	32.4
		96.4%	94.1%

ORIGIN OF THE CALICHE

F. B. Plummer and P. F. Tapp (personal communications) give four possible origins for caliche:

1. Deposition of calcium carbonate by evaporation of water rising to the surface by capillarity.
2. Direct precipitation and deposition in sea water as marl or unconsolidated limestone.
3. Alteration of marine shales and limestones resulting in loss of alumina and silica and concentration of calcium carbonate.
4. Precipitation of calcium carbonate from spring water as impure travertine.

Distribution of the San Diego caliche over a wide area probably eliminates the fourth type of origin. The fact that the caliche is independent of the shale and sandstone stratification but instead is related to the present topographic surface. (Pl. 35, fig. 1) eliminates the second and indicates the probability of the first or third mode of origin. For either of these two origins the caliche would have been formed near the ground surface. The fact that the shale grains of Sample A are fresh and unweathered in appearance suggests deposition of caliche from evaporation of ground water rather than by alteration of shales. This type of origin is considered in more detail by Price (1933) and the actual stages in the formation of caliche are described by Hawker (1927). Robinson (1937) considers the typical environment of caliche soils to be semi-deserts, where the annual rainfall is 5 to 10 inches. Although the outcrops of caliche near San Diego are within a few miles of the ocean, the area represents no great exception, since the average annual rainfall is only 10 to 12 inches (Ellis and Lee, 1919). The relation of the caliche to the Poway formation may be due to a possible higher original calcium carbonate content of this formation than of other formations in the area, or to easier movement of ground water.

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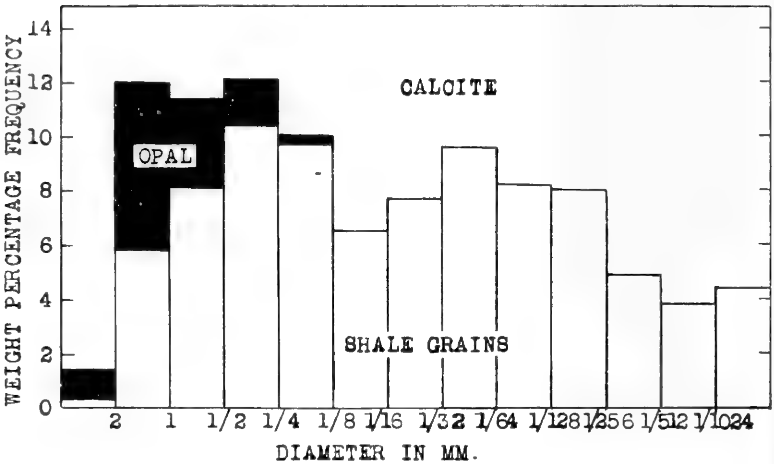

PLATE 34

Histogram showing percentage size distribution of shale grains and of opal tube fragments. The percentage weight of calcite in the original sample is indicated by the area of the blank space above the histogram, while the percentage weight of insoluble residue is indicated by the area of the histograms.

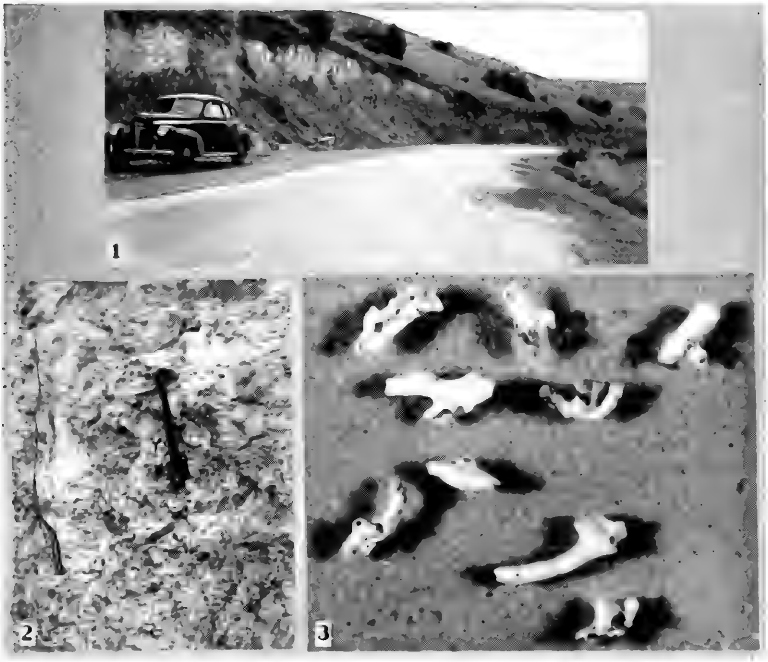

PLATE 35

FIG. 1. Outcrop of caliche 6 miles west-southwest of Santee. Note that caliche follows undulations of topography, and cuts diagonally across the shale bedding which is shown in the background to be nearly horizontal.

FIG. 2. Detailed view of caliche. Note the shale breccia a few inches to the right of the hammer handle. About a foot left of the hammer is a vertical fissure containing relatively pure calcium carbonate.

FIG. 3. Opal tubes from acid-insoluble residue of caliche. (X6).

DR. JAMES ZACCHAEUS GILBERT

1866-1945

The passing of James Z. Gilbert on July 7, 1945 removes from the ranks of the Academy one of its outstanding pioneers.

Dr. Gilbert's research along paleontological lines brought distinction to the several institutions with which he was associated, and has left a record that will cause his name to endure in the annals of science.

Academy members of long standing will recall the keen interest that was occasioned by the development of the La Brea fossil beds during the period between 1907 and 1910. Dr. Gilbert brought this important find to the attention of the Academy, and at its request supervised the exploration of the special pit allocated to it for investigation. The publication of his report in the January issue of Volume IX of the Academy Bulletin for 1910 gave wide stimulus to this interest. His many papers on zoological and paleontological subjects, such as the Cretaceous turtles of

Kansas, fossil whales and fishes of California and food fishes of the Pacific bear evidence of the wide diversity of his interests.

James Zacchaeus Gilbert was born in North Manchester, Indiana, January 1, 1866. He received his Ph.B. from McPherson College in 1894 and his Sc.D. in 1919. He also received the A.M. degree from Kansas University in 1895, and was granted an honorary LL.D. by Mt. Morris College in 1919.

His teaching career started in the schools of Indiana in 1884. He tutored in McPherson College in 1891, and served as a high school principal in Kansas in 1895.

Later he gave up the position as head of the science department of Plattsburg to accept the Presidency of Botetourt Normal College, Virginia, in 1900. He remained there until his removal to Los Angeles in 1904.

From that time on he was a teacher in the Los Angeles High School until his retirement in 1938. For six consecutive years of this period he also lectured on biology in the Dental College of the Univ. of So. Calif.

Dr. Gilbert was preeminently a teacher, and his kindly interest and scholarly attainment will long be remembered by thousands of students who came under his influence.

He held office or was a member of several scientific societies, including the Physical Geography Club and the Southern California Academy of Sciences. At one time he cooperated with Dr. David Starr Jordan in ichthyological research.

Dr. Gilbert was married to Harriet Yoder on December 25, 1895.

He is survived by his widow, and by two sons and a daughter, i.e., Dr. Harry Howard Gilbert of Los Angeles, Walter Pryce Gilbert of Pasadena, and Mary Marguerite (Mrs. Lynn Sheller) of Fullerton, California.

DR. RALPH HENRY SMITH

1888-1945

Ralph Henry Smith was born on a farm in Anderson County, Kansas, on June 7, 1888. His parents were pioneer farmers and he lived a strenuous but interesting childhood on the farm. He attended the country schools in the neighborhood and had two years of high school in Garnett, Kansas. After successfully passing the county examination for teachers he taught one or two terms in a country school before he was twenty years old. In 1908 he went to Emporia to attend Kansas State Teachers' College and graduated from that school in 1914.

He taught for one year in Blue Rapids, Kansas, High School, and was Superintendent of Schools in Irving, Kansas, for two years.

During the school year of 1915-16 he attended Kansas University and received his A.B. degree there in the spring of 1916. In July of that year he went to Oregon State College, Corvallis, Oregon, where he had a teaching fellowship for one year.

In 1917 he entered the University of California at Berkeley on a teaching fellowship, and received his M.S. degree there in May, 1918. He was immediately sent by the Federal Government to take charge of a war emergency project on the control of clover aphis at Twin Falls, Idaho. At the end of the war the Idaho State University took over the work and established a sub-experiment station at Twin Falls with Mr. Smith in charge.

He began work on the control of codling moth at that time and stayed in Twin Falls until March, 1922. He then went to San Francisco and while working for the Golden State Milk Company he developed the casein spreader now so widely used in sprays. During the two years he worked on that project he continued the codling moth investigations and visited every state and all the important apple growing districts, in the U. S.

In the fall of 1924 he reentered the University of California at Berkeley, completing the work on his Ph.D. in the spring of 1925. His Doctor's thesis was "The Efficacy of Lead Arsenate in Controlling Codling Moth."

Dr. Smith taught in the Entomology Department at Stanford University during the fall and winter terms of 1925-26. In March of 1926 he went to the Citrus Experiment Station at Riverside as Assistant Entomologist and began work on oil sprays. During the ten years he spent at Riverside he developed and perfected the tank mix method of oil spray. He was promoted to Associate Entomologist during that time and in 1936 was made a full professor in the University and transferred to U. C. L. A. to organize the Entomology Department on that campus. Thereafter he worked on the insects affecting ornamental plants. He was also conducting extensive experiments on the use of the new insecticide, DDT, in controlling insect pests of ornamental plants.

At the time of his death, which occurred on Saturday, September 22, 1945, he was working on two books; one "The Insect Pests of Ornamental Plants in the United States," and the other "The History of Oil Sprays."

Dr. Smith published many articles and his work with clover aphis, codling moth control, and tank mix method of oil spray were notable contributions to science.

Besides being a member of the Southern California Academy of Sciences Dr. Smith was active in the American Assoc. of Economic Entomologists, the Pacific Coast Entomol. Society, and the Entomological Soc. of So. Africa. He was also a member of the So. Calif. Horticultural Inst., the Kansas Hortic. Soc., the Illinois Hortic. Soc. and the Western Society of Naturalists.

Dr. Smith was married in 1914 at Bonne Terre, Missouri, to Sarah Fake, a fellow school teacher of Irving, Kansas. They have four sons: Norman, Hamilton, Gordon, and Stanford. In addition to his widow, Dr. Smith is survived by his mother, two brothers and three sisters, all of whom live in Kansas or Oklahoma.

GEORGE WILLETT

1879-1945

George Willett, Ornithologist of the Los Angeles County Museum and member of the Committee on Conservation of the Southern California Academy of Sciences died in Los Angeles on August 2, 1945.

Mr. Willett had attained a place of distinction in the fields of ornithology, mammalogy, conchology and paleontology. His numerous published papers in all of these branches of the zoological sciences had won for him the distinction of being an authority. More than that, his genial nature, and untiring efforts in behalf of others made for him a host of loyal friends.

George Willett was born in Hawkesbury, Ontario, Canada, May 28, 1879, the son of George and Hannah Theodosia (Hill) Willett. His father was an ordained Congregational minister.

Very early in life he developed the keen powers of observation and analysis which enabled him to obtain first hand knowledge of living creatures, and to organize, corelate and record his findings, thereby to later win for himself a place among scientists who possessed far more academic training than did he.

His grammar school work was obtained in Cowansville and Eaton Corner, Ontario, Canada, and Redlands, California, and his high-schooling was had at San Luis Obispo and Whittier, California.

He graduated from Whittier Preparatory School in 1896. The following year he entered Whittier College, where he played on the football team. He was not able to carry through his college work owing to economic pressure.

On May 5, 1898 he enlisted in the 7th California Volunteer Infantry, Company G, for the war with Spain. Later he served in Company A of the 35th U. S. Volunteer Infantry on active duty against Aguinaldo in the Philippine Islands. He was honorably discharged on December 2 ,1898, and thereafter served for a short time as a member of the Manila police force, before returning to the United States.

In November of 1902 he joined the U. S. Geological Survey and served under Harry Patterson until October of 1903.

The following year he became a member of the Los Angeles police force. He remained in police service for eight years during which he carried on intensive work in ornithology in his spare time.

Early in 1905 he married Anna M. Wells, and his son George Jr. was born the following year.

In 1906 he was elected to the Vice-presidency of the Cooper Ornithological Club. Three years later he was made a member of the Committee appointed by that organization to prepare documents and historical data for inclusion in the corner stone of the Museum building then being erected in Exposition Park. In 1912 the Cooper Club published his "Birds of the Pacific Slope of California." This same year he was made a member of the Conservation Committee of the Southern Division of the Cooper Ornithological Club.

In the summer of 1912 he resigned his sergeancy in the Police Department and became Ornithologist for the U. S. Biological Survey.

From that year on until 1926 most of his time was spent in Alaska. This was probably the most acquisitive period of George Willett's life from the standpoint of biological study and observation in the field.

The first six years, 1912 to 1917, he served as Ornithologist of the U. S. Biological survey, his studies taking him to Sitka in the summers of 1912-'13, and to Forrester Island in 1914 to '17. His winters were spent in Arizona and California except for a short trip to Laysan and Midway Islands in 1913.

From 1918 to 1921 he pursued biological studies independently, combining them with trapping, fishing and other occupations. He was on Forrester Island in 1919 and 1920 and also lived on Prince of Wales Island for a period of time. He was also at Wrangell in 1920 and '21.

From 1921 to 1925 he was a Deputy U. S. Marshall in Ketchikan, Alaska, where, on February 18, 1925 he married Ora Alta Bellah of Ketchikan. Thereafter Ora was his constant companion in the field and able assistant in his scientific endeavors. In the summer of 1925 he and his wife ran a fox farm on a small island off the coast of Alaska.

From June to December of 1926 he served as Ornithologist of the Alaska Game Commission. The following February he was called to the Los Angeles Museum to serve as acting Ornithologist on the Science Staff. In July of 1928 he became Curator of Ornithology in that institution, which position he held until the day of his death.

The nineteen years in which he held this post were the most productive of his entire career, as attested by the many published records, the considerable number of new species that he described, and the wealth of material that he added to the collections of the Los Angeles County Museum.

A list of the articles on natural history subjects which he wrote and published between 1895 and 1945, totaling 126, reveals that three-fifths of the items were issued during the time that he served as head of the Department of Ornithology of the Museum.

Several of his papers appeared in our Bulletin of the Academy.

He was buried with military honors in the Sawtelle Soldiers Home Cemetery, the final services being conducted by Roosevelt Camp, United Spanish War Veterans, of which organization he was a member.

J. A. C.

Bulletin, Southern California Academy of Sciences

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INDEX OF SUBJECTS

New varieties, species and genera indicated in **bold face type.**

INDEX OF AUTHORS

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NEW OR LITTLE-KNOWN CRANE-FLIES FROM CALIFORNIA

(TIPULIDAE, DIPTERA), II

By CHARLES P. ALEXANDER

The preceding part under this general title appeared in 1945 (Bull. So. California Acad. Sci., 44: 33-45, pls. 13-16). In the present report I am discussing the Californian species of the subgenus *Trichotipula* Alexander in the vast genus *Tipula* Linnaeus. Besides the thirteen species known from the state at this time, several additional forms are found in adjoining states, particularly to the east. The enumeration of the species adopted in the preceding part is continued in this paper, the first species in this report being No. 11. By adopting such a system of continuous numbering it will be possible at any time to readily ascertain the total number of species treated in the entire series of reports. I am very greatly indebted to several entomologists and collectors for their continued interest in saving Tipulidae during the past season. Particular acknowledgment is made to Messrs. John A. Comstock, Gustave Glückert, Joe Mayeda, Axel L. Melander, Lawrence W. Saylor, John L. Sperry and Loran Whitelock, Jr., for many specimens used in the present study. Through the appreciated interest of the various collectors, I am privileged to retain the type specimens of the species in my collection of these flies.

SUBGENUS TRICHOTIPULA

KEY TO MALES OF CALIFORNIAN SPECIES

1. Claws toothed 2
   Claws simple 5
2. Wings patterned, with distinct markings additional to the stigmal darkening 3
   Wings virtually unpatterned, except for the darker stigma 4
3. Mediotergite with a yellow central line; male hypopygium with the appendage of the 9th sternite bearing a slender lateral branch; antennal scape and pedicel more or less darkened. *beatula* O. S.
   Mediotergite uniformly plumbeous gray; male hypopygium with the appendage of the 9th sternite bearing a short stout lobe; antennal scape and pedicel light yellow. *capistrano* sp. n.

4. Male hypopygium with the 9th sternite produced caudad into two elongate appendages; inner dististyle with outer blade simple. *trichophora* Alexander

Male hypopygium with the 9th sternite not conspicuously produced; inner dististyle with outer blade bilobed. *macrophallus* (Dietz)

5. No macrotrichia in outer cells of wing 6

Macrotrichia in outer radial cells 7

6. Wings pale, costal border strongly darkened; knobs of halteres light yellow; vertical tubercle very high, clear yellow. *mayedai* sp. n.

Wings without a distinctly darkened costal border; knobs of halteres vaguely brightened; vertical tubercle low and convex. *desertorum* sp. n.

7. Male hypopygium with the 9th sternite produced caudad into two elongate pale horns. *megalodonta* sp. n.

Male hypopygium with the 9th sternite not produced 8

8. Male hypopygium with the outer dististyle with short, pale, inconspicuous setae 9

Setae of outer dististyle long and conspicuous, darkened 10

9. Outer dististyle pale. *bituberculata* Doane

Outer dististyle blackened. *cahuilla* Alexander

10. Wings strongly infuscated or blackened, stigma very distinct, obliterative areas conspicuous; mesonotum brownish black, with a broad central pale stripe extending the entire length 11

Wings only moderately infuscated, the stigma and obliterative areas not conspicuously contrasting; mesonotum without such a continuous pale stripe 12

11. Male hypopygium with the beak of inner dististyle short and obtuse; basistyle and 9th sternite with tufts of strong black setae. *sayloriana* sp. n.

Male hypopygium with the beak slender; basistyle and 9th sternite not bearing evident brushes of black setae. *furialis* sp. n.

12. Male hypopygium of simple unmodified structure, the inner dististyle not flattened or armed with spines; aedeagus simple; macrotrichia of wing cells sparse. *cazieri* Alexander

Male hypopygium with the rostral portion of inner dististyle strongly flattened into a blade, basad of which the margin is produced into two acute blackened spines; aedeagus elongate, divaricate at tip; outer cells of wing with numerous macrotrichia. *repulsa* Alexander

11. TIPULA (TRICHOTIPULA) BEATULA Osten Sacken.

The types were from Marin and Sonoma Cos., April-May, 1876 (Osten Sacken). Further records show a wide range in central and southern California.

Alameda County: Castro Valley, May 17, 1939 (Mont Cazier); Livermore, May 1, 1939 (T. H. G. Aitken); Moraga, May 1939 (Thomas Kelley).

Contra Costa County: Mount Diablo, altitude 1,000-3,000 feet, April 28, 1939 (Cazier & Kelley).

Santa Cruz County: Ben Lomond, near Brookdale, altitude 1,500 feet, June 1, 1945 (L. W. Saylor).

Monterey County: Hastings Reservation, April 30-May 15, 1943 (Jean Linsdale).

Riverside County: Idyllwild, altitude 5,400 feet, June 15, 1940 (C. D. Michener).

Los Angeles County: Griffith Park, Los Angeles, May 15, 1945 (Loran Whitelock, Jr.).

San Diego County: Palomar Mountain, 4,700 feet, July 3-4, 1945 (J. A. Comstock); Campo, on Mexican border, altitude 2,190 feet, May 18, 1945 (L. W. Saylor).

12. TIPULA (TRICHOTIPULA) BITUBERCULATA Doane.

The types were labeled "California," without exact locality.

Monterey County: Hastings Reservation, April 25-May 10, 1943 (Jean Linsdale).

Kern County: Arvin, March 14, 1935 (A. L. Melander).

Riverside County: Riverside, February 24, 1935 (A. L. Melander).

Los Angeles County: Claremont, on *Artemesia tridentata,* 1929 (Helen E. Sweet).

San Diego County: San Diego (through Doane).

13. TIPULA (TRICHOTIPULA) CAHUILLA Alexander.

The types were from Atascadero, San Luis Obispo County, April 26, 1919, and Bradley, Monterey County, April 27, 1919, collected by E. P. Van Duzee. Further material from Campo, San Diego County, altitude 2,190 feet, close to the Mexican border, and also across the border in Baja California, one mile south of Campo, all May 18, 1945 (L. W. Saylor).

14. Tipula (Trichotipula) capistrano sp. n.

Allied to *beatula;* mesonotum gray, the four praescutal stripes conspicuously bordered by brownish black; humeral and lateral borders of praescutum yellow; postnotal mediotergite brownish gray, unpatterned; antennae with scape and pedicel yellow; flagellum black; femora yellow, tips narrowly blackened; claws (♂) toothed; wings yellowish gray, restrictedly patterned with darker, the pattern arranged much as in *beatula;* male hypopygium with the appendage of ninth sternite stout, unequally bilobed, each lobe with conspicuous brushes of setae.

Male: Length about 11.5-12 mm.; wing 12-14 mm.; antenna about 2.2-2.7 mm.

Female: Length about 13-16 mm.; wing 11-14 mm.

Allied and generally similar to *beatula* Osten Sacken, differing in details of coloration and, especially, in the structure of the male hypopygium.

Frontal prolongation of head dark brown above, with a capillary yellow median line; sides of prolongation on dorsal half yellow, on ventral portion dark brown; nasus dark, long and slender; palpi dark brown. Antennae relatively short in both sexes; scape and pedicel yellow, flagellum black; flagellar segments in male weakly incised; verticils a little shorter than the segments. Head above obscure yellow; center of posterior vertex infuscated, sending a capillary vitta forward onto the anterior vertex; vertical tubercle low and virtually entire in front.

Pronotal scutum infuscated, scutellum light yellow. Mesonotal praescutum with four clear gray stripes that are conspicuously bordered by brownish black, the median vitta a little dilated near midlength; humeral and lateral praescutal borders yellow, the former more interrupted by darker at the margin; scutum gray, the mesal and posterior portion of each lobe narrowly blackened; central region of scutum and adjoining portion of praescutum yellow; scutellum yellow, with a central black stripe, parascutella blackened; mediotergite brownish gray, without the yellow central line found in *beatula;* pleurotergite yellow, the katapleurotergite conspicuously bordered by brownish gray, more intense dorsally. Pleura chiefly obscure yellow, restrictedly patterned with brownish gray, especially on the propleura, ventral anepisternum, ventral sternopleurite and meron. Halteres with stem yellow, base of knob dark brown, apex of knob obscure yellow. Legs with the coxae gray, the fore pair a little paler; trochanters yellow; femora obscure yellow, the tips narrowly blackened, the amount subequal on all legs; tibiae yellow, the tips even more narrowly blackened; tarsi obscure yellow basally, passing into black; claws (male) toothed. Wings with the ground yellowish gray, restrictedly patterned with darker; stigma oval, dark brown; paler brown clouds along cord, a spot near outer end of cell *M*, another beyond midlength of *Cu;* other washes in centers of outer radial cells, near base and tip of cell *1st A*, along border of *2nd A* and as a heavier cloud at end of vein *2nd A;* outer medial veins less evidently seamed with brown; veins dark brown, prearcular veins, *Sc, R* and R_{1+2} paler. Sparse macrotrichia in outer end of cell R_5 and occasionally in the adjoining cells; stigmal trichia lacking. Venation: Sc_1 very weak and faint but evidently preserved; R_{1+2} with macrotrichia only at base; fork of M_{3+4} before level of *r-m; m-cu* on M_4, the basal section of the latter perpendicular.

Basal abdominal segments yellow, sparsely gray pruinose, the outer segments more or less patterned medially and laterally with brownish black; a narrow subterminal brownish black ring; sternites and hypopygium chiefly yellow. Ovipositor with cerci straight, longer and stouter than the hypovalvae, the latter with very acute tips. Male hypopygium (Plate 1, fig. 1) relatively large. Ninth tergite, *9 t*, with the caudal notch relatively broad but deep, U-shaped; lateral lobes obtusely rounded, the usual blackened spinoid setae not reaching the base of the notch, being here replaced by delicate setulae; spines or outer thickened portion of lobes shorter, more peglike, retrorse. Ninth sternite, *9s*, with the appendage of either side stout, conspicuous, bearing a smaller lateral lobule on side; apex of main arm of appendage with unusually long dense yellow setae; lateral lobule with more sparse but powerful setae at apex and along sides. Outer dististyle, *od*, broadly oval, setae long but pale. Inner dististyle, *id*, with the rostrum blackened, very long, the outer third slender. Eighth sternite emarginate on posterior portion, the notch filled with pale membrane.

Holotype, ♂, San Gabriel River Bird Sanctuary, near El Monte, Los Angeles County, May 21, 1945 (J. A. Comstock). *Allotopotype*, ♀, pinned with type. *Paratopotypes*, ♂ ♀. *Paratypes*, ♂, San Francisco, March 27, 1935 (Ting), formerly determined as *beatula;* ♂ ♀, Elsinore, Riverside County, 1,300 feet, May 13, 1945 (G. Glückert); Del Mar, San Diego County, June 10, 1945 (J. A. Comstock); Campo, San Diego County, 2,190 feet, May 17, 1945 (L. W. Saylor).

15. TIPULA (TRICHOTIPULA) CAZIERI Alexander.

A ♂, Claremont, Los Angeles County (C. F. Baker). Although this specimen is much larger than the type and other specimens from Nevada, the structure of the male hypopygium is so similar that I must regard the identification as being correct.

16. TIPULA (TRICHOTIPULA) DESERTORUM sp. n.

General coloration opaque; praescutum with three brownish gray stripes, the interspaces narrowly dark brown, more or less united in front, behind crossing the suture onto the mesal portion of each scutal lobe; antennae with scape and pedicel light yellow, flagellum black; halteres weakly darkened, knobs brownish yellow at tips; wings weakly tinged with brown, cell *Sc* and stigma medium brown; no macrotrichia in wing cells; male hypopygium with the outer dististyle broadly flattened, with coarse setae; inner dististyle with beak obtuse; setae immediately back of beak very long, pale, erect.

MALE: Length about 13 mm.; wing 10 mm.; antenna about 4 mm.

FEMALE: Length about 15 mm.; wing 12 mm.

Frontal prolongation of head obscure brownish yellow above, including the nasus; lower half of prolongation dark brown; palpi brown; nasus longer in female than in male. Antennae with scape and pedicel light yellow, flagellum black; flagellar segments of male moderately incised, verticils shorter than the segments; in female, segments subcylindrical, the verticils exceeding the segments in length. Front and anterior vertex light yellow, the orbits and central portion of posterior vertex more obscure yellow, sides of posterior vertex infuscated; vertical tubercle simple, low and convex.

Pronotum obscure yellow, restrictedly patterned with pale brown, the sides of both the scutum and scutellum light yellow. Mesonotal praescutum opaque, with three brownish gray stripes, the interspaces narrowly dark brown, extending the entire length of the sclerite, more or less united across the cephalic border, behind crossing the suture onto the mesal portion of each scutal lobe; lateral borders of each praescutal stripe similarly darkened, expanded behind, crossing the suture onto the anterior portion of the scutal lobes; scutellum brownish yellow; mediotergite pale brown, its central portion and narrow lateral borders vaguely more yellowed. Pleura and pleurotergite obscure yellow, restrictedly patterned with brown, most evident on the anepisternum; dorsopleural membrane pale. Halteres short, stem obscure yellow, base of knob weakly darkened, the apex obscure brownish yellow. Legs with the coxae yellow, the fore pair a trifle darker; trochanters yellow; femora yellow, the tips narrowly brownish black, the amount subequal on all legs; tibiae and basitarsi obscure yellow, the outer tarsal segments passing into black; claws (male) simple. Wings with a very weak brownish tinge, cell *Sc* and stigma medium brown; whitish obliterative area across base of cell *1st* M_2 moderately distinct, pre- and poststigmal brightenings scarcely evident; vague whitish streaks in certain cells, especially *R, M,* outer radial cells and in cell *1st A* near vein *2nd A;* veins brown. Stigmal trichia very sparse, only 3 or 4 in either sex; no macrotrichia in outer wing cells. Venation: Sc_1 distinctly preserved, erect; M_{3+4} very short, forking before level of *r-m.*

Abdomen medium brown, the more basal segments variegated with yellow, especially on the basal rings or incisures; outer segments more uniformly brown; sternites and hypopygium yellow. Male hypopygium (Plate 1, fig. 3) with the ninth tergite, *9t,* broad, especially the lobes; median notch narrow but deep; elongate spinoid setae extending almost to base of notch; retrorse spicules on ventral face of lobe numerous. Outer dististyle, *od,* broadly flattened, apex obtuse; setae elongate, those of outer margin of medium length, black, very dense, those of lower edge of various lengths, paler in color, the longest only a little shorter than the maximum width of style. Inner dististyle, *id,* with the beak moderately produced, obtuse; outer setae behind the beak very long, pale, erect (near the outer basal lobe with a flattened blade that is not shown in the figure). Ninth sternite with the appendage a low rounded lobe, provided with long reddish setae, with a comparable group on the basistyle.

Holotype, ♂, Borego, San Diego County, April 19, 1944 (J. L. Sperry). *Allotopotype,* ♀, pinned with type.

Closest to species such as *Tipula (Trichotipula) mayedai* sp.n., but amply distinct.

17. TIPULA (TRICHOTIPULA) FURIALIS sp. n.

Very similar in its general appearance to *sayloriana,* differing especially in the structure of the antennae and male hypopygium, as compared below.

MALE: Length about 11.5-13 mm.; wing 10.5-12 mm.; antenna about 4.5-5 mm.

Antennae more elongate than in *sayloriana,* the flagellar segments correspondingly lengthened, especially the stems; in the Inyo County paratype, antennae shorter (4 mm.). Praescutum with the lateral stripes distinct but darker gray than the much more evident median line; central region of scutum light yellow, extended forward onto the posterior portion of praescutum; scutellum weakly infuscated, somewhat interrupting the central pale mesonotal stripe; pale line on mediotergite very distinct, subequal in width to the line on the scutum. Pleura and pleurotergite dark gray, the dorsopleural region and a ventral stripe paler, the latter more distinct on the mesepimeron and metapleura. Halteres with apex of knob obscure yellow. Wings with the whitish obliterative areas more extensive, the prestigmal one including all of cell R_1 before the stigma, the others correspondingly large; membrane in vicinity of veins somewhat paler than the centers of the cells to produce a slightly streaked appearance. Stigmal trichia more abundant. Male hypopygium (Plate 2, fig. 6) with the tergite, *9t*, more deeply emarginate, the lateral lobes slightly narrower; a group of small blackened spicules on lateral lobes. Ninth sternite and basistyle with the setae more sparse, paler and more slender, not forming conspicuous brushes. Outer dististyle, *od*, broader, the length about two and one-half times the greatest width. Inner dististyle with the beak more slender, its tip rounded; crest back from the beak bearing 8 to 10 very long setae; setae of dorsal crest dark brown in color.

Holotype, ♂, Campo, San Diego County, altitude 2,190 feet, June 28, 1945 at light (L. W. Saylor). *Paratopotype*, 1 ♂, June 24, 1945 (L. W. Saylor). *Paratype*, 1 ♂, Camp Manzanar, Inyo County, altitude about 3,700 feet, July 6, 1945 (Joe Mayeda).

18. TIPULA (TRICHOTIPULA) MACROPHALLUS (Dietz).

Part of the type series was from Milpitas, Santa Clara County, collected in April 1912 by H. Miller. The species has a wide range in western North America, additional California records being as follows:

Contra Costa County: Berkeley, May 4, 1939 (T. H. G. Aitken).

Monterey County: Carmel, July 7, 1940 (Aitken & Cazier): Hastings Reservation, June 1, 1943 (Jean Linsdale).

Los Angeles County: San Gabriel River Bird Reservation, near El Monte, May 21, 1945 (J. A. Comstock); Griffith Park, Los Angeles, May 19, 1945 (Loran Whitelock, Jr.).

19. TIPULA (TRICHOTIPULA) MAYEDAI sp. n.

General coloration of body contrasted light yellow and gray; frontal prolongation of head dark chestnut brown, the mid-dorsal line, including nasus, yellow; antennae relatively long, scape yellow, flagellum black; head light yellow, including the very high, simple verticle tubercle; sides of posterior vertex more brownish gray; praescutum with four gray stripes that are separated by pale brown interspaces; median region of scutum, scutellum, parascutella, a conspicuous central stripe on mediotergite, and the dorsal pleura light yellow; ventral pleura chiefly brownish gray; knobs of halteres light yellow; wings pale brownish, the costal border conspicuously darker brown; no trichia in cells of wing; male hypopygium with the outer dististyle broad, with coarse setae; inner dististyle with the beak narrow; eighth sternite with extensive pale membrane, isolating the lateral lobes.

MALE: Length about 12-13 mm.; wing 10-10.5 mm.; antenna about 4.5-4.6 mm.

Frontal prolongation of head dark chestnut brown, polished, at base and along mid-dorsal line, including the elongate nasus, narrowly yellow; palpi black. Antennae (male) relatively long; scape yellow, pedicel dark brown, flagellum black; flagellar segments moderately incised, clothed with a dense white pubescence; longest verticils shorter than the segments. Head bright yellow, more infuscated on sides of posterior vertex, the surface of the latter, with the narrow orbits, light gray pruinose; vertical tubercle very high and conspicuous, entirely simple.

Pronotal scutum testaceous yellow, the lateral angles and the scutellum very light yellow. Mesonotal praescutum opaque, almost covered by four light gray stripes; interspaces pale brown, relatively inconspicuous, more evident behind, the capillary median darkening even less evident, becoming obsolete at near midlength of the sclerite; humeral region light yellow, concolorous with the pronotum and dorsopleural membrane; lateral praescutal border gray; scutal lobes chiefly gray, the anteromesal portion vaguely darkened; median region of scutum, with the narrow adjoining portion of the praescutum, the scutellum, including parascutella, and a conspicuous central stripe on mediotergite all light yellow, the mediotergite elsewhere with a conspicuous brownish gray area on either side; pleurotergite more or less brownish gray, especially on the katapleurotergite, otherwise yellow. Pleura chiefly brownish gray, the dorsopleural region broadly light yellow, the remainder vaguely patterned with yellow, more evident on the posterior sclerites. Halteres with stem brownish black, knob conspicuously light yellow. Legs with the coxae infuscated, sparsely pruinose, the fore pair somewhat darker brown; femora brownish yellow, the tips very narrowly blackened, the amount subequal on all legs; tibae yellowish brown to brown, passing into black; tarsi black; claws (male) simple. Wings with the ground pale brownish, paler, more whitened, in the paratype; prearcular field, cells *C* and *Sc*, and the stigma conspicuously darker brown; obliterative area across cell *1st* M_2 conspicuous, the prestigmal and poststigmal brightenings somewhat less so; veins dark brown. No trichia in outer cells of wing; stigmal trichia coarse but sparse, varying in number from 2 to 8. Venation: Sc_1 more or less preserved, in cases slightly broken at *C*.

Abdomen with pattern somewhat variable, in cases, including type, the more proximal tergites and sternites chiefly obscure yellow, more darkened laterally, outer segments more uniformly darkened; in other cases, the abdomen more extensively and uniformly darkened, leaving the median region of the tergites broadly yellow; hypopygium chiefly yellow. Male hypopygium (Plate 1, fig. 2) with the ninth tergite, *9t*, having the median notch deep, margined with sparse blackened spinoid setae that extend to the very base of the notch; ventral blackened spiculae near apex of lobes mostly retrorse. Outer dististyle, *od*, broad; setae long and conspicuous; style widest at or just before midlength, about one-half as wide as long. Inner dististyle, *id*, with the beak narrow, before the apex with an extensive group of long pale setae. Eighth sternite appearing rather deeply emarginate by pale membrane that is provided only with microscopic microtrichia; lobes with long coarse setae that become more concentrated at the apices.

Holotype, ♂, Camp Manzanar, Inyo County, altitude about 3,700 feet, July 1-6, 1945 (Joe Mayeda). *Paratopotypes* 2 ♂ ♂.

Paratype, 1 ♂, Borego, San Diego County, April 18, 1944 (J. L. Sperry).

The species is named for Mr. Joe Mayeda, to whom we are indebted for many fine Tipulidae from the vicinity of Camp Manzanar.

20. Tipula (Trichotipula) megalodonta sp. n.

General coloration opaque brownish gray, including four stripes on praescutum that are bordered by darker brown, the lateral praescutal borders broadly yellow; antennae with scape and pedicel light yellow, flagellar segments beyond the first one or two blackened; apex of knob of halteres obscure yellow; femora yellow, the tips narrowly brownish black; wings brownish yellow, the oval stigma dark brown, very conspicuous; outer cells of wings with abundant macrotrichia; basal abdominal tergites brown and yellow, the outer segments more uniformly darkened; sternites and hypopygium chiefly yellow; male hypopygium with the tergal notch narrow; ninth sternite produced caudad into two elongate horns that jut beyond the other hypopygial elements; beak of inner dististyle slender.

Male: Length about 9-10 mm.; wing 10-11.5 mm.; antenna about 3.5-3.8 mm.

Female: Length about 12-13 mm.; wing 11-11.5 mm.

Frontal prolongation of head above, including nasus, yellow, darker on sides; palpi brown. Antennae (male) of moderate length; scape and pedicel light yellow, basal two flagellar segments brown, the outer segments dark brown or brownish black; flagellar segments gently incised, subequal in length to the longest verticils. Head above yellow, with a major brownish gray area on either side of the posterior vertex, the midline light yellow; vertical tubercle very low and simple.

Pronotum yellow, restrictedly patterned with brownish gray, arranged in four more or less distinct areas, the intermediate pair narrowly separated by a yellowish central line. Mesonotal praescutum with four opaque brownish gray stripes that are bordered by darker brown, these lines forming the interspaces; humeral and lateral portions of praescutum broadly yellow; scutal lobes similarly brownish gray, bordered internally by brown; median area of scutum clear yellow; scutellum and anterior central portion of mediotergite obscure yellow, the remainder brownish gray, Pleura yellow, conspicuously patterned with brownish gray, including more or less distinct longitudinal stripes, the more dorsal from the propleura across the anepisternum, not including the pteropleurite; ventral stripe including the lower sternopleurite and meron, the lower edge of the katapleurotergite darkened. Halteres with stem yellow, base of knob dark brown, the apex obscure yellow. Legs with the coxae narrowly brownish gray basally, the apices broadly yellow; trochanters yellow; femora yellow, the tips, together with the tarsi, black; claws (male) simple. Wings brownish yellow, the oval stigma dark brown, very conspicuous; a restricted brown cloud over the anterior cord; a linear dusky line in cell *R;* less evident pale brown seams over veins M_1, M_2 and distal section of Cu_1; obliterative areas before and beyond stigma and across base of cell *1st* M_2 relatively small and inconspicuous against the ground; veins dark brown, *Sc* and *R* more yellowed. Macrotrichia of outer cells abundant and well-distributed, especially numerous in cells R_3, R_5 and M_1, where more than the outer half of cell is included; in cells *2nd* M_2 and M_3 the trichia are more restricted to the outer ends of the cells; stigmal trichia abundant. Venation: Sc_1 atrophied; R_{1+2} entire, with trichia throughout its length; cell M_1 deep, its petiole usually subequal to or shorter than *m;* basal section of M_{3+4} short, usually subequal to *r-m*.

Basal abdominal tergites obscure yellow, with a broad dark brown stripe on either side, at about midlength of abdomen becoming more extensive to confluent, restricting the ground to the lateral borders; sternites yellow, the seventh dark brown; hypopygium chiefly yellow, the outer horns of the ninth sternite dusky. In female, the genital shield brownish black; hypovalvae and cerci subequal in length, straight Male hypopygium (Plate 2, fig. 4) having the tergite fused with the sternite and basistyle only on the cephalic portion. Ninth tergite, *9t*, with an unusually deep and narrow median notch, the margin with blackened spinoid setae, those of the more thickened outer border of lobes smaller, more peglike, retrorse. Ninth sternite, *9s*, profoundly divided beneath, produced caudad into two elongate horns that extend far beyond all other elements of the hypopygium, the narrowed outer third or more directed slightly dorsad, the tips narrowly obtuse. Outer dististyle, *od*, unusually narrow, tapering to the subobtuse apex, the surface provided with long coarse setae. Inner dististyle, *id*, with the beak unusually slender, blackened; outer basal lobe produced into an erect pale hornlike point or spine, its tip acute, the surface with long coarse setae; near base of lobe with a second stouter but shorter black lobe. Eighth sternite with the median area very extensively filled with pale membrane that is destitute of setae, the sides and dusky lateral lobules provided with coarse setae.

Holotype, ♂, Elsinore, Riverside County, 1,300 feet, May 13, 1945 (G. Glückert). *Allotopotype*, ♀, pinned with type. *Paratopotypes*, 8 ♂, ♀, three pairs pinned "in copula." *Paratypes*, *2* broken ♂ ♂, Griffith Park, Los Angeles, May 26, 1945 (Loran Whitelock, Jr.); 1 ♀, Del Mar, San Diego County, April 29, 1945 (J. A. Comstock).

21. TIPULA (TRICHOTIPULA) REPULSA Alexander,

Known from British Columbia to California.

Solano County: Green Valley, June 13, 1939 (George Bohart).

Mariposa County: Mormon Bar, June 6, 1940 (Brookman, Cazier & Aitken).

22. TIPULA (TRICHOTIPULA) SAYLORIANA sp. n.

Allied to *apache;* general coloration of mesonotum dark brown to brownish black, with a broad central pale stripe extending the entire length; femora obscure yellow, the tips narrowly blackened; wings with an unusually strong brownish ground, variegated by the still darker stigma and small but very conspicuous whitish obliterative areas, these including a mark across base of cell *1st* M_2 and pre- and post-stigmal areas; sparse macrotrichia in outer ends of cell R_5 and M_1; vein Sc_1 retained; male hypopygium with brushes of blackened setae on basistyle and ninth sternite; outer dististyle narrow, the length exceeding three times the width, provided with long conspicuous setae; inner dististyle with the beak short and obtuse; dorsal crest with a fringe of long yellow setae.

MALE: Length about 11 mm.; wing 10.5 mm.; antenna about 4.5 mm.

Frontal prolongation of head above light yellow, the sides and ventral portion abruptly brownish black; nasus distinct, pale; palpi black. Antennae with the scape and pedicel light yellow, flagellum uniformly black; flagellar segments beyond the first gently incised; longest verticils a little shorter than the segments. Anterior portion of vertex light yellow, the sides of the posterior vertex infuscated.

Pronotum narrowly yellow medially, dark brown on the sides. Mesonotum dark brown or brownish black, with a broad central pale stripe down the entire length, light gray on the praescutum, light yellow on the posterior sclerites, a little widened at the scutellum, narrowed to a point at the abdomen; lateral praescutal stripes and scutal lobes barely differentiated from the blackened ground; parascutella black; side of mediotergite more pruinose. Pleura and pleurotergite chiefly dark brown, light gray pruinose, vaguely patterned with obscure brownish yellow, most evident on the dorsopleural membrane, along the dorsal sternopleurite and across the posterior pleurites to the root of the halteres. Halteres short, blackened, only the base of the stem restrictedly yellow. Legs with the coxae dark brown, sparsely pruinose; trochanters obscure yellow; femora obscure yellow, the tips narrowly blackened; tibiae brown, tarsi passing into black; claws (male) simple. Wings with an unusually strong brownish ground, cell *Sc* a trifle darker; stigma dark brown, oval, very conspicuous; isolated small white spots before and beyond stigma, at extreme outer end of cell *C*, and across the base of cell *1st* M_2 and adjoining portions of *R*, not or scarcely invading cell M_3; veins brown, except in the obliterative areas. Rather sparse macrotrichia in outer ends of cells R_5 and M_1, more abundant in the former; a few scattered stigmal trichia. Venation: Sc_1 distinctly preserved; *m* subequal to petiole of cell M_1; basal section of M_{1+2} about twice the basal section of M_{3+4}.

Abdominal tergites variegated with obscure yellow and brown or brownish black; the pale color includes the proximal portions, especially the basal rings, of the segments, the caudal and sublateral portions blackened; lateral margins narrowly light gray; sternites paler brown, sparsely pruinose; hypopygium chiefly brownish black above, obscure yellow beneath. Male hypopygium (Plate 2, fig. 5) with the tergite, *9t*, slightly narrowed posteriorly, the caudal border with a broad V-shaped notch, the margin with relatively sparse, slender, blackened spinous setae; ordinary elongate black setae on the disk, these lacking on the cephalic third. Basistyle and adjoining portion of ninth sternite each with a concentration of strong black setae, forming more or less distinct brushes or pencils. Outer dististyle, *od*, relatively narrow, its length slightly exceeding three times the greatest width; surface and especially the margins with coarse black setae. Inner dististyle, *id*, with the beak short and obtuse, provided with numerous setae; lower beak elongate, glabrous; dorsal crest with abundant long yellow setae. Eighth sternite with the caudal margin truncated or nearly so, unmodified; a pale central line that extends cephalad almost to the posterior margin of the sclerite.

Holotype, ♂, Campo, San Diego County, altitude 2,190 feet, about one-half mile from the Mexican border, June 24, 1945 (L. W. Saylor).

I take great pleasure in naming this interesting *Tipula* in honor of Lawrence W. Saylor, who has sent me many Tipulidae from the Pacific and from California. Although somewhat similar to species such as *Tipula (Trichotipula) apache* Alexander and *T. (T.) furialis* sp. n., it is amply distinct.

23. Tipula (Trichotipula) trichophora Alexander

Described from material taken at Santa Cruz, June 1, 1919, by E. P. Van Duzee. Additional material was taken at Ben Lomond, in Santa Cruz County, 1,500 feet, June 1, 1945, by Saylor, evidently close to the type locality. Further material was secured at Mirror Lake in the Yosemite National Park, Mariposa County, altitude 4,000 feet, on June 6, 1939, by Anthony Downes. A female taken at Del Mar, San Diego County, May 14, 1945, by J. A. Comstock, appears to represent this same uncommon species and is the most southern record to this date.

EXPLANATIONS

PLATE 1

DETAILS OF MALE HYPOPYGIA

Fig. 1. *Tipula (Trichotipula) capistrano* sp. n.
Fig. 2. *Tipula (Trichotipula) mayedai* sp. n.
Fig. 3. *Tipula (Trichotipula) desertorum* sp. n:

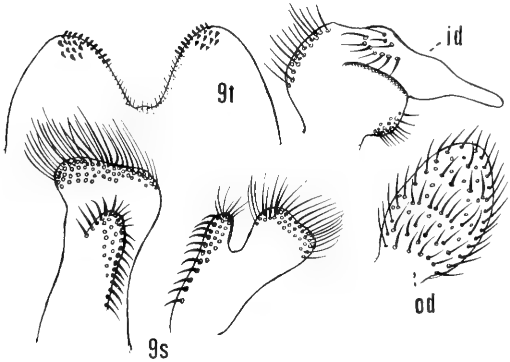
(Symbols: *id*, inner dististyle; *od*, outer dististyle; *s*, sternite; *t*, tergite).

PLATE 2

DETAILS OF MALE HYPOPYGIA

Fig. 4. *Tipula (Trichotipula) megalodonta* sp. n.
Fig. 5. *Tipula (Trichotipula) sayloriana* sp. n.
Fig. 6. *Tipula (Trichotipula) furialis* sp. n.

(Symbols: *id*, inner dististyle; *od*, outer dististyle; *s*, sternite; *t*, tergite).



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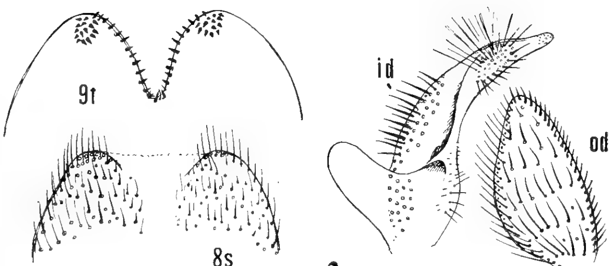

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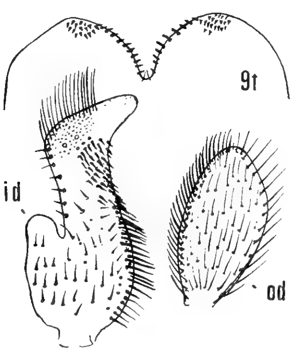
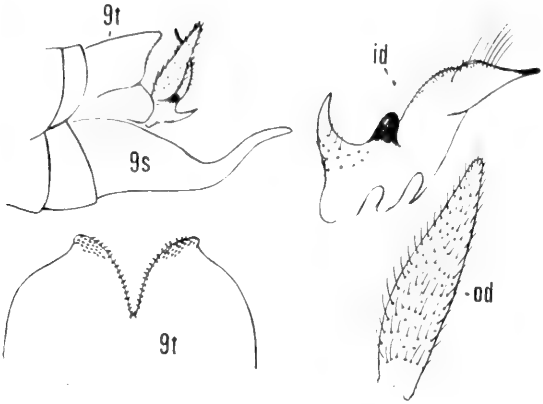


PLATE 1

4



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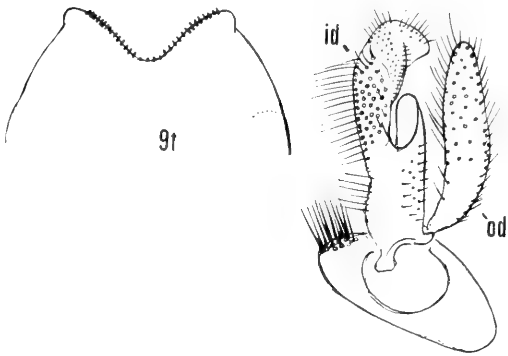

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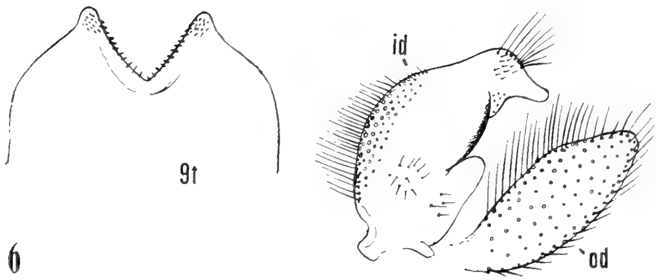


PLATE 2

NOTES ON THE LIFE HISTORY OF ANACAMPTODES (CLEORA) FRAGILARIA Grossb. (LEPIDOPTERA)

By JOHN A. COMSTOCK AND CHARLES M. DAMMERS

One of the very common Geometrid moths of southern California is *Anacamptodes fragilaria* Grossb. It occurs at all altitudes and is on the wing in practically every month of the year. Apparently there is a succession of broods building up the scant population of the earlier months to a period of greatest abundance in the late fall and early winter. It is frequently taken at light. In view of its relative abundance in urban areas it probably feeds on a great variety of introduced trees and bushes. The list of these at present recorded includes only *Eriogonum, Salix, Ceanothus, Prosopis, Cercocarpus, Albizzia, Thuya orientalis, Jacaranda, Acacia (melanoxylon R. Br., pruinosa* Cunn., *neriifolia* Cunn., etc.), *Pelargonium domesticum,* Lemon verbena, Satsuma plum, apricot, *Foeniculum vulgare* L. (flowers), and *Ulmus parvifolia* Jacq.

A gravid female confined with *Eriogonum* in a breeding cage refused to oviposit on the plant but laid numerous eggs on the gauze cover. These were deposited singly.

Egg: Elongate oval, the top rounded and base flat. Length, .85 mm.; greatest breadth, .22 mm.

The surface is irregularly rugose or granular. Color, at first bright green, changing later to a yellow-green. See Plate 3, figure A.

Larva in second instar: Body color predominantly dull olive-brown. The dorsum is covered with longitudinal dashes and discontinuous stripes of a darker shade. These are more clearly defined near the cephalic end, and become less distinct toward the cauda.

A soiled white stigmatal line is present, but is not clearly delimited. It expands around each spiracle, and is broken into irregular dashes or spots on several segments.

Abdomen, legs and prolegs, mottled brown. Spiracles, soiled white with black rims, and indistinguishable except with strong magnification.

Setae, minute and dark, each one arising from a small black nodule.

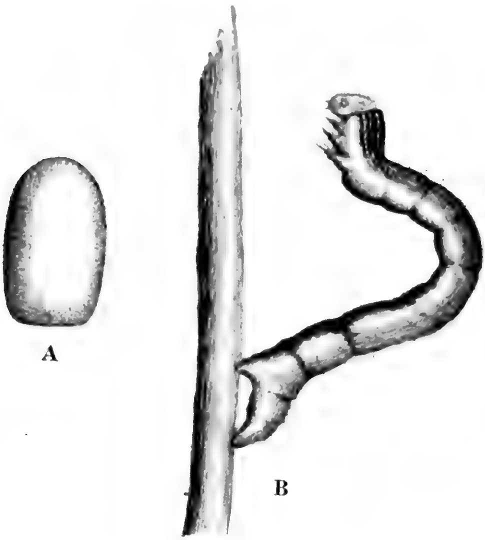


PLATE 3

A. Egg of *Anacamptodes fragilaria* magnified approx. X 28.

B. Larva of *A. fragiliaria* in 2nd instar, enlarged approx. X 12.

Reproduced from painting by John A. Comstock.

Head, dull orange-brown spotted or blotched with brown. A white stripe occurs on the cheek in line with the stigmatal band. Ocelli, black. Setae short and translucent.

The larva is cylindrical, of the usual geometrid type with a single pair of prolegs and anal prolegs. It shows no trace of the pyramidal nodules on the fifth segment which are characteristic of the mature larva. Measurements varied greatly in larvae of the same age, but the average was about 5 mm. long.

The young larva is illustrated on Plate 3, figure B.

Mature larva: Average length, 36 mm.

There is great variation in the color and markings of mature larvae, ranging from a light cream or pinkish form with darker pink crenulations, to a dark maroon type with dark brown-maroon markings.

Probably the most common form is one that matches the color of the stems of *Eriogonum fasciculatum* Benth. Our description is of the latter.

Body color, pale mauve, overlaid with vermiculated lines and dashes of maroon. The stigmatal area or fold is slightly lighter than the remainder of the body surface, but is not white as in the early instars. The abdomen, base of legs and prolegs are concolorus with the body, as is also the abdominal surface. The tips of the legs are pink. Crochets of prolegs, pink. Spiracles, yellow, with black rims. There are two longitudinal whitish lines placed medially on the abdomen.

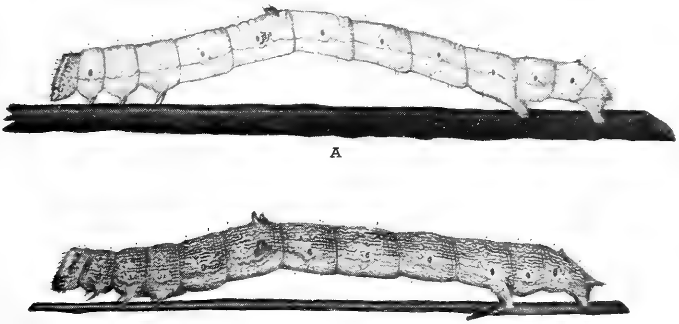
Head, concolorus with body, blotched with dark brown. Ocelli, black. Mouth parts, pink.

The head and body bear a few short colorless setae which we have not attempted to map.

In shape the larva is elongate, cylindrical, with the head only slightly larger than first segment. The fifth segment bears a pair of pyramidal tubercles, and a somewhat similar tubercle is placed above and slightly behind each spiracle on this same segment. On the top of the eleventh segment there are a pair of small projections placed close to the median line.

Plate 4, figures A and B illustrate a light and dark form of the larva.

Pupa: Length, 13 mm. Subfusiform, the head evenly rounded and cauda tapering to a cone-shaped segment, terminating in a pair of cremasteric spines which are not recurved. At the base of each spine is a short spur. Wing cases smooth and glistening. Antennal sheaths extending to the edge of the wing cases. Eyes prominent. Abdominal segments punctate except for certain of the areas adjacent to segmental junctures.



A

B

PLATE 4

Mature larva of *Anacamptodes fragilaria* illustrating (A) light and (B) dark forms. Enlarged approximately X 2.

Reproduced from painting by Charles M. Dammers.

Color, red-brown, the cephalic portions and particularly the eyes, darker. Cremaster, black. Spiracles, brown-black.

There is a suggestion of a mid dorsal blackish stripe or band on the abdominal segments.

The pupa is illustrated on Plate 5.

Our examples, reared in captivity, pupated in debris on the floor of the breeding cage.

We have heretofore considered *A. fragilaria* to be a California coastal species, but a recent letter from Mr. N. L. H. Krauss states that Rev. Edw. Guedet records it from as far east as Colorado, north to British Columbia, and south to the Chiricahua Mountains, Arizona. If Guedet's identification of the species is correct, and we can presume that it is in view of his careful work in the Geometrids, the species ranges from the Rocky Mountain states west to the Pacific, including lower California.

We are indebted to N. L. H. Krauss of the H. S. P. A. for notes on host plants and range.

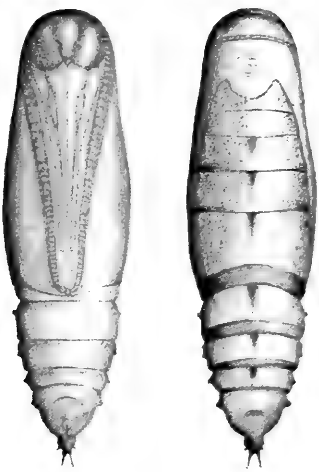


PLATE 5

Pupa of *Anacamptodes fragilaria.*
(A) ventral and (B) dorsal aspects, enlarged X approx. $4\frac{1}{2}$.

Reproduced from painting by John A. Comstock.

FOSSIL ARTHROPODS OF CALIFORNIA

9. EVIDENCE OF TERMITES IN THE PLEISTOCENE ASPHALT OF CARPINTERIA, CALIFORNIA

By JOHN F. LANCE

INTRODUCTION AND ACKNOWLEDGMENTS

Termites are among the most primitive of living insects, and they are well-known as fossils from the Tertiary, particularly in the Old World. In the Western Hemisphere, fossil termites are found in the Eocene of Tennessee (Collins, 1925), and in the Miocene shales of Florissant, Colorado (Scudder, S., 1883; Cockerell, T.D.A., 1913; Snyder, T.E., 1925), while fossilized fecal pellets were described by Rogers (1928; 1938) from the Pliocene of California and by Light (1930) from the Pleistocene of Florida.

In the summer of 1945 the writer found numerous fecal pellets of termites on pieces of wood preserved in the Pleistocene asphalt deposits at the Higgins ranch near Carpinteria, Santa Barbara County, California. The wood was found in association with typical plant remains comprising a part of the Pleistocene Carpinteria flora as described by Chaney and Mason (1933).

Before commercial exploitation of the asphalt deposits was abandoned, the excavation near Carpinteria had been enlarged to form a pit approximately 600 feet long and 300 feet wide. The termite remains were taken from the eastern edge of the present pit, east of the original fossil localities, and near the top of the Pleistocene horizon. The stratigraphic difference between the two localities is less than 10 feet. Although the excavated Pleistocene floral remains were rather sparsely represented, no vertebrate fossils have been discovered by any recent digging in this section of the pit.

The writer wishes to acknowledge his debt to Dr. Chester Stock for guidance and helpful interest in the work. Thanks are also expressed to Dr. W. D. Pierce for loan of comparative material, and to Professor G. F. Beck of the Central Washington College of Education for his study of the wood, Mr. R. von Huene assisted in making the photomicrographs.

NATURE AND OCCURRENCE OF MATERIAL

Before describing the fossil material, the distinctive characteristics of modern termite pellets should be noted. These pellets are the excreta of certain kinds of termites, notably the so-called damp-wood and dry-wood types. The rectum in these termites is so constructed that the pellet is extruded with a characteristic ovate shape, impressed with six flat or rounded sides which are separated by double longitudinal ridges divided by narrow grooves (Child, H. J. in Kofoid, C.A., pp. 33-83, 1934). The general appearance is thus roughly that of a hexagonal prism with rounded ends, sometimes slightly more pointed at one end. The exact shape of a pellet depends upon the type of termite and its diet, particularly with regard to moisture content. The pellets of dry-wood termites tend to be smaller and more characteristically impressed than those of the damp-wood termites, the pellets of the latter often being shapeless or rounded (Castle, G.B., in Kofoid, C.A., pp. 264-282, 1934).

If the termite is living in relatively damp wood, the pellets often tend to cling at random to the sides of runways, but in drier wood they fall and collect at the bottoms of chambers, or are carried to the exterior.

Cockroaches and certain kinds of beetles (Van Dyke, E. C., in Kofoid, C.A., pp. 323-335, 1934), particularly the Anobiid beetles or death watches, produce pellets which have superficial resemblance to those of termites. However, in each instance the pellets may be distinguished from those of termites by their longer and narrower dimensions and by a lack of the characteristic impressed shape.

The fossil pellets were found on pieces of tar-impregnated wood associated with floral remains typical of the Carpinteria deposits. Most of the pieces of wood are small chips and parts of branches, averaging not more than four or five inches in length, but one root four feet long was found to have pellets distributed throughout. This root was imbedded in two sides of a block of asphaltic sand which had been torn loose by power shovels used in former excavations. Although this block was not in place, the smaller fragments are from excavations in which they were closely associated with Pleistocene pine cones, pine needles, and seeds. No vertebrate remains were found, and the plant materials are by no means so abundant as those in the pits from which the original Carpinteria flora and fauna were described.

Samples of the termite infested wood were sent to Professor George F. Beck, who very kindly consented to examine them in microscopic sections. Professor Beck states (letter to C. Stock, dated January 30, 1946) that the specimens represent the genus *Pinus*.

The termite pellets occur as granular masses adhering to the wood. In many cases, these masses fill or partially fill what were obviously old runways and chambers of a termite colony. The fossil pellets fall into two groups, and apparently represent a damp-wood termite and a dry-wood one. The damp-wood pellets are larger, averaging about 1.4 mm. in length. The more regularly-formed dry-wood pellets average about .8 mm. in length and are more likely to have one end slightly pointed. Chambers and runways of the old colonies can be clearly seen in several pieces of wood.

The two distinct types of pellets are intimately associated on the same piece of wood. This is unusual, since termites of different colonies or even the same species do not mingle. However, termites of different species and genera have been found existing in the same stump or piece of wood in places where their geographic ranges overlap (Light, S.F., in Kofoid, C.A., pp. 201-207, 1934). It seems probable that in this case the two types of termites inhabited the same piece of wood, perhaps simultaneously, and that eventually one colony invaded certain chambers abandoned by the other colony.

As Light has pointed out, little has been done in making specific determinations of termites from their pellets. However, on the basis of size and shape it seems likely that the Pleistocene termites found at Carpinteria are the typical West Coast genera of dry-wood and damp-wood termites, *Kalotermes minor* and *Zootermopsis,* respectively. The damp-wood pellets suggest either *Z. angusticollis* or *Z. nevadensis,* more probably the latter, because of its smaller size.

The ecological conditions of the Carpinteria region in Pleistocene time, which are regarded as having been similar to those now existing on the Monterey Peninsula in Monterey County, California, give some support to these tentative determinations. The three species of termites named above all occur at present in the Monterey area. In fact, although California has at least 19 known species of termites, only 4 are found in the coastal and moist mountain regions (Light, S.F., in Kofoid, C.A., pp. 118-126, 1934). In addition to the three mentioned, *Reticulitermes hesperus,* called the Western subterranean termite, does not leave the typical impressed fecal pellets.

Carpinteria Pleistocene Assemblages

A preliminary report on the Carpinteria material was made in 1927 by Hoffman, Stock, Miller, Chaney, and Mason. Since that time various authors have discussed the flora and fauna in greater detail. A. H. Miller (1932), L. H. Miller (1931), and I. S. DeMay (1941) have described the bird life, Wilson (1941) the mammals, Chaney and Mason (1933) the plant life, and Grant and Strong (1934) have written on the invertebrate fauna. In a chapter in the paper on the flora, Irma Webber discussed the wood from the deposits. Putnam (1942), in a paper on the geomorphology of the Ventura region considered the geologic and physiographic features of the accumulation.

According to Chaney and Mason, most of the flora grew on a coastal slope, and a large proportion of the remains was brought to the site of accumulation by running water and impregnated by an asphaltic deposition. This conclusion is based on the water-worn character of much of the material, particularly chips of wood, and on the evidence of fungus decay shown by more than half of the wood, which decay would not have set in had the plant remains fallen directly into a tar pool. Furthermore, plants are preserved in nearby sediments of the Carpinteria formation where there has been no impregnation by tar and, also, a greater variety of species is represented than would be expected to be growing in the immediate vicinity of the accumulation. The occurrence of water-worn chips of redwood and Douglas fir, to the exclusion of twigs and cones of these species, suggests transportation from some distance away, as does the appearance of floral elements in the collection characteristic of a dry, inner coastal region. These semi-arid elements include a few remains referable to the digger-pine, California juniper, and *Arctostaphylus glauca*. A large representation of additional types of manzanitas, now associated with the Monterey pine forests, suggests that a heavy growth of underbrush existed with the Carpinteria forest.

Chaney and Mason (1930) made the suggestion that in Pleistocene time a peninsula, which included the area now represented by Santa Cruz Island, extended westward from the California mainland, partly enclosing an embayment. What is now the Carpinteria area occurred near its head. Pleistocene plant remains have been uncovered on Santa Cruz Island and the evidence points to the fact that remains of Douglas fir and Santa Cruz pine found in the Carpinteria asphalt did not grow at that locality, but were transported there either along the peninsula or across the embayment. The view is also advanced that the redwood specimens were brought down from the north by off-shore currents. This would indicate that the site of deposition was nearer the seashore than is suggested by the sparsity of aquatic birds in the avifauna.

The wood in the Carpinteria deposit was reported by Webber in a chapter in the paper on the flora. A total of 5,499 specimens of wood from the asphalt were examined (Chaney and Mason, 1933). Most of these were pieces of trunks or branches less than 2 inches in diameter, or were small fragments termed "chips." The water-worn character of many of the specimens and the high percentage of fungus decay indicated that deposition was probably in alluvium that was later impregnated by tar. No evidence of termite infestation was reported in any of the wood.

From his study of the Carpinteria Pleistocene mammalian fauna, Wilson (1933) concluded that, although the presence of the shrew, chipmunk, and tree squirrel substantiates the sylvan environment at the site of deposition as inferred from the flora and avifauna, the appearance of the kangaroo rat, horse, bison and *Camelops,* which normally live in more open country and in a semi-arid climate, suggests that the accumulation occurred near the edge of a forest and that there was a fluctuation in tree and plant cover during the time of entrapment. Wilson further states that the preponderance of juvenile to sub-adult individuals suggests their great susceptibility to entombment in a tar trap, and the possibility that the trap operated in an area which afforded tree and shrub cover to young individuals. He regards the age of the fauna as not older than Rancho La Brea, and possibly younger.

The consensus as to age of the Carpinteria fauna and flora is that they are approximately equivalent to Rancho La Brea and McKittrick, being possibly slightly younger than the former and slightly older than the latter. The tar pools were probably situated near the edge of a forest of Monterey pine, with heavy underbrush, and with adjacent patches of open grasslands. The site of deposition was on a coastal plain, but nearness to a shore line is not expressed by any noticeable strand influence on the composition of the fauna. The climate was colder and more humid than that existing in the vicinity of Carpinteria today. The apparent discrepancies as to mode of accumulation have been discussed by Putnam (1942). The water-worn character of many of the plant remains as well as the diversity of plant types indicate transportation from a distance of some of the materials. Lack of evidence of attrition in most of the bones of the collection and the high percentage of predatory forms and of young individuals suggest a typical asphalt seep entrapment. According to Putnam, tar seeps are now operating as traps in the Upper Ojai valley, and the accumulations are being enriched from time to time by material transported to them by seasonal floods. Similar conditions might well explain the seeming paradox at Carpinteria.

SUMMARY

Two types of fossil pellets found in pine wood in the Pleistocene Carpinteria asphalt resemble closely those of *Kalotermes minor* and *Zootermopsis angusticollis* or *Z. nevadensis.* Distribution of these termites at the present time includes the Monterey peninsula on which is found a Monterey forest assemblage like that which occurred at Carpinteria during the Pleistocene. It thus appears safe to assume that the fossil material represents termites which inhabited both damp-wood and dry-wood. This is in accord with evidence that varied ecological conditions existed during the accumulation of the Carpinteria flora and fauna.

It is worth emphasizing that no wood infestation by termites was noted among more than 5000 specimens examined in the col-

lections previously obtained at Carpinteria. It seems likely that termites inhabited some of the pine wood after it was washed down from higher inland slopes and scattered in the vicinity of the tar pits, and that petroliferous impregnation occurred later.

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Division of the Geological Sciences,
California Institute of Technology.

Contribution No. 389.

PLATE 6

Fig. 1. Tar-impregnated wood of genus *Pinus*, with termite fecal pellets, approx. X 1½.

Fig. 2. *Kalotermes* cf. *minor* Hagen. Fecal pellets approx. X 16.

Fig. 3. *Zootermopsis* cf. *nevadensis* Hagen. Fecal pellets, approx. X 16.

All specimens from Pleistocene Carpinteria asphalt, Santa Barbara County, California.

Calif. Inst. Tech. Paleont. Coll.

ADDITIONAL NOTES ON THE PLIOCENE MOLLUSCAN FAUNA OF LOS ANGELES CITY

By G. Willett

Clarence L. Moody (Univ. Calif. Publ. Geol., 10, No. 4: 39-62, 1916) has reported on a Pliocene fauna from the corner of Fourth and Broadway, Los Angeles, the material studied by him having been secured by Dr. J. Z. Gilbert in 1913. Some years later, E. K. Soper and U. S. Grant (Bull. Geol. Soc. America, 43: 1041-1068, 1932) compared Moody's list with similar ones compiled from specimens collected at Fifth and Hope, and Sixth and Flower streets, distant five and seven city blocks respectively from the Fourth and Broadway locality.

In the Los Angeles County Museum there are rather limited collections from Fourth and Broadway and Fifth and Hope, the former secured by Dr. Gilbert, and the latter by Charles M. Jay and G. E. Wert. At least part of this material was available to Moody and to Soper and Grant, but the writer is uncertain how much of it was considered by them. As our list of species from these deposits parallels to a large extent those previously published, it will not be given in full here, and comments will be limited to additional species, or to instances wherein the writer's conclusions vary from those of the authors mentioned above.

Although there is some difference between the faunae of the two localities under discussion, this is probably due to ecologic factors, there being no apparent evidence against Soper and Grant's postulation that the two localities represent the same fossiliferous horizon. However, their statement (p. 1065) that "the fauna suggests shallow water" may be considered to merit clarification, as the term "shallow water" is somewhat indefinite. There are numerous species represented that would indicate a depth of thirty or more fathoms, provided, of course, that their bathymetric range was the same during Pliocene times as it is today. A few, like *Antiplanes perversa* Gabb, *Spirotropis renaudi* Arnold, *Cancellaria crawfordiana* Dall and *Neptunea tabulata* Baird, seldom appear in adult form above fifty fathoms and are most plentiful considerably below that depth.

Species in the Los Angeles County Museum collection not previously reported from these deposits are listed with numbers of specimens, as follows:

	4th & Brdwy.	*5th & Hope*
Ostrea erici Hertlein	13	—
Pecten hindsi Cpr.	6	—
Lithophaga plumula Hanley	—	1
Axinopsis sericatus Cpr.	7	—
Protothaca staminea Conr.	3	—
Semele decisa Conr.	1	1
Gari edentula Gabb	20+	—
Mya truncata Linn.	2	—
Volvulella cylindrica Cpr.	—	2
Megasurcula stearnsiana Ray	—	1
Clathodrillia incisa fancherae Dall	1	3
Fusinus kobelti Dall	—	4
Nassarius moranianus Martin	—	4
Murex santarosana Dall	—	1
Tritonalia barbarensis Gabb	—	20+
Tritonalia squamulifera Cpr.	13	20+
Epitonium acrostephanum Dall	2	—
Melanella thersites Cpr.	1	1
Turbonilla tenuicula Cpr.	1	—
Bittium attenuatum Cpr.	3	—
Bittium munitum Cpr.	20+	—
Bittium interfossum Cpr.	10	—
Cheilea equestris Linn.	7	4
Acmaea mitra Esch.	—	1
Haliotis fulgens Phil.	1	—
Callistochiton palmulatus mirabilis Pils.	6	1

Species labelled as follows in our collections are included in former lists under the names in parenthesis:

Pecten riversi Arnold (*P. calamitus* Hanna)
Cardita occidentalis Conr. (*C. ventricosa* Gld.)
Cardita crebricostata Krause (*C. barbarensis* Sts.)
Lora fidicula Gld. (*L. tabulata* Cpr.)
Mangelia variegata Cpr. (*M. hecetae barbarensis* Oldroyd)
Trophon lasius Dall (*T. tenuisculptus* Cpr.)
Calyptraea fastigiata Gld. (*C. ? mamillaris* Brod.)
Natica aleutica Dall (*N. clausa* Brd. & Sby.)
Diodora inaequalis Sby. (*D. murina* Cpr.)

Notes on some of the species:

OSTREA ERICI Hertlein. Although neither Moody nor Soper and Grant report *Ostrea*, there are 13 valves in our collection from Fourth and Broadway. After these were tentatively assigned to the above species by the writer, specimens were sent to Dr. Hertlein for comparison with the type of *erici,* and the identification was confirmed by him. Two especially well preserved examples from our lot are ornamented by series of irregular, brownish, radial rays.

Pecten riversi Arnold + *P. levis* Moody + *P. calamitus* Hanna. Although Grant and Gale synonymize this species with *P. alaskensis* Dall, it appears to me to differ from that species in lack of concentric ridges on exterior of right valve, more numerous ridges on anterior ear, and possibly larger size (our largest specimen measures 23.6x22.8 mm.). As Grant and Gale state that *P. calamitus* Hanna (*P. levis* Moody) is exactly like *riversi,* the latter name is used here. We have two specimens from Fourth and Broadway.

Chama (Chama) pellucida Brod. Three valves from Fifth and Hope and two from Fourth and Broadway appear definitely referable to this species.

Chama (Pseudochama) exogyra Conr. Two inner and four outer valves from Fourth and Broadway agree with Recent specimens of *exogyra.* In addition to the above, there are 36 outer valves from the same locality that are very puzzling. The sculpture corresponds closely to that of *exogyra,* but the shells are dextral. Apparently none is fully adult, the largest measuring only 21 millimeters in greatest diameter. If these shells turned in the opposite direction, they would be assignable to *exogyra* without question, as in sculpture they resemble that species much closer than they do typical *pellucida.* It would appear either that another species of *Chama* is involved, or that *exogyra,* in the Pliocene, was both sinistral and dextral. The writer is uncertain which of these postulations is the correct one. In view of the fact that Moody records *exogyra* as common at Fourth and Broadway and does not mention any other *Chama,* it might be natural to wonder whether he identified his specimens by sculpture alone, and failed to notice the direction of their whorls.

Cardita crebricostata Krause. Abundant at Fourth and Broadway, but not found at Fifth and Hope. Previously recorded as *C. barbarensis,* but here referred to *crebricostata* because of heavy shell, which is usually considerably longer than high.

Cardita occidentalis Conrad (Proc. Acad. Nat. Sci. Phil., 7: 267, 1855: Pac. R. R. Rep. 6 (2): pl. 5, fig. 24, "1856" (1857). Although this shell is closely related to *C. ventricosa* Gld., our specimens differ from that species in larger size, proportionately greater altitude, and fewer ribs (15-18). It is probably the same as *monilicosta* Gabb, 1861, and must be close to *stearnsi* Dall, 1902. It is recorded by Moody as *C. borealis* Gld., and by Soper and Grant as *C. ventricosa* Sts. Conrad's type was a fossil from Santa Barbara, and his description is as follows: "Subtriangular, equilateral ? ventricose; ribs 15, rounded, wider than the interstices, and regularly granulated by transverse lines. Allied to C. ————, of the San Pedro Recent formation, but proportionately more elevated and having more prominent granules." Conrad's figure is poor, but plainly represents a high shell, with comparatively few ribs. This species was abundant at Fourth and Broadway and common at Fifth and Hope.

Fusinus. The six specimens of this genus in the Fourth and Broadway lot appear to be *F. barbarensis* Trask, but in the series from Fifth and Hope this species and *F. arnoldi* Cossman are so confused that it is impossible to be sure of the assignment of some specimens. This situation suggests that *barbarensis* and *arnoldi* were conspecific in the Pliocene, the latter having become extinct after that time. *Arnoldi* is abundant in some early Pleistocene deposits, but apparently unknown in the Recent fauna. In the lot from Fifth and Hope, four specimens are assigned to *F. kobelti* and two to *F. monksae*.

Amphissa reticulata Dall. Common in both deposits. Moody does not record this species from Fourth and Broadway, but does list *A. corrugata* Rve. (= *columbiana* Dall) as "very abundant." As the latter is not present in our material, it would appear that the previous identification should be checked.

Bittium larum Bartsch. There are numerous specimens among our large series of *B. rugatum* that seem to me indistinguishable from Recent *larum,* also others showing complete intergradation between the two.

Cheilea equestris Linn. We have four examples of *Cheilea* from Fifth and Hope and seven from Fourth and Broadway. These appear to agree specifically with specimens labelled with the above name in the California Academy of Sciences collection, examined through the courtesy of Dr. Leo. G. Hertlein. This is an interesting record, as it is new to the California fossil fauna and, as far as the writer knows, the genus has not been recorded living on the Pacific coast north of Mazatlan, Mexico. *Cheilea* is readily identifiable, not only by the free, funnel-like inner process, but by the smooth nucleus, which appears to emerge from beneath the outer lining of the shell. Soper and Grant's record of "*Calyptraea filosa* Gabb" at Fifth and Hope may be founded on imperfect specimens of this species.

Polinices lewisi Gld. Although this is probably what Moody called "*Natica orbicularis* Nomland", I find no characters differentiating our specimens from *lewisi.* Many of our smaller specimens are not satisfactorily determinable, as the funicle, one of the best characters in distinguishing species, is particularly liable to disintegration.

LAQUEUS VANCOUVERENSIS Davidson. Although no Brachiopod appears to have been recorded previously from these deposits, we have six specimens of the above species in our material from Fourth and Broadway.

A NEW MOLLUSK OF THE GENUS SOLARIELLA FROM ALASKA

By G. WILLETT

SOLARIELLA LEWISAE sp. nov. Pl. 7.

Description.—Similar to *Solariella varicosa* Migh. and Ad., but whorls carinated instead of rounded, varices fewer (15 instead of about 20), and inside of wide umbilicus spirally striate. Body whorl with two strong keels at the periphery, another at the summit, and a much fainter one a little in front of the suture. Whorls on the spire with single keel at the summit. Varices continuous from spire to umbilicus, except for interruption by the double keel at the periphery of the body whorl; the strong keel at the summit is crossed and rendered nodulous by the varices. Base flattened, with about 17 fine, spiral cords. Operculum normal for the genus. Color of outside dusky with greenish sheen between the varices. Aperture subcircular, obtusely angulated on the outer lip by the peripheral keels and on the inner lip by the umbilical keel. The penultimate whorl is somewhat like that in the illustration of *Cidarina carlotta* Dall (U. S. Nat. Mus. Bull. 112, pl. 18, fig. 4), but the base and aperture are very different and the varices cross the keel at the summit.

The type, a dead specimen, No. 1084 Los Angeles Museum, was collected by Mr. and Mrs. Fred E. Lewis in 15 fathoms, at Spiridon Bay, Kodiak Island, Alaska; a younger, living specimen was dredged in 15 fathoms at Galena Bay. The type has 4¾ whorls, and measures: Diameter, 6.1; alt. 5 mm.

Named for Mrs. Fred E. Lewis.

Contribution from the
Los Angeles County Museum
Division of Science.

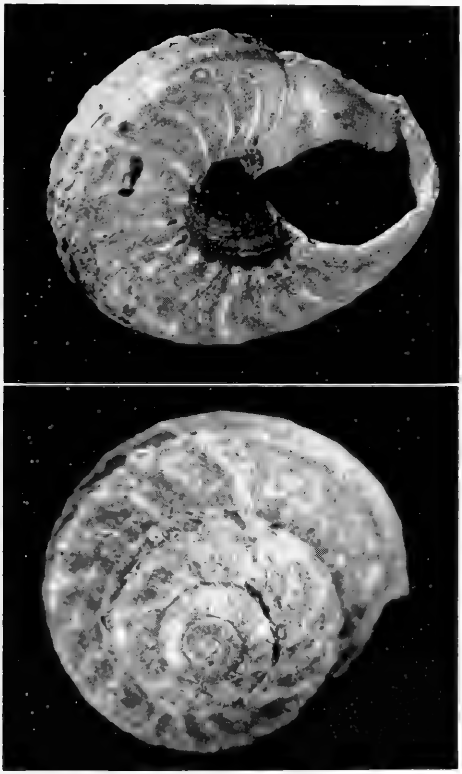

PLATE 7

Solariella lewisae, sp. nov. TYPE, Los Angeles County Museum No. 1084.
X 8½ (approx.)

MOLLUSK FOOD OF THE BEETLE, SCAPHINOTUS INTERRUPTUS (MEN.)

By William Marcus Ingram
Mills College, California

It is a well known fact that the beetle, *Scaphinotus interruptus* (Men.), feeds on slugs. Lange (1941) in his study of artichoke pests states, "The large carabid beetle, *Scaphinotus interruptus* (Men.), is a very effective natural enemy of slugs, and has been found preying on both the garden [*Deroceras agreste* (Linneaus)] and green house slug [*Milax gagetes* (Müller)] in most of the artichoke-growing areas." Essig (1926), concerning members of the genus *Scapinotus* found in California, states, "The writer has many times observed different ones of these species feeding on the small gray garden slug, *Agriolimax agrestis* (Linn.) [*Deroceras agreste*] in the San Francisco Bay region." To gather specific information about this predaceous carabid beetle field and laboratory observations were undertaken on the Mills College campus and in the immediate surrounding area in Oakland, California. Data are included here illustrating the manner in which this beetle attacks its prey in the field; indicating the number and kinds of mollusks consumed over stated periods of time; and giving the food-weight-beetle-weight relationship.

Field Observations

Scaphinotus is especially abundant beneath brush piles and loose boards on the Mills College campus, and is only slightly less abundant under turned-up clods in certain cultivated fields. The typical mollusk associates were two slugs, *Deroceras agreste* (Linnaeus) and *Milax gagetes* (Müller), and to a lesser extent the European Brown Snail, *Helix aspersa* Müller. It was observed at night with the aid of a flashlight that the beetle feed on the above three species of mollusks. In the field *Scaphinotus* was observed typically to attack its prey along the anterior end of the body. On one evening fieldtrip eight *D. agreste* were observed crawling up the side of a garage from 3 to 5 feet above the ground; the flashlight beam revealed two *S. interruptus,* away from their shelter of boards and brush, feeding on two *D. agreste.* Attacks on adult individuals of *H. aspersa* were not always successful; when bothered by the beetles the mature snails would withdraw into their shells and secrete a mucous froth, entangling the beetle's legs, and discouraging it from further predation in the attacks observed. Immature individuals of *H. aspersa* were observed having their fragile shells broken into by this beetle so that their soft parts could be devoured. The very immature *H. aspersa* apparently had no means of defense against this carabid. The writer did not observe *S. interruptus* feeding on snails and slugs during the daylight hours in the field, but laboratory experiments indicate that the beetles feed at any hour.

LABORATORY FEEDING OBSERVATIONS

To study the feeding of *S. interruptus* in the laboratory terraria were constructed. These consisted of wide-mouthed collecting jars filled with firmly packed moist soil, and having caps with air holes. Five of these, each containing a beetle, were set up. Snails and slugs were added to the terraria, and were ever present during the period of observation. The terraria data are summarized in the following table.

DAYS OBSERVED, SNAILS AVAILABLE, AND SNAILS EATEN

Terrarium	Days	Snails Available	Snails Eaten
1.	15	16 Deroceras 4 Milax 7 Helix (adult) 2 Helix (immature) 29 total	3 Deroceras 1 Milax 1 Helix (immature) 5 total
2.	23	30 Deroceras 6 Helix (immature) 36 total	12 Deroceras 1 Helix (immature) 13 total
3.	24	20 Helix (immature) 18 Milax 11 Deroceras 49 total	 3 Milax 3.5 Deroceras 6.5 total
4.	25	42 Deroceras 17 Helix (adult) 3 Helix (immature) 62 total	12 Deroceras 1 Helix (adult) 1 Helix (immature) 14 total
5.	28	73 Deroceras 43 Helix (adult) 116 total	11 Deroceras 11 total

The longest period that a beetle went without feeding even though a food supply was ever present was six days. Two mollusks were the most eaten on a single day by any one beetle: one beetle ate one *Deroceras* and one semi-adult *Helix;* one ate two *Milax;* and there were five instances in which two *Deroceras* were eaten. Two of the beetles fed on mollusks for four consecutive days; one of these devoured four *Deroceras,* and another three *Deroceras* and one immature *Helix.*

The beetle showed a quite definite preference to slug food, feeding on approximtely 24% of the available *Deroceras,* on approximately 18% of the available *Milax,* and on only .04% of the available *Helix. Helix* in the natural state does not come in contact with *Scaphinotus* as often as do the slugs. The secretion of mucous by adult *Helix* and withdrawal into the shell tends to discourage the beetle from predation.

Food-Weight-Beetle-Weight Relationships

The food-weight-beetle-weight relationship was computed for *Deroceras* and *S. interruptus.* The *Deroceras* had a mean weight of .23275 grams; the beetles a mean weight of .13620 grams. Thus in feeding on one *Deroceras,* a beetle ate a mean weight of .09655 grams over its own mean weight. In the five instances in which beetles consumed two *Deroceras* in a day, the beetles ate a mean weight of .05690 grams, over three times their mean weight. The greater part of the body of *Deroceras* is water, for the mean percentage of weight lost when exposed to heat in a dessication chamber was 86.99 percent.

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NOMEN CONSERVANDUM PROPOSAL FOR THE GENUS AROMIA IN THE COMPOSITAE

By BONNIE C. TEMPLETON

In searching the early 19th century literature, recently, with reference to a study being made on the genus *Amblyopappus,* the writer encountered a question of priority of nomenclature which she believes worthy of consideration by the International Botanical Congress.

Aromia tenuifolia Nuttall and *Amblyopappus pusillus* Hooker & Arnott were both published in 1841. Subsequently the Index Kewensis gave priority to *Amblyopappus,* and reduced *Aromia* to synonymy. It is clear that the date of issue of the description of *Aromia* Nuttall is March 1841, but there is some question as to the publishing and issuing dates of *Amblyopappus* Hooker & Arnott.

The task of searching the literature for the answer has been a long and arduous one. Although the writer has examined many publications of that period (1833-1845), she realizes that not all of them have been consulted. The exigencies of the War have prevented travel to distant libraries, the loan of publications, and replies to queries from Europe because of their material having been stored for safe-keeping. It is believed, however, that the findings herein discussed are sufficient to support the precedence of the genus *Aromia* Nutt., and it is suggested that these facts and the genus name, *Aromia* Nutt., be submitted at the next International Botanical Congress as *nomen genericum conservandum propositum.*

It is a pleasure to acknowledge the substantial help which has been received during the course of this study. I am particularly indebted to Mr. Robert C. Gooch, Chief, General Reference and Bibliography Division, Library of Congress, Washington, D. C., for his assistance; to the libraries of the University of California and the Missouri Botanic Garden for photostatic copies; and to the Boston Public Library, Doheny and Hancock Libraries at the University of Southern California, the libraries at the University of California at Los Angeles, Pomona College, Huntington Library and Art Galleries, and Los Angeles County Museum for the loan of books and other literature. Suggestions and advice by Dr. S. F. Blake, Dr. P. A. Munz, and Dr. F. W. Pennell are here gratefully acknowledged.

The original description of *Amblyopappus pusillus* by Hooker and Arnott appears on page 321 of Volume III of Hooker's

Journal of Botany, in the part or section designated on the bottom of page 281, as No. 22, March 1841. This has been presumed to be the actual publication date. The description was included in Article XXIII[2] titled as follows:

> "Contributions towards a Flora of South America, and the Islands of the Pacific. By Sir W. J. Hooker, K. H. and G. A. Walker Arnott, Esq., LL.D.
>
> I. Extra-Tropical South America.
> (Continued from page 47, of the present volume.)"

This article had been, according to Hooker (op. cit. p. 19) "Continued from page 254 of Vol. II of the Companion to the Botanical Magazine" published in 1836. From this, it is apparent that these "Contributions" were sporadic and extended over a long period of time.

The question has arisen again and again, as the writer has been working on the *Amblyopappus* problem, as to whether Hooker's Journal of Botany, Volume III, was actually published separately according to the numbers and dates indicated in it. If it was published in parts, where were the divisions? Were they issued when printed, or were they collected and issued several numbers at a time, or bound and issued as a volume? If the parts of the Journal of Botany, Vol. III, were printed separately but bound and issued as a whole, what was the exact date in 1841 that the volume was issued?

The validity of *Aromia* or *Amblyopappus* resides in the conditions and dates of effective publication. The International Rules of Botanical Nomenclature[39] state in Art. 36 that "Publication is effected, under these rules, by sale to the general public or to botanical institutions, of printed matter or indelible autographs, or by distribution of these to specified representative botanical institutions. No other kind of publication is accepted as effective."

Aromia tenuifolia Nutt. appears in Article XX, page 395-396, volume VII of the Transactions of the American Philosophical Society.[13] The title of Article XX is as follows:

> "Descriptions of new Species and Genera of Plants in the natural Order of the Compositae, collected in a Tour across the Continent to the Pacific, a Residence in Oregon, and a Visit to the Sandwich Islands and Upper California, during the years 1834 and 1835. By Thomas Nuttall."

Article XX begins on page 283[13] and bears the statement that it was "Read Oct. 2, 1840." This Article continues on to the end of the volume and concludes on page 453. On the top of page 357 are the words "Continuation of Mr. Nuttall's Paper. Read December 18, 1840." This may indicate the third and last part of this volume.

There seems to have been some question as to the publication dates of volume VII of the Transactions, for Greene[1], in 1895, writes:

> "The most important of all earlier contributions to the knowledge of Northwest American Compositae is Nuttall's elaborate paper published in the Seventh Volume of the Second Series of Transactions of the American Philosophical Society. The volume bears on its title page the date 1841; and it was, until recently, always given as the date of Nuttall's paper. But in 1891, Dr. Otto Kuntze found evidence, in some European libraries, that the document in question had been in the hands of the botanists in 1840.
>
> A copy of the whole volume, now in the botanical library of the Catholic University at Washington explains the matter fully, and removes all doubt about the datem or rather, dates of Nuttall's Compositae.
>
> The entire volume was published originally in three parts; each part being issued in a paper cover, with title and date.
>
> Part I, issued in 1840, has a long table of contents, but nothing botanical.
>
> Part II, also issued in 1840, contains a portion of the *Descriptions of New Species and Genera of Plants in the natural Order of the Compositae, collected in a Tour across the Continent to the Pacific, etc.* By Thomas Nuttall.
>
> Part III, issued in 1841, contains the remainder of the paper above-named.
>
> The dates according to the paging are as follows: Pages 283 to 356, 1840; pages 357 to 453, 1841."

Here, the writer believes, Greene has used the word "issued" to mean "printed". Otherwise his statement in this regard does not coincide with the report in the Proceedings of the "Society"[12], for, on page 16 of the report of the meeting of February 5, 1841, it is stated:

> "Dr. Hays, from the Committee of Publication, reported that the 2nd Part of Vol. VII of the Society's Transactions, is now ready for distribution."

And at the following meeting, held February 19, 1841, it is reported, page 28:

> "Mr. Lee, as chairman of the Committee of Publications, laid before the Society a copy of Part 2, Vol. VII., of the Transactions."

This, therefore, establishes the fact that, although part 2 may have been printed in 1840, it was issued on or about February 5, 1841 which may be considered the effective date of publication.

During this time (January to February, 1841) Part III of the "Transactions" was printed. This Part, which is the "Continuation of Mr. Nuttall's Paper", contains the original description of *Aromia tenuifolia.* In regard to this, the following was recorded for the meeting, January 1, 1841, in the "Proceedings"[12]:

> "The Committee, consisting of Mr. Lee, Dr. Wood, and Dr. Coates, to whom was referred, on the 18th of December last, the continuation of Mr. Nuttall's communication, entitled 'On the Corymbiferae, collected on a tour across the continent of North America,' reported

in favor of its publication in the Transactions, which was ordered accordingly. The Committee of Publications was authorized to print it continuously with Mr. Nuttall's former paper on the same subject."

This, in part, has been noted above in the statement "Continuation of Nuttall's paper. Read December 18, 1840."

The "Proceedings"[12] does not mention in the records of its next two meetings, that of March 5th and March 19th, as to when Part III was ready for distribution. It does, however, make mention on April 2, 1841, that:

"Mr. Lee, on behalf of the Committee of Publication, laid on the table part 3, Vol. VII of the Transactions of the Society, which completes the volume."

Part III of Vol. VII was issued sometime after February 19th and before April 2, 1841. It may have been ready for distribution on or about March 5, 1841, if the procedure was followed as reported in the February meetings for Part II. These parts and others of volumes of the Transactions were well distributed in Europe, whereas, there is no mention of the receipt of numbers of Volume III of Hooker's Journal. This will be discussed in detail in the following pages.

Hooker was well informed of Nuttall's tour across the Continent to the Pacific, a residence in Oregon, and a visit to the Sandwich Islands and Upper California, for he reported as early as 1836 in his Companion to the Botanical Magazine, Vol. 11[25] (p. 185) as follows:

"Mr. Nuttall is returned to the United States after a most interesting expedition across the Rocky Mountains to the shores of the Pacific at the mouth of the Columbia, and a voyage thence to the Sandwich Islands. We understand that the journey has been a very successful one in point of botanical acquisitions, and the Rocky Mountains having been crossed considerably to the southward of Mr. Drummond's or Mr. Douglas' route, the character of the vegetation will be proportionably different, and we trust Mr. Nuttall is engaged in preparing an account of them for the press."

Hooker, in an early number of Vol. III of the "Journal",[6] makes an editorial comment on a reprint from the Transylvania Journal of Medicine, No. XXXV, of Short's Sketch to the Progress of Botany in Western America, in which he says (p. 97):

"It was reserved for our valued friend and correspondent, Dr. Short of Lexington University to enlarge more particularly on the discoveries of the United States, and we gladly give insertion to his interesting sketch in the pages of our Journal. Four years indeed have elapsed since this paper was written, and Mr. Nuttall's most extensive and important travels to the Pacific remain yet to be detailed."

This editorial note occurred in No. 18, Nov. 1840, of the "Journal" and at this time the first part of Nuttall's "Tour across the Continent" was in the process of being printed.

Further on in Vol. III of the "Journal"[3] Hooker writes a review of Parts III and IV of Torrey and Gray's Flora of North America. In his discussion of it he makes statements which could lead one to believe he may have seen Nuttall's specimens as well as some of the manuscript descriptions, for he says (p. 292):

> " . . . ; one of the authors (Dr. Gray) having since the appearance of the first two portions, made a very extensive tour in Europe, for the purpose of examining the various herbaria which can throw light on the species already published by different authors; and we can bear ample testimony to the great energy, untired patience, and distinguished talent which the authors have employed (both Dr. Torrey and Dr. Gray, each in his respective visit) in clearing up doubtful species."
>
> " . . . We are anxious that the names of these individuals who have so ably promoted the cause of American Botany, should be recorded in the pages of our Journal. At the head of them justly stands Mr. Nuttall, to whom the authors are indebted (independently of the immense mass of information derived from his valuable publications, which are known wherever Botany is studied), for a nearly complete series of plants collected during his recent journey across the Rocky Mountains to Oregon and California, accompanied with manuscript descriptions of his new genera and species, . . . "

Hooker then lists the botanical sources of which Torrey and Gray availed themselves, followed by a detail of the "contents of the two parts", at the end of which he concludes (p. 299):

> "We shall hail with peculiar pleasure the appearance of the second volume of this great undertaking."

This review occurred as a part of article No. XXI titled "Botanical Information" and, although the description of *Amblyopappus* is included in his article No. XXIII, both are a part of the *section* designated as "No. 22, March, 1841". It should be noted here, that the "Parts III and IV" of the Flora of North America of which Hooker speaks are actually recorded as being Part III. This part was published in 1840. Volume II of the Flora of North America in which Torrey and Gray include *Aromia tenuifolia* Nutt. (pt. III), was published in three parts; Part I, 1841, Part II, 1842, and Part III, 1843.

From these facts we may realize that Hooker was aware, for the most part, of nearly all of Nuttall's collections, publications, and manuscripts. Now, we come to the point where Hooker published his *Amblyopappus pusillus* in his Journal of Botany, Vol. III, No. 22, March, 1841. The question has constantly confronted me as to how he distributed or issued these numbers of Volume III. Herein resides the basis of effective publication and the priority status. The writer has very thoroughly searched the literature that was available to her and the facts, as they were found, will be given in the following pages. These will be presented somewhat in detail and at times may seem irrelevant but on the whole will give a composite view as to why the writer believes that *Amblyopappus pusillus* was ineffectively published. Before these facts can be presented, something must be said of the composition of Hooker's Journal of Botany, Vol. III.

Each article published in the book is given a Roman numeral. The first article has the numeral "I" and the last article is "XXXI". The book has its contents proportioned to each month beginning with Oct. 1840. These are signified on the bottom of each page as follows:

Page	1.—Jour.	of	Bot.	Vol.	III.	No. 17,	Oct. 1840
"	57.— "	"	"	"	"	No. 18,	Nov. 1840
"	115.— "	"	"	"	"	No. 19,	Dec. 1840
"	169.— "	"	"	"	"	No. 20,	Jan. 1841
"	225.— "	"	"	"	"	No. 21,	Feb. 1841
"	281.— "	"	"	"	"	No. 22,	Mar. 1841
"	337.— "	"	"	"	"	No. 23,	Apr. 1841
"	393.— "	"	"	"	"	No. 24,	May 1841

On every eighth page following the signature of each of the above numbers is the repetition of the volume and the section number, the date being left off. These, we know are used as guides for the binder.

It seems improbable that the numbers could have been issued monthly as the above mentioned designations would indicate because in nearly every case each new number breaks into the middle of a sentence and in the middle of the paragraph. There seems to be no breaking up of the contents as would be the case if they were issued monthly. Another confirming factor is that, in the section concerned with *Amblyopappus,* "Jour. of Bot. Vol. III. No. 22", which begins on page 281, there is on the eighth page following this designation (p. 289) the error " . . . . No. 21" instead of "No. 22". This leads the writer to believe that had these numbers been printed and issued monthly, time would have elapsed sufficiently so that in all probability the printer would not still have been in the habit of printing "No. 21" instead of the rightful "No. 22".

These facts were confirmed and supported by Mr. Robert G. Gooch, Chief, General Reference and Bibliography Division, Library of Congress, in his letter to me which states:

> "It appears, from the following facts, that *The Journal of botany* . . . by Sir William Jackson Hooker, volume III. London. Longman, Orme & Co. (etc.) 1841, was published at one time and in one volume:
>
> The Library of Congress copy is in contemporary binding (that of the publisher). The signatures indicating the volume, number and sometimes the date in this copy bear no evidence that they were issued singly; in fact they show every indication that they were collected and bound together in one volume before issue since there is no breaking up into definite sections of the subject contents of the different groups of quires as is necessary in a periodical coming out each week or month."

Mr. Gooch further says "we have examined the English trade catalogues, book lists and reviewing journals (general and botanical) for mention of the publication date of the above volume without success".

Joseph Dalton Hooker, in his *Sketch of the Life and Labours of Sir William Jackson Hooker,*[4] writes:

> "Regarding the conduct of this series of journals under their different titles, it is impossible to overrate the value of the assistance and encouragement which he received throughout in contributions from fellow botanists at home and abroad; especially Arnott, Bentham, Berkeley, Harvey, W. Wilson, Hewett Watson, and Asa Gray; and this though, owing to the limited circulation of the volumes, the publishers (of whom there were consecutively seven) gave the contributors neither the work nor copies of their papers, except on payment. The editor contented himself with one copy, and gave his services, and in many cases the drawings on stone, gratuitously."

The "Journals" of which Joseph Dalton Hooker speaks were discussed, in some detail, in his sketch of his father's life. Parts of it are quoted here because it will help the reader to bear in mind the chronology of the series of Hooker's journals as well as be related to facts later on (p. 40-41).[4a]

> "The works published by my father when in Glasgow were very numerous . . . They may be grouped under four headings—British Botany, American Botany, Miscellaneous Works and Serials.
>
> In the British Botany there was the 'Flora Scotica', . . . 'Flora Londinensis' four editions of the 'British Flora', and many contributions. . .
>
> The more important works on American Botany were the 'Flora Borali-Americana'; Botanical Appendices to the Narratives of Sir E. Parry's three last voyages . . . There were also, in his botanical journals, descriptions of . . . United States and Oregon plants, and articles on the botany of Peru and Chili . . .
>
> Under Miscellaneous Works may be classed as most important Breville's and Hooker's 'Icones Felicum', the 'Botany of Captain Beechey's Voyage to Behring's Sea, the Pacific Ocean, and China' by himself and Arnott; the third edition of Woodville's 'Medical Botany'; the botanical articles in Murray's 'Encyclopedia of Geography,' and the first three volumes of 'Icones Plantarum' . . .
>
> Of the Serial Works the first was the 'Exotic Flora' . . . It was commenced in 1823 and concluded in 1827. . . . It was followed in 1827 by his undertaking the authorship of the 'Botanical Magazine'. Of this work thirteen volumes were issued from Glasgow. In the same year (1827), finding that his extensive correspondence with botanists and travellers abroad provided him with information of great value that might otherwise never see the light, and that his herbarium was at the same time teeming with plants unknown to science, my father formed the plan of himself editing a periodical for the diffusion amongst botanists of the information obtained from these sources . . . He never stopped or stooped to calculate the time, worry, and cost that this undertaking would entail upon him, which occupied him for the next thirty years of his life; for he had throughout no assistant editor, and was dependent solely on my mother, and at intervals on myself when at home, for aid in proofreading, etc. The correspondence it entailed conducted by himself alone . . ."[4a]
>
> "Including the continuation of the series issued from Kew, these periodicals embrace twenty-eight volumes . . . , were issued from

> Glasgow. These were the 'Botanical Miscellany', three volumes (1830-3), the 'Journal of Botany', two volumes . . . (1834 and 1840), and the 'Companion to the Botanical Magazine', two volumes . . . (1835-6). In the interval between the publication of the 'Companion to the Botanical Magazine' and the resumption of the 'Journal' he undertook the editorship with Sir William Jardine and others of Taylor's Annals of Natural History', which for three years (1837-40) was the recipient of much of his botanical matter; but the latter became too copious to be included in the numbers of the 'Annals', and. the result proving otherwise embarrassing, that editorship was abandoned. After leaving Glasgow for Kew he resumed the 'Journal', three volumes (1840-42) of which were followed by the 'London Journal of Botany' seven volumes (1842-7) and that by the 'Journal of Botany and Kew Garden Miscellany', nine volumes (1849-57).[4b]

Here we note that J. D. Hooker states that there were two volumes published, one in 1834 and the other in 1840, of the "Journal of Botany" and after coming to Kew there were three volumes published (1840-42). Since there were only four volumes published in this series, after examining the volumes, the writer believes that there was only two volumes published from 1840-42. Volume III[38], as is noted above, has its first number designated for Oct. 1840 and the last number for May 1841. It is evident from this that, at least, a portion of this volume was published after his coming to Kew. Just what portion, however, has not been ascertained, since the title page gives his residence as Glasgow. It was, perhaps, sometime after March, 1841 that Hooker went to Kew for,[4c] "It was not until the following March that my father was officially informed that the Treasury had sanctioned his being appointed Director of the Botanic Gardens at Kew . . . On April 1, 1841, my father received his commission . . . The translation from Glasgow to West Park occupied my father for three months, . . . "

The writer has studied the four volumes of Hooker's Journal of Botany, and other botanical works of his that had been published during this period, for some clue as to how he conducted his work and how each was issued, without success.

It was found that Vol. I of Hooker's "Journal"[36] (1834) did not have the same composition as Vol. III for, there were no designations at the bottom of the pages as are present in Vol. III. There seemed to be some arrangement of the contents into parts. And the "Contributions towards a Flora of South America" is continued on pages 276 to 296.

The fact that Vol. I was issued in parts is borne out in Loudon's *Magazine of Natural History*, Vol. VII.[43] This volume was published bi-monthly until September and monthly thereafter. At the end of each issue, throughout the book, is a section devoted to "REVIEWS". This section was then divided into "Art. I. Catalogue of Works on Natural History, lately published, with some notices of those considered the most interesting to British Naturalists", and "Art. II. Literary Notices." Notice of Hooker's Journal of Botany appears on page 286 of the May 1834 issue and states:

> " . . . being a Second series of the Botanical Miscellany. In Quarterly 8vo parts, containing 96 pages and several plates, some of them coloured. 7s. 6d. each part."

Then on page 480 of the September 1834 issue is the following notice: "Part iii of Hooker's Journal of Botany, which has reached us since the publication of our last . . . " Here we notice that not only were the parts of Vol. I of Hooker's Journal of Botany reported as received but also the price of each was indicated, etc. This has not been the case with Volume III, which is concerned with *Amblyopappus*. The *Companion to the Botanical Magazine*[25] was checked, for any mention by Hooker as to why he discontinued his "Journal of Botany", without success. It should be noted here that on the title page of this volume of the "Companion" (vol. I) is the date "1835" but on the page following that of the title is a "dedication" and dated "Glasgow. July 1, 1836." This would lead one to believe there were irregularities in the printing, since the date of the dedication is much later than that given for the printing.

The Magazine of Natural History, Vol. VIII (1835),[44] mentions Hooker's Companion to the Botanical Magazine. This publication[44] was printed monthly. At the end of each month's publication of articles there are a few pages devoted to "Reviews" on "Titles of Subjects of Natural History, published recently" and "Literary Notices" of publications, etc. On page 528 of the September issue the following is mentioned:

> "Dr. Hooker's Companion to Curtis's Botanical Magazine. Dr. Hooker has discontinued his Botanical Journal, under this name, and has begun to communicate the kind of information which has been applied in the Botanical Journal, which magazine Dr. Hooker edits. The first number of the Companion was published on August 1.; it is to be continued monthly, in numbers, each of two sheets and 2 partially coloured plates. 1s. 6d.; if taken stitched with the Magazine, 1s."

After the second volume of the "Companion" was published, Hooker joined Sir W. Jardine, P. J. Selby, and Richard Taylor in editing the *Annals of Natural History*,[14] which was actually the continuation of the "Magazine of Zoology and Botany" and Hooker's "Botanical Companion" combined. He edited, with the others just mentioned, four volumes of this series and then left it to resume his "Journal of Botany".

Volumes I to X of the *Annals of Natural History*[14] were examined, which cover the years 1837 to 1842, and nowhere was there mention of Hooker's *Journal of Botany*, of either of the volumes or parts thereof. We do find, however, the form of designation used in the "Annals" ("Ann. Nat. Hist. Vol. I. No. 1, March

1838") that was carried by Hooker into his volumes 2, 3 and 4, of the "Journal". The only work of Hooker's that was mentioned in any of these volumes [14] was that of his *London Journal of Botany.* The first notice of it occurred in Vol. IX, No. 59, July 1842, mentioning the fact that it was a new publication, and giving the contents of Nos. I-VI of Vol. I.

The *Transactions of the American Philosophical Society,* Vol. VII (1841),[13] has, at the end of the volume, thirty-five pages devoted to a list of donations for the library received by the American Philosophical Society since the publication of Volume V, New Series. The items were listed as having been received from Sovereign Princes, Governments, and States, from American and foreign Societies, Universities, and from individuals. Nowhere in any of the citations is there any mention of their having received any volumes or parts of Hooker's Journal of Botany. In the *Proceedings of the American Philosophical Society,* Vol. II,[12] which were for two meetings each month from January, 1841 to May 1843, there were listed donations for the library, preceding the reports of these meetings. Throughout these lists there was nothing of Hooker's Journals mentioned as having been received.

Volume II of *Hooker's Journal of Botany,* which he commenced after he discontinued the editorship of the *Annals of Natural History,* has the same composition as that of Vol. III previously discussed. It begins with " . . . No. 9, February 1840" and ends with " . . . No. 16, Sept. 1840". On page 102 of the part designated as "Journ. of Bot. Vol. II, No. 10, March 1840" there is a statement that leads one to believe that pages in each part were printed at intervals. It reads:

> "Since the printing of the sheet which contains the description of Martinsia (p. 84), Mr. Bentham had received his set of Mr. Gardner's Brazilian plants . . . " etc.

Page 84 is still in this part (No. 10). A similar statement is also found on page 200 of " . . . No. 12, May, 1840".

The*American Journal of Science and Art,* Vols. 39-43 (1840-42) was the first publication, the writer has found, that mentions the numbers of Hooker's "Journals" in any way. These references are only to Volume II and the beginning number of Volume III. The first mention appears on page 177 of Volume XXXIX[7], No. 1 (April to June, 1840), in a section devoted to "Bibliographical Notes". Dr. Silliman gives, as a title to the review, all the facts printed on the title page of Vol. II, and then writes as follows:

> "(Vol. II, Nos. 9 and 10, February and March 1840) Hooker's Journal of Botany, which was commenced in 1834 but soon discontinued for want of sufficient patronage, is again resumed, and is to be continued in monthly numbers. Each number contains 52 to 56 pages, and two plates . . . "

He then proceeds to give the names of the publisher and the price, and a detailed account of the contents of the two numbers. Volume XL[8] cites on page 172-73 in its "Bibliographical Notes" of No. 1 for Oct. to Dec. 1840, the following:

> "We sometimes since noticed the resumption of this periodical Journal, and gave a list of the contents of the first two numbers viz. Nos. 9 and 10 of the second volume, the publication of which was suspended in the year 1835. The Companion to the Botanical Magazine took its place for two years, but . . . was discontinued (for want of adequate support) or rather was merged in the Annals of Natural History, . . . It is published regularly on the first of each month, and the number for October (the seventeenth) commences the third volume of the series . . . "

It must be noted here that the statement just quoted,—"the number for October . . . commences the third volume . . . "—is the only instance, the writer has found, that any part of Volume III of the "Journal" was mentioned. This statement, the writer believes, was an assumption. Her premise being that, had Dr. Silliman been actually in possession of "No. 17", he would have given a detailed account of its contents as he had been doing for each of the numbers preceding this one. On page 391 in the "Bibliographical Notices" of No. 2,[8] January to March, 1841, "Hooker's Icones Plantarum, Part VII" was noted, but there was no reference to the "Journal". Nor was the "Journal" listed in the subsequent issues of July and October (Vol. XLI.).[9] In the "Bibliographical Notices" of Volume XLII,[10] page 185, the following mention is made:

> "Hooker's Journal of Botany.—The fourth volume of this interesting periodical commenced with the number for June last; which is occupied with a translation of a paper by Martius, . . . The October number is nearly filled with a biographical sketch of the late Allan Cunningham, the botanical collector."

Then on page 189 of No. 1, April to June, 1842 of Vol. XLIII[11] is the following mention:

> "The London Journal of Botany; edited by Sir Wm. Hooker. This is the title of the new monthly periodical, commencing in January last, which takes the place of Hooker's Journal of Botany, and is in fact, a continuation of that excellent work . . . " etc.

Here, we see, the *American Journal of Science and Art* has given us the most complete report on Hooker's "Journal". It has discussed Volume II in full, and led us up to No. 17, the first number in Volume III. It has discussed Volume IV almost in full, and the first part of the Loudon Journal of Botany, but why was there no mention of any of the other numbers of Volume III?

Many other works, as well as book lists and catalogues, were searched for mention of numbers of Volume III of the "Journal". The results of each of these will be discussed in the following pages. This is done so that the reader may know the works consulted, the method each used in reporting publications, and the thoroughness of these reports.

Charlesworth's *Magazine of Natural History*[15] is a new series and continuation of Loudon's publication by the same name (previously noted). Some "Reviews" are noted in Vol. IV (1840). Some comments on "New Works in Natural History", also, are carried in a section devoted to it but the plan is not consistent throughout the volume. Although many publications were noted, no works of Hooker's are mentioned.

In the first volume of the *Transactions of the Botanical Society of Edinburgh*[16] there is, at the end of its introduction ("Report on the Progress and State of Botany in Britain, from March 1839 to February 1840 inclusive, by Robert Kaye Greville LL.D. President. Read at the Fourth Anniversary Meeting."), a "Catalogue of Botanical Works and Memoirs Published in Great Britain, from the beginning of February 1839 to the end of January 1840". The publications are listed under various classifications and some of Hooker's works are cited as follows:

"FLORAS, MONOGRAPHS, CATALOGUES

Harvey, Hon. W. H. and Dr. J. D. Hooker,-Musci Indici, or a List of Mosses . . . etc.
Journ. of Bot. Vol. ii, p. 1.

Hooker, Sir W. J. and Dr. G. A. Walker-Arnott.
The Botany of Captain Beechey's Voyage. Parts VII and VIII.

ILLUSTRATED WORKS

Hooker, Sir W. J.—Icones Plantarum, . . . Part VI.

MISCELLANEOUS

Hooker,Sir W. J.—The Journal of Botany, No. 9.

(NOTE: This No. 9 covers the same as the first item under "FLORAS, . . . " above.)

Although No. 9 is for February (1840) of the "Journal" Vol. II, it is here included in their "Catalogue . . . to the end of January 1840". No. 9 either came out before February, or if it came out during February, was included because the "Report" covered February 1840. Part 1 of these "Transactions"[16] gives the date of publication as 1841, but the title page, included at the back of Part 3, gives the date as 1844.

The seven volumes examined, of the *Edinburgh Review*, contained a section devoted to "Lists of New Publications" at the end of each part or sometimes volume. These lists are classified, in most cases, and "Botany", "Natural History", and "Miscellaneous Publications" were searched for any mention of Hooker's Journal of Botany. Hooker's Icones Plantarum Vol. III was cited in Volume 71 (April 1840 to July 1840)[27] but no "Journals". Nothing of Hooker's was mentioned in Volume 72[28], or in Volume 73.[29] The "List of Principal Works in Volume 74 (July to

October 1841)[30] mentions Vol. IV of Icones Plantarum but nothing more of Hooker's. There is no mention of Hooker's works in Volume 75,[31] but in the "List of Publications for July, August, and September 1842" the following items are noted (p. 146-157):

"Icones Plantarum by Sir W. J. Hooker, Vol. I new series or vol. 5 of the entire work . . .
The British Flora by Sir W. J. Hooker. Just ready."

The British Flora is again reported in the next part (Vol 76)[32] but gives a description of it, the price, and size in detail.

The *Proceedings of the Royal Society of Edinburgh*[50] Vol. I, is composed of parts No. 1 to No. 24. They covered meetings which occurred on the first and third Mondays of each month, from December 1832 to May 1844. The data for each meeting included: The name of the president presiding at the meeting, a list of "Donations" received since each foregoing meeting, a list of specimens received, and papers read at the meeting. The list of "Donations" included papers, periodicals, and books. The writer has checked carefully and nowhere in the entire volume does it make mention having received any of Hooker's works. It does, however, mention:

"No. 18—Dec. 7, 1840
Trans. Am. Philos. Soc. New Series, Vol. VII, pt. 1.
No. 19—Dec. 6, 1841
Trans. Am. Philos. Soc. New Series, Vol. VII, pts. 2, 3.
No. 21—Dec. 5, 1842
Trans. Am. Philos. Soc. New Series, Vol. VIII, pt. 1.

In their "lists", the papers, books, and periodicals are recorded as having come from far places such as Bombay, Moscow, Europe and America.

The *Transactions of the Royal Society of Edinburgh*[51] contained only papers on various subjects. There was no mention of any publications.

The *Edinburgh New Philosophical Journal,* Vol. XXX" (1841), a quarterly publication, contained in its lists of "New Publications" the mention of numbers, parts, and complete volumes of numerous publications but there was no mention of any of Hooker's "Journals".

The *Proceedings of the Philosophical Society of Glasgow,*[46] Vol. 1 (1841-44), has a section, on page 59 and 60, devoted to "Books added to the Society's Library in the Years 1840, 41, and 42." The list is divided into "Periodical Publications" and Miscellaneous Books". There is no mention of any of Hooker's works here but on page 269, under "Books added to the Society's Library since November 1842. Continued from page 60.", is the following item under "Miscellaneous Books"—"Hooker's Notes on the Botany of the Antartic Voyage.", and under "Periodicals",.—"Hooker's Journal of Botany, *Monthly*". No volume numbers or monthly numbers were cited. It appears to the writer that it may have been received as a bound volume since it was received long after Vol. IV of the "Journal" was published.

In the *Proceedings of the Royal Irish Academy*,[48] Vol. 1 (1841), the volume is made up into numbers. In each of the numbers are one or more lists of "Donations". These record the publications of numerous societies and organizations as well as private parties. Nowhere is there any mention of Hooker's "Journals", although the parts of several volumes of the Transactions of the American Philosophical Society, as well as the Proceedings of that Society, with dates of the receipt of each individual part, are mentioned. In volume II of these Proceedings,[49] they report for Nov. 30, 1840, the receipt of Vol. VII, pt. 1 of the Trans. Am. Philos. Soc., New Series; Vol. VII, part 2, on May 24, 1841; and Vol. VII, part 3 on July 12, 1841. There was, however, no mention of any of Hooker's "Journals."

In the *Gentleman's Magazine*[33] for July to December, 1841, the following items were mentioned in the September issue:

Page 292—Flora Boreali-Americana, Parts IX and X, by Sir W. J. Hooker.

Page 294—Hooker's Icones Plantarum, Vol. IV.

This volume and the preceding one, for January to June, 1841, were searched thoroughly for any further mention of Hooker's publications without success. In both volumes, numerous pages were devoted to reviews of new publications, scientific and otherwise, at the end of each monthly issue.

Volumes No. 124 to 134, covering the years 1834 to 1844, of the *Philosophical Transactions of the Royal Society of London*[52] were examined. At the end of each volume is a list of publications received, titled "Presents received by the Royal Society with the Names of the Donors". Volume 132, under "Presents Received . . . from November 18, 1841, to June 21, 1842", states that Part III of Vol. VII of the Trans. Am. Philos. Soc. had been received. There was no mention of any of Hooker's Journals, however.

The *Proceedings of the Linnean Society*[41] (1838-48) were examined without success. However, the *Transactions of the Linnean Society of London* [40] furnished some items of Hooker's publications. Volume XVII, of which the first part was published in 1834 and the last part in 1837, has at the end of the volume, a list of their "Catalogue of the Library of the Linnean Society". This title bears with it a note stating: "To books which are continuations of works included in any of the former parts of the catalogue, the original numbers are here affixed and the other books are numbered in the regular progression." Numerous works and authors are listed and the following publications of Sir W. J. Hooker are mentioned:

> "1486—Botanical Miscellany. 2, 3, 6, 7, 8, and 9, London, 1829-33.
> 1763—Companion to the Botanical Magazine Vol. 1, London 1835.
> 1764—British Flora, 3rd Ed. 2 vols. London 1835".

In the "Catalogue" of Volume XVIII, of which the first part was published in 1838 and the last part was published in 1841. Several items of Hooker's were listed but no "Journals". In the "Catalogue of Volume XIX, of which the first part was published in 1842 and the last part in 1845, the following entries appeared:

> "2511—British Ferns, 4th Ed. Vol. 1. London, 1838.
> 2512—Journal of Botany, vols. 1-4. London 1834-42.
> 2513—Notes on the Botany of the Antarctic Voyage. London, 1843.
> 2514—Species Filicum, parts 1-3, London 1844".

It is apparent from this, that the Linnean Society received Hooker's Journal of Botany in bound volumes and the four volumes together. Otherwise, had they been received separately, either by volume or parts of a volume, they would have been listed in the "Catalogue" with an earlier catalogue number.

Volume VI of the *Memoirs of the Literary and Philosophical Society of Manchester*[42] was published in London in 1842. Its contents began in 1832, however, for the first article in the volume is dated "February 24, 1832". At the end of the volume is given a "List of books, &c. presented to the Society since 1831". Among the numerous items contained in the list, there is nothing of Hooker's but it makes mention of the receipt of "Trans. of the Am. Philos. Soc. vols. IV, V, VI and VII (New Series)."

Pritzel's *Thesaurus of Botanical Literature*[53] (1872) was consulted for some mention as to how Hooker's Journal of Botany, Vol. III, was issued. The following statement was made on p. 148:

> "4220—Journal of Botany, being a second series of the Botanical Miscellany;" . . . . "vol. III, 1841, 446 p. 17 tab., effigies Jussieu.

The Ray Society's[47] Report and Papers on Botany (1849) were consulted without success. The *Botanische Zeitung*[19] has the date 1843 as the publishing date on its title page but the volume contains reports dated from January 6, 1843 to December 27, 1844. The only work of Hooker's mentioned is his "London Journal of Botany, vol. I, 1842 (p. 289). In the *History of Botany in the United Kingdom*[34] (1914), which covers the period in question, pages are devoted to Hooker's activities but there are no particular details made regarding his "Journals".

Numerous catalogues were consulted but in most instances only the whole volumes of the "Journal" are cited. The "Catalogues" examined are as follows:

1. *Catalogue of the Library of the Royal Botanic Garden, Kew*[22] (1899) lists numerous publications of Hooker's and under "Periodicals" cites "Journal of Botany", 4 vols."

2. *A Catalogue of British Scientific and Technical Books*[19] (1921) does not list any of Hooker's "Journals" although it does mention two books of his on "Ferns".

3. *Catalogue of the Printed Books in the Library of the Faculty of Advocates*[24] (1876) mentions, among other items of Hooker's, "The Journal of Botany, being a second series of the Botanical Miscellany, 4 vols. London 1834-42."

4. *Catalogue of Books, Pamphlets, Manuscripts, and Drawings in the Lindley Library*[23] cites, on page 44 (1927) under "Botanical Miscellany" by Sir W. J. Hooker, the "Journal of Botany, 4 vols. 1834-42", and other items of Hooker's.

5. *English Catalogue of Books Published from January* 1835 *to January* 1863[21] (1864) gives the date of publication, size, price, edition, and publisher of each item. The books are listed under each author's name by title in alphabetical order, as follows:

Hooker, Sir W. J.
(A number of items preceded this point)
Icones Filicum . . . (gives size, price, pub. & date).
——— Plantarum, v. 1-4 (gives size, price, pub.) 1837-41.
——— ——— v. 5-8 (gives size, price, pub.) 1842-52.
——— ——— v. 9; v. 10 (gives size, price, pub.) 1854
Jour. of Botany & Kew Miscellany:
v. 1-3. v. 4, v. 5, v. 6, v. 9 (size, etc). 1849-57.
London Jour. of Botany, v. 1-6
——— ——— ——— v. 7 (size, etc) 1850.
Notes on Botany of Ross's Antarctic Voyage (size, etc) 1843."

Other items followed, but we see here that volumes of Hooker's Journal of Botany, for the years 1840-42, are not mentioned.

6. *A General Catalogue of Books* by Bernard Quaritch,[20] Vol-1 (1887) lists a number of Hooker's works on pages 132-38, 170-189, 578-82, and on pages 583-94 of a section devoted to "The Botanical Library of the Late Hewett Cotrell Watson". "Hooker's Journal of Botany, 4 vols. 1834-42" was only cited on page 178.

7. *A Catalogue of Books* by Henry C. Bohn (Bookseller)[18] (1841) has its contents classified and the items numbered. The following was found under:

NATURAL HISTORY

Botany (p. 289-320)

3446 Hooker's Flora Boreali-Americana; . . . . . (gives details of the publication and goes on to state that parts 1-10 are already published" . . . etc.

3447 Hooker's British Jundermaniae . . . "

(This was followed by other publications of his ranging in dates from 1816-37).

Miscellaneous Works on Natural History, comprehending general collections, Transactions, Periodicals, etc. No Hooker's "Journals" were mentioned.

ENGLISH BOOKS

A number of Hooker's publications are mentioned but no volumes of the "Journal" are included.

In the back of this catalogue is a separate section of 146 pages devoted to "New and Valuable, and Most Important Books of which the Advertiser has purchased the Entire Editions or Remainders . . . " etc., with a notation stating that "The Advertiser has sole Proprietor of the entire Remainders of the books announced in this Catalogue", etc. This section is paged separately from the rest of the volume. It devoted, in some cases, a whole page to the advertisement of the items of which, Hooker's Flora Londinensis, British Jungarmanniae, Muscologia Exotica, Botany of Captain Beechey's Voyage, Botanical Miscellany, and Flora Boreali-Americana, were included and each separately advertised.

SUMMARY

From the foregoing discussion, it is apparent that *Aromia tenuifolia Nuttall* (Trans. Am. Philos. Soc. Vol. VII part 3, p. 395) and *Amblyopappus pusillus* Hooker & Arnott (Journ. of Bot. Vol. III, No. 22, p. 321) both appeared under date of March 1841. The preponderance of evidence indicates that the Transactions of the American Philosophical Society, Vol. VII, part 3 was in the hands of most of the botanical societies, clubs, organizations, libraries, and universities in Europe, as well as in America, shortly after it was printed; while the separate numbers of Volume III of Hooker's Journal of Botany were in no case cited as having been received as such. Although many of Hooker's works were listed in the publications examined, Volume III of the "Journal" was infrequently cited, and then only as a volume.

The validity of *Aromia* or *Amblyopappus* resides in the conditions and dates of effective publication. From the foregoing facts, and according to the International Rules of Botanical Nomenclature, the writer believes that only *Aromia* was effectively published and suggests that the "Committee on Nomenclature" submit the genus *Aromia* for *nomen genericum conservandum* at the next International Botanical Congress.

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Contribution from the Los Angeles County Museum,
Division of Science, Department of Botany.

MEETING OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES JANUARY 18, 1946

ARCHEOLOGICAL SECTION

Dr. R. H. Swift, *Chairman*

The program was opened by Dr. R. H. Swift presenting a paper on studies of ancient Egyptian glass from Tell-el-Amarna, and Deir el Bahari.

A brief review of the origin of glazing from early dynastic times to fine products of the XVIIIth Dynasty was given with examples shown. Since the chemistry of the glaze was essentially the same as later and even our modern glass, the step to the discovery of this product was simple and became widespread in the early 16th century B.C. The chemistry of the metallic oxides used for color and the methods of the el Amarna glass workers in fusing powdered quartz, natron and lime was described. Methods of bead making by winding hot glass threads about a copper wire or producing polychrome design objects by drawing hot colored rods was explained. Molds into which hot glass was pressed to make amulets were shown. Methods and resulting products of small decorated glass vase manufacture were presented, showing how melted glass rods were wound about a sand-clay core, as blown objects were not known until Roman Times in Egypt. The production of Mille fiori dishes by fused sections cut from colored rods, was described and a specimen shown. Examples of mosaic glass beads in necklaces were exhibited.

The next speaker, Robert Johnston, field representative American Museum, Haye Foundation, spoke on recent travels and work done in Mexican and Central American precolumbian cultures. The fine talk was illustrated by motion pictures in natural colors. Architectural sites were shown from the air and in dense jungles where many works of art still are imprisoned. Colorful studies of the modern descendants of these ancient artists were included in this graphic visit to the Land of the Maya, whose culture peak was contemporaneous with the late Egyptian period treated in the earlier evening studies.

The Chairman expressed the hope that the Section of Archeology would draw to it all members of the Academy now active in the study of Art of the Past, so that frequent meetings can be held.

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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.

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Bulletin of the Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

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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Check-list of the Recent Bivalve Mollusks (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall 1.00

FLORA OF SOUTHERN CALIFORNIA by Anstruther Davidson and George L. Moxley, 452 pp., 1923................ 2.50

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Check-list of the Lepidoptera of Boreal America. Superfamilies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 ....$ .50

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A CHECK LIST OF THE HELICOID SNAILS OF CALIFORNIA

FROM HENRY A. PILSBRY'S MONOGRAPH

WILLIAM MARCUS INGRAM
Mills College, California

This list is based entirely on Dr. Henry A. Pilsbry's monumental monograph on "The Land Mollusca of North America (North of Mexico)" (1939) (1940). The writer's name is merely affixed because of the time consumed in sorting out and in listing to counties the Helicoid snails reported by Pilsbry from California.

The value of such an independent list needs but little clarification: it is one that can be conveniently taken into the field and added to; and it is more readily available than a large monographic work of several volumes; too, it represents a geographic unit for the collector of land mollusks in California. Synonomy has been omitted since it is accessible in the above monograph. Type depositories and type localities are included when available to aid one in field work.

One hundred and seventy-three species and subspecies of Helicoid snails are included from California: this number includes one species each of *Helix, Theba, Cochlicella, Ammonitella,* and *Polygyroidea;* fifteen species and subspecies of *Monadenia;* eighty-six species and subspecies of *Helminthoglypta;* forty-two species and subspecies of *Micrarionata;* two species of *Oreohelix;* three species and subspecies of *Glyptostoma;* ten species and subspecies of *Trilobopsis;* nine species and subspecies of *Vespericola;* and one "lost species" is listed as an "*Epiphragmophora.*" The species found only in the fossil state are not included.

SPECIES LIST

FAMILY—HELICIDAE

HELIX ASPERSA (Müller)

Alameda County: Oakland, Berkeley, San Leandro, Emeryville.

Santa Clara County: Santa Clara, San Jose.
Monterey County: Monterey, Pacific Grove, Carmel.
San Luis Obispo County: San Luis Obispo.
San Diego County: San Diego, La Jolla.
Orange County: Fullerton, Anaheim, Santa Ana, Newport Beach.
Los Angeles County: Los Angeles, Glendale, Burbank, Pasadena, Long Beach.

(NOTE: The writer now has specimens from every county in the state of California).

THEBA PISANA (Müller)

San Diego County: La Jolla, Greenwood Cemetery, San Diego.
Orange County: Seal Beach.
Los Angeles County: Midway City, Garden Grove.

FAMILY—HELICELLIDAE

COCHLICELLA VENTROSA (Férussac)

Alameda County: Oakland gardens.

FAMILY—HELMINTHOGLYPTIDAE

MONADENIA FIDELIS (Gray)

Type locality: Vicinity of Vancouver, Washington (Selected by Pilsbry).

Siskiyou County: Siskiyou Mountains, Mt. Shasta.
Del Norte County: Endert's Beach, 5 miles from Crescent City; Smith River, 9 miles east of Crescent City; Lighthouse Island, Crescent City; Requa.
Humboldt County: South of mouth of Klamath River; Cape Mendocino.

MONADENIA FIDELIS PRONOTIS Berry

Type: 6961 Berry Collection.[1]

Type locality: Point St. George near Crescent City.
Del Norte County: Point St. George, near Crescent City.

[1] The Berry collection is housed in Dr. S. S. Berry's possession in Redlands, Calif.

MONADENIA FIDELIS OCHROMPHALUS Berry

Type: 7767 Berry Collection.

Type locality: Etna Creek, about two and one-half miles above Etna.
Siskiyou County: Etna Creek, about two and one-half miles above Etna.

MONADENIA FIDELIS LEONINA Berry

Type: 7687 Berry Collection:

Type locality: About one mile above mouth of Beaver Creek.
Siskiyou County: Beaver Creek, one mile above mouth.

MONADENIA FIDELIS KLAMATHICA Berry

Type: 6011 Berry Collection..

Type locality: Along Oak Flat Creek, near Klamath River.
Siskiyou County: Along Oak Flat Creek, near Klamath River.

MONADENIA FIDELIS SUBCARINATA (Hemphill)

Syntypes: 5630-32 California Academy of Sciences Collection.

Type locality (?): near Eureka, Humboldt County
Humboldt County: near Eureka; Jordan Creek near Scotia: six miles above Carlotta.

MONADENIA INFUMATA (Gould)

Alameda County: Oakland (writer's record); Hayward.
Contra Costa County: St. Marys College (writer's record).
Marin County: Bolinas Bay.
Pilsbry (1939) states, "Siskiyou County (W. M. Gabb): all the coast counties from Humboldt to Marin; Napa, Solano, Contra Costa and Alameda counties."

MONADENIA CHURCHI Hanna and Smith

Type: 5806 California Academy of Sciences Collection.

Type locality: Rock-slide 2.1 miles east of Payne's Creek Station., Tehama County.
Tehama County: Lava rock slide 2.1 miles east of Payne's Creek; Deer Creek; near Butte Creek, 22 miles east of Chico on road to Butte Meadows.

Trinity County: Grass Valley Creek; 4 miles west of summit (county line) on the Redding-Weaverville highway; Trinity Alps Camp, Stuart's Fork of the Trinity River, 12 miles northeast of Weaverville.
Shasta County: Ceader Creek, 6 miles east of Ingot.

MONADENIA MORMONUM (Pfeiffer)

Type locality: Mormon Island in the American River, Sacramento County.
Eldorado County: Pioneer Cave; Placerville.
Sacramento County: Mormon Island in the American River.
Tuolumne County: Columbia and Cave City.

MONADENIA MORMONUM BUTTONI (Pilsbry)

Type: 73630 Academy Natural Sciences, Philadelphia.

Type locality: Nassau Valley.
Calaveras County: Nassau Valley.

MONADENIA MORMONUM LOWEANA Pilsbry

Type: Academy of Natural Sciences, Philadelphia,

Type locality: Road to Huntington Lake in San Joaquin River Canyon.

Fresno County: Road to Huntington Lake in San Joaquin River Canyon.

MONADENIA MORMONUM HIRSUTA Pilsbry

Type: 2639 Academy of Natural Sciences, Philadelphia.

Type locality: Mountain Pass, Tuolumne County.
Tuolumne County: Mountain Pass.

MONADENIA HILLEBRANDI (Newcomb)

Calaveras County: No specific locality.
Tuolumne County: No specific locality; Newcomb's type locality.
Mariposa County: Mariposa; Lower Chilnuana Falls near Wawona, 5000 feet, and Alder Creek, Yosemite National Park.

MONADENIA HILLEBRANDI YOSEMITENSIS (Lowe)

Type: A lectotype 114782 Academy of Natural Sciences, Philadelphia.

Type locality: Yosemite Valley in a rock-slide near Vernal Falls.
Mariposa County: Yosemite Valley in a rock-slide near Vernal Falls; Camp Curry.

MONADENIA CIRCUMCARINATA (Stearns)

Type: United States National Museum.

Type locality: Near Turlock, Stanislaus (?).
Stanislaus County: Near Turlock (?).

HELMINTHOGLYPTA TUDICULATA (Binney)

San Diego County: San Diego; Mission Valley; Oceanside; Murray Dam, San Diego.
Orange County: Laguna Beach; Newport-Balboa Beach.
Los Angeles County: Glendora; Millard Canyon near Pasadena.

HELMINTHOGLYPTA TUDICULATA GRIPPI (Pilsbry)

Type: 105300 Academy of Natural Sciences, Philadelphia.

Type locality: Santee, 18 miles from San Diego.
San Diego County: Santee, 18 miles from San Diego; San Diego River Gorge near San Diego.

HELMINTHOGLYPTA TUDICULATA SUBDOLA (Hemphill)

Type: Syntypes 2487 to 2490b California Academy of Sciences.

Type locality: San Jacinto Valley.

Riverside County: San Jacinto Valley, Riverside.
Los Angeles County: Cerritos; Tujunga Wash.

HELMINTHOGLYPTA TUDICULATA ANGELENA Berry

Type: 8654 Berry Collection.

Los Angeles County: Throughout the Los Angeles Basin.
San Bernardino County: Lower end San Timoteo Canyon on northeast side near Redlands; Mill Creek Canyon in San Bernardino Mts.
Orange County: Orange; Anaheim.
Ventura County: Ventura; Bardsdale.
Riverside County: Riverside; Tremont Park and Perris.

Helminthoglypta tudiculata imperforata Pilsbry

Type: 91714 Academy of Natural Sciences, Philadelphia.

Type locality: Ontario.

Los Angeles County: Near Claremont.
San Bernardino County: Ontario

Helminthoglypta berryi Hanna

Type: 1492 California Academy of Sciences.

Type locality: Eight miles northeast of Bakersfield; Kern County.

Kern County: Eight miles northeast of Bakersfield, Kern River oil fields; about three-fourths of a mile north of Kern River and four miles east of Oil City.

Helminthoglypta allyniana (Berry)

Type: 4850 Berry Collection.

Type locality: Jasper Point, Mariposa County.

Mariposa County: Jasper Point; Bagby.
Stanislaus County: La Grange, and banks of the Tuolumne River at Waterford.

Helminthoglypta allyniana kernensis Berry

Type: 6863 Berry Collection.

Type locality: Poso Creek, Kern County.

Kern County: Poso Creek; three miles east of bridge on Woody Road, Poso Creek.

Helminthoglypta allyniana rex Church and Smith

Type: 7189 California Academy of Sciences.

Type locality: Above bend Middle Fork of Tule River, about 2 miles above east of Springville at boundary of Sierra National Forest.

Tulare County: Above bed Middle Fork of Tule River, about 2 miles above and east of Springville at boundary of Sierra National Forest; 8 miles east of Porterville; Tule River Indian Reservation, 18 miles east of Porterville; Visalia, Cramer.

HELMINTHOGLYPTA CYPREOPHILA ("Newc." Binney and Bland)

Type locality: Copperopolis, Calaveras County.

Calaveras County: Copperopolis.
Tehama County: Tehama.
Butte County: Chico.
Also having the following distribution with no specific county localities:
"Lower foothills of the eastern slope of the interior valley from Fresno County north to Tehama, and westward across the Sacramento River, but east of the Coast Range, into Colusa County; known from the following counties: Fresno, Merced, Madera, Mariposa, Tuolumne, . . Placer, . . Sutter, Colusa, . . , " Pilsbry (1939).

HELMINTHOGLYPTA ALLYNSMITHI Pilsbry

Type: 17340 Academy of Natural Sciences, Philadelphia.

Type locality: Merced River Canyon 3 miles below El Portal.

Mariposa County: Merced River Canyon 3 miles below El Portal; 5.3 miles below El Portal.

HELMINTHOGLYPTA HERTLEINI Hanna and Smith

Type: 7094 California Academy of Sciences.

Type locality: Lava rock slide 6.6 miles east of junction of Klamath Falls road with U. S. highway No. 99, Jackson County, Oregon.
Siskiyou County: Near mouth of the canyon of the Shasta River.

HELMINTHOGLYPTA CALIFORNIENSIS (Lea)
Monterey County: Monterey Peninsula; Point Pinos; Point Cypress; Point Lobos.

HELMINTHOGLYPTA NICKLINIANA (Lea)

Type: 106746 United States National Museum.

Type locality: Monterey.

Alameda County: Oakland, Berkeley.
Sonoma County: Santa Rosa.
San Francisco County: Golden Gate Park.
Monterey County: Monterey.
Santa Clara County: Palo Alto.

Marin County: Bolinas Beach Club House.
Contra Costa County: Point Isabel.
Concerning the General distribution of this species Pilsbry (1939) states,
"From north of Santa Rosa, Sonoma County, southward on both sides of San Francisco Bay to Monterey . . .Pinnacles National Monument."

HELMINTHOGLYPTA NICKLINIANA AWANIA (Bartsch)

Type: 336831 United States National Museum.

Type locality: Point Reyes on the steep southern slope at extreme west end.
Marin County: Point Reyes, on the steep southern slope at extreme west end.

HELMINTHOGLYPTA NICKLINIANA RAMENTOSA (Gould)

Monterey County: Between Colinga and Parkfield.
San Benito County: Upper end of Cienaga Valley.
Santa Clara County: Santa Cruz Mts.; Gilroy Hot Springs; San Jose.
Alameda County: Mission Peak 25 miles southeast of Oakland.
Solano County: Benicia; Mare Island.
Contra Costa County: No specific locality.

HELMINTHOGLYPTA NICKLINIANA BRIDGESI (Newcomb)

Type: A lectotype 26132a Cornell University, Ithaca, New York.

Type locality: San Pablo.

Contra Costa County: San Pablo; San Pablo Creek; Kensington; Mt. Diablo, east slope.
Alameda County: Berkeley; Berkeley Hills; Thousand Oaks, Berkeley.

HELMINTHOGLYPTA NICKLINIANA ANACHORETA (W. G. Binney)

Napa County: North side summit of Mt. St. Helena; at foot of south slope of Mt. St. Helena.
Sonoma County: Mark West Springs and Glen Ellen.
Lake County: West of road about 4 miles north of town of Upper Lake, at north end of Clear Lake; near Clear Lake Oaks, and across from Clear Lake Highlands, three miles north of Lower Lake.

Mendocino County: North of Blue Lake.
Marin County: Kentfield.

HELMINTHOGLYPTA CONTRACOSTAE (Pilsbry)

Type: 10712 Academy of Natural Sciences, Philadelphia.

Type locality: Byron Springs.

Contra Costa County: Byron Hot Springs; San Pablo; Isabel Point.
Lake County: Small island southern end of Clear Lake about one-half mile above outlet, and on a knoll in marshland west of outlet.

HELMINTHOGLYPTA DIABLOENSIS (Cooper)

Alameda County: Oakland; Hills back of Berkeley; west slope of Grizzly Peak; hills back of St. Marys College, Moraga.
Contra Costa County: San Pablo Creek below reservoir dam, and 2 miles east on highway to Walnut Creek; Orinda Country Club; Bay Shore at Giant; in drift at water's edge at mouth of San Pablo Creek.
Colusa County: No specific locality.
Santa Clara County: West side of Pacheco Pass near the top under rocks.
Yolo County: No specific locality.
Napa County: Geysers.

HELMINTHOGLYPTA EXARATA (Pfeiffer)

San Mateo County: Santa Cruz Mountains; Pescadero.
Santa Clara County: Los Gatos.
San Benito County: Sergeant on San Benito side of Pajaro River.
Santa Cruz County: Watsonville.

HELMINTHOGLYPTA ARROSA ("Gld." W. G. Binney)

Concerning the distribution of this species Pilsbry (1939) states, "Coast counties from Santa Cruz to Marin, Sonoma, and as far north as the Navarro River, Mendocino County."

HELMINTHOGLYPTA ARROSA HOLDERIANA (Cooper)

Type: A Neotype 171335 Academy of Natural Sciences, Philadelphia.

Type locality: Head of Moraga Valley back of Oakland (Neotype).

Concerning the distribution of this subspecies Pilsbry (1939) states,
"East side of San Francisco Bay along the first range of hills opposite the Golden Gate, for fifteen miles north and south (Cooper). Head of Moraga Valley back of Oakland (A. G. Smith), . . . Canyon back or *(sic)* Claremont. (Woodbridge Williams)."

Helminthoglypta arrosa stiversiana (Cooper)

Marin County: Tomales; edge of Drake's Estero and near the town of Point Reyes.
Sonoma County: Head of Bodega Bay; Jenner.

Helminthoglypta arrosa miwoka (Bartsch)

Type: 336832 United States National Museum.

Type locality: Point Reyes.

Marin County: Point Reyes; 12 miles from the Point and near the Bell System Transpacific Radio Station, about 15 miles from Point Reyes Light.

Helminthoglypta arrosa williamsi A. G. Smith

Type: 7204 California Academy of Sciences.

Type locality: Hog Island, Tomales Bay.

Marin County: Hog Island, Tomales Bay.

Helminthoglypta arrosa pomoensis A. G. Smith

Type: 7208 California Academy of Sciences.

Type locality: Big River near mouth of Daugherty Creek.

Mendocino County: Big River near mouth of Daugherty Creek; Navarro River at mouth of North Fork; Russian Gulch.

Helminthoglypta arrosa humboldtica Berry

Type: 7085 Berry Collection.

Type locality: Vicinity of Bridge Creek Lumber Camp south of Scotia.

Humboldt County: Vicinity of Bridge Creek Lumber Camp south of Scotia.

HELMINTHOGLYPTA ARROSA MATTOLENSIS A. G. Smith

Type: 7209 California Academy of Sciences.

Type locality: On coast between Cape Mendocino and mouth of Mattole River.
Humboldt County: On coast between Cape Mendocino and mouth of Mattole River; in Shelter Cove in southwestern angle of Humboldt County; 10 miles south of Cape Mendocino.

HELMINTHOGLYPTA ARROSA EXPANSILABRIS (Pilsbry)

Type: 7116 Academy of Natural Sciences, Philadelphia.

Type locality: Near Eureka.
Humboldt County: Eureka; Capetown on coast; near Scotia; one-fourth mile north of Jordan Creek, six miles south of Scotia; north end of bridge over Eel River at Rio Dell, about one and one-half miles north of Scotia; Grizzly Bluff not far from Grizzly Bluff School; Table Bluff Light; Freshwater Canyon, near county park, and Graham Gulch, about 9 miles north and east of Eureka; near Trinidad.
Mendocino County: Coast 11 miles north of Fort Bragg.
Del Norte County: At "Dad's Camp", face of bluff south of mouth of Klamath River.

HELMINTHOGLYPTA ARROSA MAILLIARDI Pilsbry

Type: 2646 California Academy of Sciences.

Type locality: Ocean bluff near Crescent City, Del Norte County.
Humboldt County: Beach near Orick.
Del Norte County: Ocean bluff near Crescent City; south side of Kalamath River at mouth; Requa.

HELMINTHOGLYPTA AYRESIANA (Newcomb)

Type: A lectotype 26038a Cornell University, Ithaca, New York.

Type locality: Pilsbry (1939) states, "The original locality 'northern Oregon' being erroneous, San Miguel Island has been selected as type locality, specimens from there agreeing with Newcomb's description and type."
Santa Barbara County: San Miguel Island.

Helminthoglypta ayresiana sanctaecrucis Pilsbry

Type: 10682 Academy of Natural Sciences, Philadelphia.

Type locality: Santa Cruz Island.
Santa Barbara County: Santa Cruz Island.
Ventura County: Anacapa Island.

Helminthoglypta walkeriana (Hemphill)

San Luis Obispo County: San Luis Obispo; Morro Bay; Morro Peninsula.

Helminthoglypta cuyama Hanna & Smith

Type: 7088 California Academy of Sciences.
Type locality: Two miles west of Cuyama Service Station on Cuyama River.
Santa Barbara County: Two miles west of Cuyama Service Station on Cuyama River; rock slide of Franciscan chart on south side of highway connecting Santa Maria with Maricopa, 23.7 miles east of the first.

Helminthoglypta umbilicata (Pilsbry)

Type: 64228 Academy of Natural Sciences, Philadelphia.
Type locality: Two miles south of Piedras Blancas Light.
Monterey County: Salinas River Valley; Santa Lucia Mts.; Castroville; Salmon Creek in southern edge of Monterey County; Big and Little Sur Rivers.
San Luis Obispo County: Two miles south of Piedras Blancas Light; at China Springs, 5 miles north of San Simeon; Bluffs 6 miles south of Cayucos; Old Creek, 3 miles south and Little Pico Creek, 4 miles south of Cayucos; Morro Creek, Morro Peninsula.
Santa Barbara County: Sandy beaches above Point Conception; Cuyama River; Cuyama River Valley about 7 miles east of Santa Maria.

Helminthoglypta dupetithouarsi (Deshayes)

Monterey County: Monterey; Monterey Peninsula and one mile east of Cypress Point; Point Lobos; Carmel Highlands; Carmel Estero and on Wildcat Creek; Garapata Creek; Point Sur.

Helminthoglypta dupetitthouarsi consors Berry

Type 8653 Berry Collection.

Type locality: South slope of San Juan Grade, near foot, eight miles northeast of Salinas, Monterey County.
Monterey County: South slope of San Juan Grade, near foot, eight miles northeast of Salinas.

Helminthoglypta benitoensis Lowe

Type: 1021 Los Angeles Museum.

Type locality: Pinnacles National Monument, western edge of San Benito County.
San Benito County; Pinnacles National Monument.

Helminthoglypta sequoicola (Cooper)

Type locality: Santa Cruz among decaying trees in the dampest places.
Santa Cruz County: Santa Cruz; Santa Cruz Mountains between Soquel Creek and Skyland; banks of San Lorenzo River near Big Trees; Santa Cruz Big Tree Park; Felton, and Soquel Creek.
San Benito County: Banks of the Pajaro River near Sargent.
Monterey County: South side of San Juan Grade.

Helminthoglypta sonoma Pilsbry

Type: 153680 Academy of Natural Sciences, Philadelphia.
Type locality: Monte Rio, under redwood logs along highway, Sonoma County.
Sonoma County: Monte Rio.
Napa County: Rock slides on south side of Mt. St. Helena; north of Mt. Veeder; Aetna Spring.

Helminthoglypta cuyamacensis (Bartsch)

Type: 62381 Academy of Natural Sciences, Philadelphia.

Type locality: Near Cuyamaca Mountains.

San Diego County: Near Cuyamaca Mountains; Cuyamaca Mts., three-fourths of a mile above Cuyamaca Lake, one-half mile south of road at the "beef pasture"; "San Diego Mines".

Helminthoglypta cuyamacensis lowei (Bartsch)

Type: 216906 United States National Museum.
Type locality: Palomar Mountains at 5,000 feet.
San Diego County: Palomar Mountains at 5,000 feet.

Helminthoglypta cuyamacensis avus (Bartsch)

Type: 120588 United States National Museum.

Type locality: "Los Angeles Co." Pilsbry (1939) states, "Gregg has shown that the original indefinite locality record was probably incorrect, at least for present county boundaries."

Kern County: Tejon Ranch, foothills northwest side of Tehachapi Mountains.

Helminthoglypta cuyamacensis venturensis (Bartsch)

Type: 39642a United States National Museum.

Type locality: Ventura County.

Ventura County: No specific locality.

Helminthoglypta cuyamacensis piutensis Willett

Type: 1056 Los Angeles Museum.

Type locality: Piute Mountains, at a small spring on Piute Mt., road ten and one-half miles southeast of its intersection with Basin-Brodfish road, at about 7,000 feet elevation.

Kern County: Piute Mountains (see Type locality above).

Helminthoglypta callistoderma (Pilsbry and Ferriss)

Type: 45307 Academy of Natural Sciences, Philadelphia.

Type locality: Margin of Kern River 2 miles north of Bakersfield, Kern County, on an island formed by an irrigation ditch.

Kern County: See Type locality above.

Helminthoglypta orina Berry

Type: 8642 Berry Collection.

Type locality: Near summit of Breckinridge Mountain.

Kern County: Near summit of Breckinridge Mountain.

Helminthoglypta tularensis (Hemphill)

Type and paratypes: 8772-8775 California Academy of Sciences.

Type locality: "Fraser's Mill", Tulare County. Pilsbry (1939) states, "According to Dr. Hanna (Nautilus, 52:7) Fraser's sawmill was burned about 1888. It stood about an eighth of a mile east of the packing station called Mountain Home. It is on a small flat of the north fork of the Tule River three miles west of Balch Park, a grove of giant trees owned by Tulare County and maintained as a public park. Elevation of the mill site is 6,280 feet."

Tulare County: Tule River Indian Reservation, 30 miles east of Porterville, elevation 6,000 feet; Cramer; Panther Creek Giant Forest; Camp Nelson, on the middle fork of the Tule River, elevation about 4,500 feet.

HELMINTHOGLYPTA TULARENSIS SEQUOIA Pilsbry

Type: 142857 Academy of Natural Sciences, Philadelphia.

Type locality: Sequoia National Park, Tulare County.
Tulare County: Sequoia National Park; Whitaker Forest.

HELMINTHOGLYPTA NAPAEA Berry

Type: 7216 Berry Collection.

Type locality: Whitaker Forest, Tulare County.
Tulare County: Whitaker Forest.

HELMINTHOGLYPTA NAPAEA FRESNO Pilsbry

Type: 142858 Academy of Natural Sciences, Philadelphia.

Type locality: Near Ockenden on Huntington Lake Road.
Fresno County: Near Ockenden on Huntington Lake Road.

HELMINTHOGLYPTA NAPAEA WAWONA Pilsbry

Type: 139614 Academy of Natural Sciences, Philadelphia.

Type locality: Alder Creek, Yosemite National Park, 3 or 4 miles north of Wawona.

Mariposa County: Alder Creek, Yosemite National Park, 3 or 4 miles north of Wawona.

HELMINTHOGLYPTA NAPAEA YOSEMITENSIS Pilsbry

Type: 114780 Academy of Natural Sciences, Philadelphia.

Type locality: Rock slide near Vernal Falls.

Mariposa County: Rock slide near Vernal Falls; between Camp Curry and Vernal Falls; Camp Curry; Cascade Creek.

HELMINTHOGLYPTA MOHAVEANA Berry

Type: 6155 Berry Collection.

Type locality: Victorville grade east side Victor Mountains.
San Bernardino County: Rock outcrop on west bank of Mohave River above Oro Grande; Victorville grade, east side Victor Mts.; at base of rocky cliffs on right bank of Mohave River just above Victorville.

HELMINTHOGLYPTA GRANITICOLA Berry

Type: 6157 Berry Collection.

Type locality: North slope of an isolated hill just south of Stewart substation of Southern Sierra Power Company. southeast of Victorville, San Bernardino County.
San Bernardino County: See Type locality above; form *arida* Pilsbry and Field: 5 miles north of Victorville, hill opposite Cement quarry.

HELMINTHOGLYPTA CROTALINA Berry

Type: 6302 Berry Collection.

Type locality: Sidewinder Mine, north end of Granite Mountains (all dead).
San Bernardino County: Sidewinder Mine, north end of Granite Mountains.

HELMINTHOGLYPTA JAEGERI Berry

Type: 6300 Berry Collection.

Type locality: Near Sweetwater Spring, Ord Mountains.
San Bernardino County: Near Sweetwater Spring, Ord Mountains.

HELMINTHOGLYPTA FONTIPHILA Gregg

Type: 1032 Los Angeles Museum.

Type locality: Little Rock Creek Canyon, north side of San Gabriel Mountains, in a rather restricted area around a spring, west side of road, about one-half mile below dam.
Los Angeles County: Little Rock Creek Canyon, north side of San Gabriel Mountains; further distributional comments by Pilsbry (1939) are, "Also taken directly across the canyon below a leaking flume under leaves and rocks which were constantly moistened with cold water. Elsewhere at various localities in Soledad Canyon, Los Angeles County, ranging from 5.5 to 8.5 miles from the Mint Canyon high-

way (Solemint service station). This area might be roughly termed as the western half of the canyon proper. They were found in each locality near the Soledad Canyon road, under rotten logs and in piles of brush. Each locality was but a few feet from the Santa Clara Creek. By the highway 11 miles from Palmdale, towards Saugus, under dead *Yucca whipplei* (S. C. Field)."

Helminthoglypta greggi Willett

Type: 1031 Los Angeles Museum.

Type locality: About one-half mile west of Mohave—Los Angeles Highway.
Kern County: Rock slides on the side of a hill, three and one-half miles south of Mohave.

Helminthoglypta caruthersi Willett

Type: 1039 Los Angeles Museum.

Type locality: Morris Canyon, a branch of Indian Wells Canyon.
Kern County: Morris Canyon, a branch of Indian Wells Canyon.

Helminthoglypta isabella Berry

Type: 8641 Berry Collection.

Type locality: Under dead Yuccas, 2 miles east of Isabella.
Kern County: Under dead Yuccas, 2 miles east of Isabella.

Helminthoglypta fisheri (Bartsch)

Type: 123579 United States National Museum.

Type locality: Johnson Canyon, Panamint Valley at altitude of 6,000 feet.

Inyo County: Johnson Canyon, Panamint Valley at altitude of 6,000 feet; Surprise Canyon and Jail Canyon, Panamint Mountains.

Helminthoglypta traski (Newcomb)

Type: In Newcomb Collection Cornell University, Ithaca, New York.

Type locality: (?) Point Firmin.
Los Angeles County: Point Firmin; Los Angeles; Elysian Park; "Vasquez Rocks", about 3 miles off the Mint Canyon highway .

Ventura County: No specific locality.
Santa Barbara County: No specific locality.
Kern County: Old Fort Tejon; "Fort Tejon", Grape Vine Canyon.

Helminthoglypta traski coelata Bartsch

Type: 124747 United States National Museum.

Type locality: Mesa, back of Pacific Beach.
San Diego County: The Mesa back of Pacific Beach; Torrey Pines; La Jolla; Pacific Beach; Mission Beach.

Helminthoglypta traski pacoimensis Gregg

Type: 1033 Los Angeles Museum.

Type locality: Pacoima Canyon, San Gabriel Mountains.
Los Angeles County: Pacoima Canyon, San Gabriel Mountains.

Helminthoglypta traski fieldi Pilsbry

Type: 151516 Academy of Natural Sciences, Philadelphia.

Type locality: Surf, under ice plants and sage on the beach.
Santa Barbara County: Surf.

Helminthoglypta traski phlyctaena (Bartsch)

Type: 12363 United States National Museum.

Type locality: Forty miles north of Santa Barbara.
Santa Barbara County: Near Las Cruces, and Gaviota Pass; Toro Canyon back of Montecito; 3 miles (dead) west of Casmalia; Cuyama River near Pioneer Grove.
Ventura County: Near Bardsdale.

Helminthoglypta traski willetti (Berry)

Type: 4497 Berry Collection.

Type locality: Pine Canyon, Sespe Creek.
Ventura County: Pine Canyon, Sespe Creek; Sulphur Mountain Springs and Wheeler's Springs.

Helminthoglypta traski tejonis Berry

Type: 2267 Berry Collection.

Type locality: Two miles above Grapevine Station, old State highway, Tejon Pass.

Kern County: Two miles above Grapevine Station, old State highway, Tejon Pass; Grapevine Station; San Emigdio Creek, 15 miles southeast of Maricopa.

Helminthoglypta carpenteri (Newcomb)

Fresno County: Tulare Valley; McKittrick and Maricopa; south end of Panoche Hill, fourth large creek north of Panoche Creek; Sec. 19, T18S, R 15E, Domingene Ranch Road; Jacalitos Creek; Arroya Ciervo.
Kings County: Sec. 34, T 22S, R 18E, Kettleman Hills; east flank of North Dome, Kettleman Hills; one mile south of Big Tar Canyon; extreme south end of Reef Ridge.
Kern County: Kern County at northeast corner of Section 28, T25S, R18E on west side of road from Devils Den to Keck's Station; Wagonwheel Mountain; Carneros Creek; west side of Kern County; Chico Martinez Creek; north end of Gould Hills; upper end of Salt Creek, west side of Kern County; southeast side of Orchard Peak; two miles west of Maricopa.
Monterey County: In the Salinas Valley.

Helminthoglypta reediana Willett

Type: 1030 Los Angeles Museum.

Type locality: Lowe Canyon.
Monterey County: Lowe Canyon.
San Luis Obispo County: Vicinity of Paso Robles.

Helminthoglypta similans Hanna and Smith

Type: 7136 California Academy of Sciences.

Type locality: Three-quarters of a mile southeast of Oil City.

Fresno County: Three-quarters of a mile southeast of Oil City; six miles above mouth of Jacalitos Creek; Eocene Reef just north of Coalmine Creek and Canos Creek.
Kings County: Eocene conglomerate two miles north of Big Tar Canyon.
Monterey County: At mouth of Hamilton Canyon, 5 miles southeast of King City.

Helminthoglypta petricola (Berry)

Type: 3840 Berry Collection.

Type locality: A rocky talus slope on the southeast wall of Mill Creek Canyon, San Bernardino Mountains, near the old road, about one and one-half miles from the canyon mouth, elevation about 3,250 feet.

San Bernardino County: See Type locality.

Orange County: Trabuco Canyon, Santa Ana Mountains.

HELMINTHOGLYPTA PETRICOLA ZECHAE (Pilsbry)

Type: 113426 Academy of Natural Sciences.

Type locality: San Antonio Canyon in the San Gabriel Mountains, western edge of San Bernardino County; at about 5,000 feet.

San Bernardino County: San Antonio Canyon in the San Gabriel Mountains, western edge of San Bernardino County; San Antonio and Eveys Canyon, San Antonio Range; canyons back of Ontario.

Los Angeles County: Canyons back of Ontario.

HELMINTHOGLYPTA PETRICOLA SANGABRIELIS (Berry)

Type: 4848 Berry Collection.

Type locality: Monrovia Canyon, San Gabriel Mountains.

Los Angeles County: Monrovia Canyon, San Gabriel Mountains; from the San Gabriel Mountains in Maillard's and Eaton's Canyon, north of Pasadena; from the west fork of San Gabriel River just below the divide.

HELMINTHOGLYPTA PETRICOLA OROTES (Berry)

Type: 3905 Berry Collection.

Type locality: Near trail, south fork of Warm Spring Canyon, San Bernardino Mountains, elevation 2,500 feet.

San Bernardino County: Near trail, south fork of Warm Spring Canyon, San Bernardino Mountains, elevation 2,500 feet; also at 3,700 feet near trail just southeast of summit, Warm Spring Canyon; at 6,500 feet west of Bridal Veil Falls Canyon, near mouth, above Forest Home, San Bernardino Mountains in talus.

HELMINTHOGLYPTA STAGERI Willett

Type: 1055 Los Angeles Museum.

Type locality: Southwest side of Erskine Creek, Piute Mountains, at about 5,000 feet.

Kern County: Southwest side of Erskine Creek, Piute Mountains, at about 5,000 feet.

HELMINTHOGLYPTA INGLESI Berry

Type: 8643 Berry Collection.

Type locality: Horse Meadows, on trail to Sunday Peak, Sierra Nevada Mountains.
Kern County: Horse Meadows, on trail to Sunday Peak, Sierra Nevada Mountains.

HELMINTHOGLYPTA LIODOMA Berry

Type: 7160 Berry Collection.

Type locality: North Fork of Cottonwood Creek on road to Breckinridge Mountain.
Kern County: North Fork of Cottonwood Creek on road to Breckinridge Mountain.

HELMINTHOGLYPTA FERRISSI Pilsbry

Type: 134224 Academy of Natural Sciences, Philadelphia.

Type locality: Above Tehipite Valley, middle fork of Kings River.
Fresno County: Above Tehipite Valley, middle fork of Kings River; one-half mile above Durrwood, in the Kern River Canyon.

HELMINTHOGLYPTA PROLES (Hemphill)

Type: 8681 California Academy of Sciences.

Type locality: "Fraser's Mill" (now Mountain Home, a packing station 3 miles west of Balch Park, at 6,280 feet elevation).
Tulare County: "Fraser's Mill" (now Mountain Home, a packing station 3 miles west of Balch Park, at 6,280 feet elevation); southern edge of Sequoia Park, on the south fork of Kaweah River.
Mariposa County: Clark's Ranch.

HELMINTHOGLYPTA PROLES MARIPOSA Pilsbry

Type 158339 Academy of Natural Sciences, Philadelphia.

Type locality: Mariposa Big Trees.
Mariposa County: Mariposa Big Trees; between Camp Curry and Vernal Falls, Yosemite Park; from Signal Peak near Wawona, from Wawona Pt., above the Mariposa Big Trees; Glacier Point on the rim of Yosemite Valley; at the base of Sentinel Dome back of Glacier Point.

Helminthoglypta proles saccharodytes Berry

Type: 8644 Berry Collection.

Type locality: Sugar Loaf Mountain at 6,000 feet, Sierra Nevada.
Tulare County: Sugar Loaf Mountain, Sierra Nevada.

Helminthoglypta euomphalodes Berry

Type: 7266 Berry Collection.

Type locality: Blodgett's Camp, Greenhorn Mountain.
Kern County: Blodgett's Camp, Greenhorn Mountain.

Helminthoglypta tularica (Bartsch)

Type and paratype: 70703 Academy of Natural Sciences, Philadelphia.

Type locality: "Fraser's Mill" (near what is now Mountain Home, a packing station three miles west of Balch Park, at 6,280 elevation).
Tulare County: "Fraser's Mill".

Micrarionta rufocincta (Newcomb)

Type: In Cornell University Collection, Ithaca, New York.

Type locality: Santa Catalina Island.
Los Angeles County: Santa Catalina Island.

Micrarionta beatula Cockerell

Type: Lectotype and paratypes 142737 Academy of Natural Sciences, Philadelphia.

Type locality: Catalina Island, on grassy slope above Avalon.
Los Angeles County: Catalina Island, on grassy slope above Avalon; slopes of canyon back of Avalon.

Micrarionta gabbi (Newcomb)

Type: 1097 California State Museum.

Type locality: San Clemente Island.
Los Angeles County: San Clemente Island.

Micrarionata facta (Newcomb)

Type: 1099 California State Collection.

Type locality: Santa Barbara Island.
Los Angeles County: Santa Barbara Island.

Micrarionata feralis (Hemphill)

Type: California Academy of Sciences.

Type locality: San Nicolas Island.
Ventura County: San Nicolas Island.
Los Angeles County: San Clemente Island (as fossil only).

Micrarionata stearnsiana (Gabb)

San Diego County: Point Loma; Pacific Beach; Imperial Beach; hill back of Scripps Institution, near La Jolla; below Murray dam, near La Mesa; Los Coronados.

Micrarionata kelletti (Forbes)

Los Angeles County: Santa Catalina Island usually on or under tunas (Opuntia); mainland of Los Angeles County, from Point Firmin to Portuguese Point; Point Vincent.

Micrarionata redimita (W. G. Binney)

Los Angeles County: San Clemente Island.

Micrarionata tryoni (Newcomb)

Type: Cornell University, Ithaca, New York.

Type locality: Santa Barbara Island.
Los Angeles County: Santa Barbara Island.
Ventura County: San Nicolas Island.

Micrarionata tryoni carinata Pilsbry

Type: 86804 Academy of Natural Sciences, Philadelphia.

Type locality: Santa Barbara Island.
Los Angeles County: Santa Barbara Island.
Ventura County: San Nicolas Island.

Micrarionata intercisa (W. G. Binney)

Los Angeles County: San Clemente Island.

Micrarionata rowelli acus Pilsbry

Type: 168516 Academy of Natural Sciences, Philadelphia.

Type locality: Needles Peaks near Topock, Arizona.
San Bernardino County: Mountains northeast of Essex; Mohave Mountains opposite Topock.

MICRARIONATA ROWELLI UNIFASCIATA Willett

Type: 1023 Los Angeles Museum.

Type locality: Newberry Springs, north end of Kane Mountains.

San Bernardino County: Newberry Springs, north end of Kane Mountains.

Riverside County: Southern end of Coxcomb Range.

MICRARIONATA ROWELLI MCCOIANA Willett

Type: 1044 Los Angeles Museum.

Type locality: McCoy Well, McCoy Mountains.

Riverside County: McCoy Well, McCoy Mountains.

MICRARIONATA ROWELLI BAKERENSIS Pilsbry and Lowe

Type: Type and paratypes 162958 Academy of Natural Sciences, Philadelphia.

Type locality: North slope of a small range of limestone hills west of the highway, about half a mile south of Baker.

San Bernardino County: See type locality above.

MICRARIONATA ROWELLI AMBOIAMA Willett

Type: 1029 Los Angeles Museum.

Type locality: Among rocks on a small hill about six miles northwest of Amboy.

San Bernardino County: See type locality above.

MICRARIONATA ROWELLI GRANITENSIS Willett

Type: 1043 Los Angeles Museum.

Type locality: Northwest end of Granite Mountain.

Riverside County: Northwest end of Granite Mountain.

MICRARIONATA ROWELLI CHUCKWALLANA Willett

Type: 1040 Los Angeles Museum.

Type locality: About one mile south of Corn Springs, Chuckawalla Mountains.

Riverside County: About one mile south of Corn Springs. Chuckawalla Mountains.

MICRARIONATA ROWELLI CHOCOLATA Willett

Type: 1041 Los Angeles Museum.

Type locality: Near Beal's Well, Chocolate Mountains.
Imperial County: Near Beal's Well, Chocolate Mountains.

MICRARIONATA IMACULATA Willett

Type: 1051 Los Angeles Museum.

Type locality: Seevn miles south of the town of Vidal.
Riverside County: East slope of Riverside Mountains.
San Bernardino County: Seven miles south of the town of Vidal.

MICRARIONATA MILLEPALMARUM Berry

Type: 6502 Berry Collection.

Type locality: Thousand Palms.
Riverside County: Thousand Palms.

MICRARIONATA BRUNNEA Willett

Type: 1042 Los Angeles Museum.

Type locality: Near Chuckawalla Spring, Little Chuckawalla Mountains.
Riverside County: Near Chuckawalla Spring, Little Chuckawalla Mountains.

MICRARIONATA OROCOPIA Willett

Type: 1060 Los Angeles Museum.

Type locality: Rock slide on south side of canyon on south slope of Orocopia Mountains, about two and one-half miles north of Rio Palmas Spring.
Riverside County: See type locality above.

MICRARIONATA MELANOPYLON Berry

Type: 7073 Berry Collection.

Type locality: Black Rock Hills, west side of Black Canyon near mouth, nine miles north of Hinkley.
San Bernardino County: Black Rock Hills, west side of Black Canyon near mouth, nine miles north of Hinkley.

MICRARIONATA ARGUS (Edson)

Type: A Lectotype 102457 Academy of Natural Sciences, Philadelphia.
Inyo County: Argus Range; Iron Cap copper mine; north and midle forks of Shephard Canyon; Great Falls, Argo Can-

yon; Indian Joe Canyon; Graham Jone's mine, Homewood Canyon.

San Bernardino County: West side of canyon northward from Trona; Slate Range: at Stockwell mine; Andres Canyon; Tank Canyon; Layton Canyon; San Francisco Canyon; January Jones Canyon, 2,000-22,000 feet; Surprise Valley. In the Panamint Range at Goler Canyon and Broken-leg Canyon; Avawatz Mountains, east side, at Silver Lake. Red Pass, 10 miles west of Silver Lake; Jim Hyten's Mt., 10 miles south of Silver Lake.

Micrarionata indioensis (Yates)

Type: 62145 Academy of Natural Sciences, Philadelphia.

Type locality: Indio, Riverside County on the south side of the valley among granite talus

Riverside County: Indio on the south side of the valley among granite talus; Indian Wells; La Quinta; Coral Reef, west of Thermal; one and one-half miles south of Coral Reef, and Fish Traps west of Mecca.

San Diego County: South slope of Santa Rosa Mountains, east of mouth of Rockhouse Canyon.

Micrarionana indioensis wolcottiana (Bartsch)

Type: 170007 United States National Museum.

Type locality: Palm Springs.

Riverside County: Palm Springs; Palm Canyon about 6 miles south of Palm Springs at about 1000 feet; Tahquitz Creek; Murray Canyon; base of mountains west of Snow Canyon; along San Jacinto Range from Palm Canyon to Snow Creek.

Micrarionata indioensis cathedralis Willett

Type: 1022 Los Angeles Museum.

Type locality: In rock slides at head of Cathedral Canyon.

Riverside County: In rock slides at head of Cathedral Canyon.

Micrarionata indioensis xerophila Berry

Type: 4888 Berry Collection.

Type locality: Five miles west of Indian Well at 4,600 feet, in crevices and under stones of slope on Ocean-to-Ocean Highway.

Riverside County: See type locality.

Micrarionata indioensis remota Willett

Type: 1050 Los Angeles Museum.

Type locality: Borego Mountain.
San Diego County: Borego Mountain.

Micrarionata ora Willett

Type: 1018 Los Angeles Museum.

Type locality: Rock slide near the north end of Fish Mountains, about three miles from the settlement of San Felipe.
Imperial County: Rock slide near the north end of Fish Mountains, about three miles from the settlement of San Felipe.

Micrarionata ora carrizoensis Willett

Type: 1049 Los Angeles Museum.

Type locality: Hills above Painted Gorge, Carrizo Mountain.
Imperial County: Hills above Painted Gorge, Carrizo Mountain.

Micrarionata harperi (Bryant)

Type: 8676A California Academy of Sciences.

Type locality: "San Jacinto Mountains." "Warner Hot Springs."
San Diego County: "San Jacinto Mountains." "Warner Hot Springs."
Pilsbry (1939), "It is at present a lost species."

Micrarionata harperi orcuttiana Bartsch

Type: 175082 United States National Museum.
San Diego County: South end of Laguna Mountains.
Imperial County: South end of Laguna Mountains; Mountain Springs (Type Loc. ?).

Micrarionata morongoana Berry

Type: 6500 Berry Collection.

Type locality: Gulch on north side of Morongo Pass, 2 miles below the Morongo Inn, Colorado Desert.

Micrarionata borregoensis Berry

Type: 6913 Berry Collection.

Type locality: Palm Canyon, west side of Borrego Valley, San Ysidro Mountains.

San Diego County: Palm Canyon, west side of Borrego Valley, San Ysidro Mountains.

Micrarionata rixfordi Pilsbry

Type: 129781 Academy of Natural Sciences, Philadelphia.

Type locality: Foot of the Mountains on the southern edge of the Mohave Desert about 10 miles west of Twenty-nine Palms, among rocks.

Riverside County: Foot of mountains on the southern edge of the Mohave Desert about 10 miles west of Twenty-nine Palms; Forty-nine Palms Canyon; Eagle Mountains; near the forks, west side of Palm Canyon, Eagle Mountains; from an isolated outlier of the Eagle Mountains, just west of the road leading south from Pinto Basin; northeast end of the Orocopia Range.

Micrarionata avawatzica Berry

Type: 6884 Berry Collection.

Type locality: Station LL, rocky point west of road in pass at junction of Barstow and Silver Lake roads, 5 miles south of Cave Spring, Avawatz Mountains, San Bernardino County.

San Bernardino County: See type locality above; also in a rock-slide at base of hill to east of road nearly opposite type station, Avawatz Mountains.

Micrarionata avawatzica eremita Pilsbry

Type: 130901 Academy of Natural Sciences, Philadelphia.

Type locality: Gunsight Mountains, 3 miles south of Resting Springs.

Inyo County: Gunsight Mountains, 3 miles south of Resting Springs.

Micrarionata baileyi (Bartsch)

Type: 123907 United States National Museum.

Type locality: Resting Springs, among rocks on a dry hill 900 feet above the Spring.

Inyo County: Resting Springs, among rocks on a dry hill 900 feet above the Spring.

MICRARIONATA MICROMETALLEUS Berry

Type: 7071 Berry Collection.

Type locality: Base of granite-rock slide in the El Paso Range three and one-half miles south of Petrified Forest.
Kern County: Base of granite rock slide in the El Paso Range three and one-half miles south of Petrified Forest.

MICRARIONATA AQUAEALBAE Berry

Type: 4890 Berry Collection.

Type locality: San Bernardino Mountains among loose leaves and mould under a small tree in gulch on east side of Whitewater Canyon, near first bend to west, altitude 1,800 feet.
Riverside County: See type locality above; talus on west side of Whitewater Canyon, about one mile above mouth at about 1,700 feet; near Cabezon, north side of San Jacinto Mountains.

"EPIPHRAGMOPHORA" BOWERSI Bryant

Riverside County: San Jacinto Mountains. Pilsbry (1939) states, "A lost species."

OREOHELIX CALIFORNICA Berry

Type: 7182 Berry Collection.

Type locality: Head of gulch on west side of Clark Mountain northeastern San Bernardino County: among limestone fragments and fir needles in rock slides at about 7,500 feet.
San Bernardino County: See type locality above.

OREOHELIX AVALONENSIS "HEMPHILL" Pilsbry

Type: 86671 Academy of Natural Sciences, Philadelphia.

Type locality: Santa Catalina Island.
Los Angeles County: Santa Catalina Island.

AMMONITELLA YATESI J. G. Cooper

Calaveras County: Near the cave at Cave City; near Murphy's aestivating under stones on north hillsides; about one to two miles north of Murphy's; Mercer's Cave; in damper talus on non-calcareous rocks below the ridges in the valley of Santo Domingo Creek.

Polygyroidea harfordiana (J. G. Cooper)

Type: 11451 Academy of Natural Sciences, Philadelphia.
Fresno County: Big Trees at 6,500 feet.
Mariposa County: Big Trees west of Wawona Point, 6-7,000 feet; quarter mile above junction of Alder Creek with the south fork of the Merced River at 4,000 feet; Big Trees Grove at Wawona Point.

Glyptostoma newberryanum (W. G. Binney)

Type locality: Around San Diego.
San Diego County: Around San Diego; Mussey Grade; Jamul, about 25 miles east of San Diego, west bank of Penasquitos River below Alvarado Falls, and Ramona and Mission Gorge, about six miles northeast of San Diego; El Cajon, Foster; Lakeside.
Los Angeles County: Claremont.

Glypsostoma newberryanum mimus Pilsbry

Type: 97745 Academy ŏf Natural Sciences, Philadelphia.

Type locality: Mountains west of Riverside.
Riverside County: Mountains west of Riverside.
Pilsbry (1939) states in a footnote under this subspecies, "Probably the form reported from Claremont by Ivan Johnson belongs here." Pilsbry refers Johnson's record in his text to *Glyptostoma newberryanum* (W. G. Binney).

Glyptostoma gabrielense Pilsbry

Type: 97748 Academy of Natural Sciences, Philadelphia.

Type locality: San Gabriel Range in canyons back of Pasadena.
Los Angeles County: San Gabriel Range in canyons back of Pasadena; Dominguez Hills, a smaller form; Elysian Park.

Trilobopsis loricata (Gould)

Sacramento County: Near the Sacramento River.
San Francisco County: San Francisco.
Alameda County: Oakland, Berkeley Hills.
Napa County: St. Helena.
Pilsbry (1939) states concerning the distribution of this species, " . . . and the Bay counties."

Trilobopsis loricata mariposa Pilsbry

Type: 170911 Academy of Natural Sciences, Philadelphia.

Type locality: Mariposa County.
Fresno County: Fish Camp.
Mariposa County: Lodge branch of Big Tree Creek; Sequoia Park, edge of forest north of Wawona.

TRILOBOPSIS LORICATA SONOMAENSIS (Hemphill)

Type: 8041 California Academy of Sciences.

Type locality: Near Healdsburg.
Sonoma County: Near Healdsburg.

TRILOBOPSIS LORICATA PERFORATA Pilsbry

Type: 11146 Academy of Natural Sciences, Philadelphia.

Type locality: Healdsburg.
Sonoma County: Healdsburg.

TRILOBOPSIS LORICATA LOWEI (Pilsbry)

Type: 138510 Academy of Natural Sciences, Philadelphia.

Type locality: Twenty-four miles east of Placerville.
Eldorado County: Twenty-four miles east of Placerville.

TRILOBOPSIS LORICATA NORTENSIS (Berry)

Type: 7456 Berry Collection.

Type locality: Ternah, near Requa.
Del Norte County: Ternah, near Requa.

TRILOBOPSIS TRACHYPEPLA (Berry)

Type: 6170 Berry Collection.

Type locality: Near Bridge Creek Lumber Camp, south of Scotia.
Humboldt County: Near Bridge Creek Lumber Camp, south of Scotia.

TRILOBOPSIS ROPERI (Pilsbry)

Type: 60059 Academy of Natural Sciences, Philadelphia.

Type locality: Redding in drift of the Sacramento River.
Shasta County: In drift of the Sacramento River, Redding; six miles east of Ingot in a slide of limestone detritus on the north side of the road between Redding and Alturas, there close beside Ceader Creek on the north side.

TRILOBOPSIS TEHAMANA (Pilsbry)

Type: 73549 Academy of Natural Sciences, Philadelphia.

Type locality: Battle Creek.
Tehama County: Battle Creek.

Trilobopsis penitens (Hanna and Rixford)

Type: 692 California Academy of Sciences.

Type locality: South bank of the south fork of the American River near the hamlet of Mormon Island.
Sacramento County: South bank of the south fork of the American River near the hamlet of Mormon Island.

Vespericola columbiana pilosa (Henderson)

Type: 11142 Academy of Natural Sciences, Philadelphia.

Type locality: San Francisco.
Contra Costa County: San Pablo.
Marin County: Lagunitas, Inverness.
Del Norte County: Crescent City.
San Francisco County: San Francisco.

Vespericola columbiana oria (Berry)

Type: 7441 Berry Collection.

Type locality: South fork of American River Canyon near Riverton.
Eldorado County: South fork of American River Canyon near Riverton; Camp Creek, three miles east of Pleasant Valley.

Vespericola hapla (Berry)

Type: 7440 Berry Collection.

Type locality: Butte Creek Canyon about 10 miles from Chico.
Butte County: Butte Creek Canyon about 10 miles from Chico.

Vespericola sierrana (Berry)

Type: 5087 Berry Collection.

Type locality: Two miles north of Weed.
Siskiyou County: Two miles north of Weed.

Vespericola shasta (Berry)

Type: 5089 Berry Collection.

Type locality: La Moine.
Shasta County: La Moine.
Eldorado County: Roadside spring 24 miles east of Placerville on Lincoln Highway.

VESPERICOLA MEGASOMA ("Dall" Pilsbry)

Type: A Neotype 11140 Academy of Natural Sciences, Philadelphia.

Type locality: Humboldt County.

Humboldt County: In a canyon back of Williams' ranch, across river from Requa; about 4 miles south of Eureka, and Jordan Creek near Scotia; foot of bluff on ocean side of peninsula at Table Bluff Light; Clam Beach 11 miles north of Arcata.

Del Norte County: Woods near Crescent City; east side Howland Hills, 3 miles north, and Mill Creek, 5 miles east of Crescent City.

(Russian River . . . County?).

Marin County: Inverness.

VESPERICOLA MEGASOMA EUTHALES (Berry)

Type: 8972 Berry Collection.

Type locality: Chaffey Ranch, 7 miles above mouth of Klamath River, in Redwoods.

Del Norte County: Chaffey Ranch, 7 miles above mouth of Klamath River, in Redwoods.

VESPERICOLA AMIGERA (Ancey)

Type locality: Santa Cruz (?).

Santa Cruz County: Santa Cruz.

San Mateo County: Hills back of Stanford University to the San Juan Grade in northern Monterey County.

Monterey County: San Juan Grade.

VESPERICOLA PINICOLA (Berry)

Type: 3482 Berry Collection.

Type locality: Back of Pacific Grove under logs.

Monterey County: Back of Pacific Grove; Salmon Creek.

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CONTRIBUTIONS FROM THE LOS ANGELES MUSEUM —CHANNEL ISLANDS BIOLOGICAL SURVEY

33. BRIEF NOTES ON THE EXPEDITIONS CONDUCTED BETWEEN MARCH 16, 1940 AND DECEMBER 14, 1941.

By John A. Comstock

The first six expeditions of the Channel Islands Biological Survey were briefly reported in the "Bulletin" for January-April, 1943, Vol. XLII, Part 1. These covered the period extending from February, 1939 to November of the same year.

Seven additional operations were subsequently carried through to successful conclusion embracing the period of March 16, 1940 to December 14, 1941, after which all work on the Islands had to be discontinued as a result of war restrictions.

It seems opportune at this time to record a few pertinent facts concerning these operations.

Expedition 7. March 16 to 23, 1940, Santa Barbara Island, Santa Barbara County, California.

Transportation to and from the Island was furnished by the California Fish and Game Commission, the trips being made in the "Yellowtail," with Captain E. R. Hyde in command. The field party included M. B. Dunkle, botanist; George P. Kanakoff, invertebrate zoologist; Lloyd Martin, entomologist; Don Meadows, entomologist, and Russ Sprong, cook. Jack von Bloeker, Jr. accompanied the party on the outgoing trip, and made a short stop at Johnson's Harbor, Catalina Island, where a small collection of insects was obtained on March 16.

Camp was established at the shack (the only building on Santa Barbara Island) to the north of Primero Canyon. Cloudy weather, with periods of fog and rain, limited to some extent the collecting of arthropods, but in spite of this the total catch (4397 specimens) exceeded that of the third expedition.

Weather conditions were favorable for botanical and conchological study and collecting. Mr. Dunkle began at this time his intensive study of plant ecology and meteorological phenomena of Santa Barbara Island which he has since supplemented by observations made on numerous trips. He collected, among other items, the type material from which *Platystemon californicus ciliatus* was subsequently named. (See Channel Islands paper No. 12, in the "Bulletin" for May-August, 1940).

George Kanakoff covered many areas of the Island and collected arthropods in considerable variety. Part of his time was devoted to studying the insect associates of *Coreopsis, Opuntia, Atriplex, Convolvulus, Mesembrianthemum* and other plant genera, in consequence of which a number of larvae were obtained.

Lloyd Martin concentrated his efforts on the lepidoptera and coleoptera, but also secured a considerable number of insects in other orders. In addition, he and Mr. Kanakoff collected a number of snails. (*Micrarionta gabbi* Newc. and *M. tryoni* Newc.).

On March 22 sea elephants were observed on the beach near North Hill by several members of the party.

EXPEDITION 8. April 10, 1940. San Nicolas Island, Ventura County.

Transportation to and from the Island was generously furnished by Captain Allan Hancock, who was host, as well as Captain and navigator of the Velero III. Landings were made through the surf at Ranch Landing on the morning of Thursday, April 11. Mr. Denver C. Spencer, U.S.N. (Radio-man in charge) gave our party welcome assistance in the landing of personnel and supplies. Equipment and dunnage were moved from the beach to quarters at the Agee Ranch, with the help of Mr. and Mrs. Roy McWaters and their son James. The excellent accommodations provided by the McWaters family were an important factor in making the expedition a success.

The field party consisted of Arthur Woodward, archeologist; Harry Geiger, archeological assistant; Chris Henne, entomologist; Leo Kartman, assistant entomologist and botanist; George P. Kanakoff, invertebrate zoologist; Jack C. von Bloeker, Jr., vertebrate zoologist, and Ona B. von Bloeker, cook. The writer accompanied the party on the outing trip, but returned on April 12.

An archeological survey of the island was conducted by Mr. Woodward and his assistant on the north and south shores. Test trenches were dug in Site 1 W. near the ranch house to determine thickness and composition of the original kitchen midden which had been left in an undisturbed condition. It was learned that the debris was only 12″-15″ in thickness and artifacts were extremely scarce.

Surface surveys were made along the north shore toward the east end and in one instance excavations were made and artifacts were obtained from a cremation burial. Several dog skeletons were encountered in another test excavation.

The most important work done at this time was the reconnaissance and partial excavation of Dutch Site No. 1 on the south shore of the Island. From this initial dig were obtained a number of fragments of eel grass textiles and enough indications were found to warrant further and more intensive work, which was carried out on the same site Nov. 23-Dec. 12, 1940.

Jack C. von Bloeker, working at Cow Creek, Mineral Creek, Coney Island Point, Dutch Harbor, Salt Creek, Corrall Harbor, and near the North Point Light, was successful in trapping a number of foxes (*Urocyon littoralis dickeyi* Grin. & Lind). He also secured many examples of mice (*Peromyscus*) and a few lizards (Xantusia).

Inclement weather made insect collecting difficult, but the combined efforts of Chris Henne, Leo Kartman and George Kanakoff brought results that ran ahead of expectations. The relative paucity of species on this island is probably explained by the many years of sheep grazing with resultant erosion, and the strong winds which prevail in this area.

EXPEDITION 9. August 15 to 30, 1940. Anacapa Island, Ventura County.

Transportation was furnished through the cooperation of the California Fish and Game Commission, by means of the "Yellowtail." Captain E. R. Hyde in command.

Personnel included: Jack C. von Bloeker, Jr., vertebrate zoologist; Chris Henne, entomoligist; George V. Kanakoff, invertebrate zoologist; M. B. Dunkle, botanist and meteorologist; Don C. Meadows, entomologist (Aug. 15 to 24 only); Jack H. Van Nordheim, student assistant biologist, and Ona B. von Bloeker, cook.

Headquarters was established on West Island at Fish Camp. The territory covered included accessible portions of East Island, Middle Island and West Island. These three small and rugged islands collectively constitute Anacapa. They are outcroppings of a submerged mountain range, many portions of which are inaccessible. Their flora and fauna are relatively rich considering their size.

In spite of difficult terrain collecting proved unusually profitable.

Mr. Dunkle secured a large variety of plants, and subsequently published as paper 27 in the "Bulletin" for September-December, 1942 a list of the reported species found on Anacapa and Santa Barbara Islands which included *Eriogonum giganteum v. compactum* Dunkle (for Santa Barbara I.) and *Castilleja anacapensis* Dunkle for Middle and West Anacapa Islands.

Jack von Bloeker took several examples of the black rat (*Rattus rattus rattus*) on West and Middle Islands, and two specimens of *Rattus rattus alexandrinus* on West Island, thus establishing the fact of the introduction of these two common pests there. His series of mice (*Peromyscus*) from all three islands was unusually fine. These proved to be a new subspecies which was later described as *P. maniculatus anacapae* von Bloeker in paper 22 of the Survey, "Bulletin" So. Calif. Academy of Sciences, Vol. XL. Pt. 3, 1941.

George Kanakoff made collections in several orders. His field notes include 530 separate entries with miscellaneous lots of insects predominating. On August 21, 1940 while collecting on the central portion of West Island he secured specimens of a leafhopper, *Xerophloea vanduzeei*. Dr. Pierce examined this material and discovered in the segments of one example two specimens of a Strepsipterous parasite which he later published as *Diozocera comstocki* n. s. This was recorded in Vol. XL, Part 1, p. 6 of the "Bulletin" So. Calif. Academy of Sciences.

Chris Henne collected numerous larvae of an *Arachnis* on Middle Island. These were reared to maturity in the Museum laboratory. The colorful moths which emerged were sent to Dr. J. F. Gates Clarke of the U. S. National Museum and were determined by him as a new subspecies (*insularis*), the description of which was published in Vol. 39, Part 3, pp. 187-188 of the "Bulletin."

Mr. Henne also secured examples of a new robber-fly which Wilcox and Martin described as *Erax anacapai* in the issue of the "Bulletin" for January-April, 1945. In addition, Chris Henne, Don Meadows and George Kanakoff caught 102 specimens of a new myriapod on Middle Island which Dr. Pierce published as *Polyxenus anacapensis* in Vol. 39, Part 2, p. 164 of the Bulletin.

A large amount of material from the ninth expedition still remains to be studied.

EXPEDITION 10. Nov. 23, 1940 to Dec. 12, 1940. San Nicolas Island, Ventura County, California.

The trip to San Nicolas Island was made in the "Velero III," Captain Allan Hancock as the host, navigator and director of transportation facilities. The Museum party consisted of Arthur Woodward, archeologist; Miss Marion G. Hollenbach, assistant archeologist; John Shrader and Howard Keller, student assistant archeologists; Christopher Henne, entomologist; George P. Kanakoff, invertebrate zoologist; Jack C. von Bloeker, Jr., vertebrate zoologist, and Mrs. Ona B. von Bloeker, cook.

A stop was made on the outward trip at Santa Barbara Island in order to allow Mr. M. B. Dunkle to go ashore there in pursuance of his ecological and meteorological studies. Dutch Harbor, on the south shore of San Nicolas Island was reached at 4 o'clock P. M., and the dunnage and camp supplies run through the surf and landed without mishap before dark.

The chief purpose of this expedition was to carry on archeological studies in the vicinity of Dutch Harbor as a continuation of the program initiated on the eighth expedition. Digging was concentrated on site No. 1, but some tests were made of other sites in the immediate area. The sum total of material found was considerable, and included many pieces of eel grass cord of varying types, eel grass fabrics made in open-work twined technique, bone harpoon heads, fishhooks of bone and abalone or red topped sea snails, and stone sinkers. There were also many chipped stone points, blades, scrapers and drills, and a number of bone awls and other implements.

Mr. Henne gave a portion of his time to assisting the archeologists particularly during the periods of inclement weather. On Nov. 27, 1940 he secured 28 examples of a robber-fly which turned out to be a new species. This is recorded by Wilcox and Martin in the issue of the "Bulletin" for January-April, 1945 and was named *Cophura hennei* in recognition of its discoverer.

On Dec. 1, 1940 Mr. Woodward reported four sea elephants (three cows and one cub) on the beach close to the site on which Juana Maria, the "lost woman of San Nicolas" had formerly built her whalebone shelter. Photographic record was made of the occurrence.

The San Nicolas fox was abundant, and a good series was secured by Jack von Bloeker.

On December 7 and 8 a flight of scarabaeid beetles of the genus *Phobetus* was encountered and a long series taken.

Camp was broken on December 11, 1940 and all equipment and materials were on board the Velero III by 4 P. M. The return trip was made on the following day.

Expedition 11. January 20 to 27, 1941. Santa Catalina Island, Los Angeles County, California.

The record of this expedition can best be made by quoting in its entirety the written report submitted by the late George Willett at the conclusion of the operation.

"This expedition to Santa Catalina Island was undoubtedly the most unpretentious of those so far made, the entire personnel consisting of George Willett, Curator of Ornithology, and his wife, Ora A. Willett, who acted as field assistant.

"Our primary purposes were to examine the terrain for the most satisfactory locations for future work, and to make contact with such persons as would be able and willing to render assistance.

"We left Terminal Island on the regular Santa Catalina Island steamer the morning of January 20, 1941, and reached the island about noon. We were met on the dock by Mr. Lester G. Smith, Assistant County Fire Warden, who had been notified of our coming. Mr. Smith placed himself and his truck at our disposal, and during our entire stay furnished transportation to the various sections of the island we desired to visit. He had also made arrangements with the management to permit our use of firearms in obtaining specimens.

"On the afternoon of January 20, after having secured an apartment in Avalon to use as headquarters, we were driven up Avalon Canyon by Mr. Smith. Here we found birds fairly plentiful and collected several. During the next six days, to and including January 26, our itinerary was as follows, with Mr. Smith furnishing transportation: Cape Canyon, Jan. 21 and 25; Avalon Canyon, Jan. 22 and 24; Middle Ranch Canyon, Jan. 23, and hills east of Avalon, Jan. 26. We also collected in Avalon Canyon on the morning of January 27, while awaiting boat-sailing time.

"Although, on the whole, desirable birds were not too plentiful and we were handicapped somewhat by rainy weather, we obtained 59 birds, as follows:

Lophortyx c. catalinensis	9	Carpodacus m. frontalis	3
Thryomanes b. catalinae	1	Sayornis nigricans	1
Calypte anna	1	Hylocichla g. guttata	6
Selasphorus a. sedentarius	2	Passerella i. monoensis	2
Turdus m. propinquus	2	Passerella i. altivagans	1
Mimus p. leucopterus	3	Passerella i. unalaschcensis	6
Otocoris a. insularis	2	Lanius l. mearnsi	8
Pipilo m. clementae	12		

"These are all fine specimens, taken at the time of year when the plumage is good. One bird, the Alberta Fox Sparrow (Passerella i. altivagans) has not been previously recorded from any of the islands. From the above birds 380 parasites were secured and turned over to the Department of Entomology. They were:

Acarina	52	Mallophaga	317
Siphonaptera	10	Diptera	1

"Further specimens secured were 9 foxes, in the flesh, trapped by Mr. Smith and his assistants, and one rattle-snake taken January 23, an unusual date for this reptile to be out.

"While on the island, I called on Mr. Renton, Superintendent of the Santa Catalina Island Company. He was very friendly and assured me that his staff would cooperate with us in our work. I also met Mr. White, in charge of stock-raising on the island, and found him interested in our operations and willing to help in any way possible. I believe that our relations with the Santa Catalina Island Company are very satisfactory, and that their representatives are ready to aid us in any manner possible.

"A summary of the birds seen on Catalina will be included in the report on Expedition No. 12 to the same island."

GEORGE WILLETT
Senior Curator of Ornithology.

EXPEDITION 12. February 14 to March 28, 1941. The original plan for this expedition contemplated a trip to each one of the eight islands but inclement weather and difficulties in arranging for transportation resulted in a change of schedules. The operations carried through to conclusion were reduced to five, as follows:

1. San Clemente Island, Feb. 14 to 22, 1941.
2. Santa Catalina Island, Feb. 23 to March 15, 1941.
3. Anacapa Island, March 15 to 22, 1941.
4. Santa Cruz Island, March 23 to 28, 1941.
5. Santa Rosa Island, March 29 to April 9, 1941.

Operation 1. San Clemente Island, Los Angeles County.

The Museum party left San Pedro at 8 A. M., February 14, 1941, in the Velero III, Captain Allan Hancock in command.

Museum personnel consisted of Jack von Bloeker, Jr., mammalogist; Ona B. von Bloeker, cook; Chris Henne, entomologist; John Shrader, archeologist; George P. Kanakoff, invertebrate zoologist; Reid Moran, botanist; George Willett, ornithologist, and Ora A. Willett, assistant ornithologist.

Wilson's Cove, San Clemente Island, was reached shortly after noon and landing was made during a rain storm. The rains had rendered roads outside the Naval Post impassable and the party was quartered in barracks at the air port for the night. Lieutenant Selby, who had extended many courtesies to the field party during the 1939 expedition, was still at the post, and was most cooperative. Through his good offices trucks were furnished to transport supplies, equipment and personnel.

The morning of February 15 was rainy, but a small amount of sunshine in the afternoon dried the roads sufficiently to allow of moving the party and dunnage to Middle Ranch, where quarters were established in vacant cabins.

The ensuing week was a period of almost continuous rain, and collecting was greatly hampered thereby. In spite of personal discomfort and difficulties incident to the sodden terrain, the members of the party collected assiduously.

George Willett, with the assistance of Mrs. Willett and Jack von Bloeker, secured 28 birds, as follows:

Otocoris a. insularis	5	Salpinctes obsoletus	2
Zonotrichia coronata	2	Thryomanes b. leucophrys	2
Sayornis saya	1	Hylocichla g. guttata	2
Melospiza m. clementae	4	Carpodacus m. clementis	9
Melospiza lincolni (in trap)	1		

Mr. Willett's field notes also record the observations of a few San Clemente shrikes, numerous mourning doves and large flocks of ravens (200 birds in a single flock on Feb. 16). Several small covies of the introduced Gambel's quail were observed. Near the military post, but not elsewhere, were a few ring-necked pheasants which had been previously introduced by some of the Naval officers.

From dissection of specimens it was noted that horned larks, rock wrens and San Clemente wrens were breeding, and house finches were beginning to do so.

Jack von Bloeker secured long series of the two species of lizards that commonly occur on that island (*Xantusia riversiana* and *Utastansburiana hesperis*) and a considerable number of the San Clemente white-footed mouse, *Peromyscus maniculatus clementis.* In addition, several examples of *Peromyscus, Reithrodontomys* and *Microtus,* not yet determined, were taken, and are being given further study.

Entomological collecting was greatly hampered by cold and rain. Very few species were on the wing, but Mr. Henne managed to pick up a miscellaneous assortment of specimens representing several orders. Collecting was done chiefly by turning over rocks, old boards and debris, and by beating. This material, and also most of the plants collected by Reid Moran still remain to be studied. However, in a preliminary checking of part of the collection made by Mr. Moran, a Lupine was noted by M. B. Dunkle, which had been collected at Middle Ranch Canyon on February 18, 1941, and which was apparently a new species. This was published as *Lupinus Moranii* Dunkle in the Bulletin So. Calif. Academy of Sciences, Vol. 42, (1) 33, 1943.

On February 22 two Navy trucks managed to reach the camp at Middle Ranch, in spite of the bad condition of the roads. Equipment and personnel were loaded and driven through a heavy rain to Wilson's Cove. The Velero III shortly put in an appearance and the party with all paraphernalia sailed for Johnson's Landing, Santa Catalina Island.

Operation 2. Santa Catalina Island, Los Angeles County.

Johnson's Landing was reached in the late afternoon of February 22. Supplies were transferred to the beach, and the members of the party moved into cabins which were generously made available by the Santa Catalina Island Company.

Inclement weather prevailed through four of the seven days spent on this island.

The ornithologists had planned to supplement and round out the observations made on the eleventh expedition to Catalina in January, 1941.

Of the 32 birds collected by Mr. Willett and his issistant, one was a new record for the island, i.e. the lutescent warbler (*Vermivora* c. lutescens).

A series of 22 examples of the Island humming bird (*Selasphorus alleni sedentarius*) proved a needed and valuable addition to the Museum collection.

Included in the species collected were the following that were not taken on the eleventh expedition:

Sturnella neglecta 1	Troglodytes a. parkmani........1
Zonotrichia coronata 1	Spizella passerina stridula.......1

Observations and notes were made on the habits and occurrence of the birds on Santa Catalina. These will be reserved for future publication by the Los Angeles County Museum.

Lloyd Martin of the entomological staff joined the expedition on February 22, and Chris Henne returned to the mainland. However, he managed to secure a few larvae of an Arctiid moth before leaving. These were reared to maturity in the Los Angeles Museum laboratory and proved to be a new race of *Arachnis picta*. Examples of the same moth had previously been taken at Avalon by Don Meadows. The writer therefore named the race *meadowsi*, and it was subsequently published in Paper No. 26 of the Channel Island series, Bull. So. Calif. Acad. of Sciences, Vol. 41, p. 83, 1942.

George Kanakoff's field notes show that he ranged widely over the island and characteristically collected nearly every animate object that came under this observation. Much of this material still remains to be classified and studied. The same is true also of the botanical specimens gathered by Reid Moran.

John Shrader prepared reports and a map of certain prehistoric Indian sites. Details of these and his subsequent studies on Anacapa, Santa Cruz and Santa Rosa Islands are on file in the Department of History of the Los Angeles County Museum where they will be held for use in subsequent field operations.

Mr. and Mrs. Willett returned to the mainland March 2, 1941, leaving the other members of the party on the island.

Operation 3. Anacapa Island, Ventura County.

On March 15, 1941 George and Ora A. Willett and Chris Henne left the mainland on the Velero III, Captain Allan Hancock in command. The boat proceeded to Avalon, Santa Catalina Island, and picked up Jack C. von Bloeker, Ona von Bloeker, Lloyd Martin, Reid Moran, George Kanakoff and John Shrader, and then left Anacapa Island, arriving there after dark. Landing was made on the east side of West Island and quarters were established in two unoccupied cabins.

Lloyd Martin returned to San Pedro on the Velero III, and Chris Henne took over the entomological work for the ensuing six days.

The camp site was isolated by impassable cliffs from the main portion of West Island and it was necessary to rent a fisherman's rowboat in order to carry on collecting. During part of the time the wind was so strong that the use of this boat would have been hazardous, in consequence of which time spent in active field work was somewhat limited.

Birds secured by Mr. and Mrs. Willet were:

Arenaria melanocephala 2	Sayornis saya 1
Sayornis nigricans 1	Zonotrichia coronata 2
Zonotrichia l. gambeli 1	Hirundo erythrogaster 1
Aeronautes saxatilis 1	Otocoris s. insularis.............1
Salpinctes obsoletus 3	Vermivora c. sordida............12
Passerculus s. alandinus.........2	Thryomanes b. nesophilus.......3
Selasphorus alleni sedentarius..15	Carpodacus m. frontalis..........6

Mr. Willett was not able to find the Rufous-crowned Sparrow, an example of which, in very poor plumage, had been taken by Jack von Bloeker on a previous summer trip.

New records of occurrence for Anacapa were noted as follows:

Pacific Loon	Red-breasted Merganser
Santa Cruz Wren	Western Mourning Dove

Single birds of the loon and merganser were seen on the ocean near camp on March 16 and 17; the wrens were fairly plentiful on brushy hillsides, although very shy, and a single mourning dove was seen on West Island March 17.

Brown Pelican's nests containing newly hatched young were observed on March 17, indicating an unusually early nesting for the species. A Western Kingfisher was noted on two or three occasions, and several Barn Swallows and White-throated Swifts were seen March 19, one specimen of each being taken.

A pair of Black Oystercatchers showed up on rocks near camp almost daily.

Jack von Bloeker's collecting covered portions of Middle and West Islands, and consisted principally of lizards (*Gerrhonotus* and *Uta*) and salamanders (*Batrachoceps*) together with a few birds.

Chris Henne collected a considerable number of insects in many orders, and made painstaking notes with reference to their ecology. This included a variety of lepidopterous larvae, a few of which were reared to maturity.

The plants obtained by Reid Moran, and a large amount of miscellaneous material collected by George Kanakoff have not been mounted or studied to date.

On March 22, 1941 the Velero III arrived and the Museum party was transported to Pelican Bay, Santa Cruz Island. George and Ora Willett returned to the mainland.

Operation 4. Santa Cruz Island, Santa Barbara County.

The chief objective of this operation was to supplement the materials taken on the fourth expedition of August, 1939, with collections made in the spring, in order to note the seasonal changes and associated ecological factors, particularly as related to the flora and insect fauna.

The field work was concentrated mainly on collecting plants and insects, and such other forms of life as were needed to fill out certain series in the Museum systematic collections.

Lloyd Martin confined his efforts to the area adjacent to Pelican Bay. He secured a total of 1940 specimens, made up predominantly of Lepidoptera, Coleoptera and Hymenoptera.

George Kanakoff collected around Pelican Bay, in Ironwood Canyon, above Twin Harbors, near Prisoner's Harbor and in in Ranch Canyon.

Jack von Bloeker covered the territory about Middle Ranch and Prisoner's Harbor in addition to his collecting around Pelican Bay. He secured a good series of the Santa Cruz Fox, a limited variety of birds and small mammals and a considerable number of lizards representing several genera.

John Shrader confined his efforts to mapping Indian sites for future investigation. Reid Moran worked assiduously on plants but his field notes are not available for a summary of results.

The California Fish and Game boat "Schofield" put into Pelican Bay on the morning of March 29, and the Museum party with all paraphernalia was transferred to Becher's Bay, Santa Rosa Island.

Chris Henne had previously boarded the Schofield at San Pedro and joined the party for work on Santa Rosa Island, and Lloyd Martin left the island on the return trip and was put ashore on the mainland at Santa Barbara.

Operation 5. Santa Rosa Island, Santa Barbara County.

The group of Museum staff members and associates which carried through to the conclusion of the fifth operation of Expedition 12 consisted of Jack C. von Bloeker, Ona von Bloeker, Chris Henne, George Kanakoff, Reid Moran and John Shrader.

Jack von Bloeker's trapping and collecting operations covered the areas adjacent to the camp site at Becher's Bay, and in addition included Elderberry Canyon and Skunk Point (April 2nd and 3rd), Windmill Canyon (April 4), Cherry Canyon and Black Mountain (April 5, 6, and 7). The material taken included principally mice (*Peromyscus*), lizards (*Sceloporus*), salmanders (*Batrachoceps*), tree toads (*Hyla*) and a few foxes (*Urocyon*) trapped at Becher's Bay, Cherry Canyon and on Black Mountain.

Chris Henne concentrated his efforts on the larvae associated with various native plants. A considerable number of immature forms were taken and field notes made of their habits. Unfavorable weather conditions made it impossible to carry more than a very few larvae through to maturity. A general collection of insects was gathered principally by the use of beating and sweeping techniques.

The salamanders taken on this trip and on prior operations formed the nucleus of materials studied by Dr. William A. Hilton, as reported in the Bulletin, Vol. 44, Part 3, pp. 101-129, 1945 under the title "Distribution of the Genus Batrachoseps, especially on the Coastal Islands of Southern California."

Field reports for Operation 5 were not filed with the department by Mr. Moran, George Kanakoff and John Shrader, but the collections made by them are included in the reservoir of island materials marked and set aside for further study.

Work was concluded on Santa Rosa Island on April 9, 1941, and the party returned on the "Velero III."

EXPEDITION 13. November 8, to December 14, 1941. Santa Rosa Island.

The first contingent of the Museum party left Terminal Island at 8:00 A. M. November 8, 1941, sailing on the "Velero III," as guests of Captain Allan Hancock. The museum group consisted of:

Kenneth Stager, mammalogist and ornithologist; Mrs. Stager, as field assistant to her husband, and camp cook; King A. Richey, paleontologist; Harry Fletcher and John C. Stock, assistant paleontologists, and the writer, as coordinator.

Anchorage was made in Becher's Bay just before dusk, in a high wind.

Landing dunnage and camp supplies proved difficult, but was finally completed without mishap. Mr. N. R. Vail furnished a tractor and trailer to move the equipment and supplies from the pier to a cabin which was generously placed at the disposal of the Survey party. Mr. Alexander Vail, and the ranch foreman, Mr. George Haise, were very helpful in organizing facilities for the convenience and comfort of our group.

The four main objectives of the 13th expedition were:

(a) to excavate an Indian site and make further exploratory samplings in the Skunk Point area; (b) to rough out and possibly remove significant portions of a dwarf Pleistocene elephant known to occur in Tecolote Canyon, and to further explore the area for fossils; (c) to secure a series of study skins of certain mammals for the Museum collection, and more specifically to complete the series representing the indigenous subspecies of spotted skunk, *Spilogale gracilis amphialus;* and (d) to make notes on and collect as large a representation as possible of the late fall and early winter insects.

With these objectives in mind it was necessary for the first small contingent of Survey workers to make preliminary arrangements for Mr. Woodward and his assistants prior to their arrival, and also to work out details of transportation and supply for the paleontologists. The latter required pack horses and specialized tools and dunnage. The paleontologists were properly outfitted, provisioed and packed on the morning of November 11, and the pack train left for Tecolote Canyon at 1:30 P. M. just as a light drizzle set in.

This party consisted of King A. Richey, John C. Stock and Harry Fletcher. They set up a temporary camp and spent three days prospecting. On their return, November 14, they reported a number of exposures suitable for working.

The following day, Nov. 15, the writer, together with King Richey and John Stock, returned to the mainland on the "Yellowtail" with Capt. John J. Barry at the wheel.

Plans had been made for the second contingent of Survey workers, consisting of Mr. Woodward and his assistants to leave Port Hueneme for the Island Friday, November 21, but heavy storms in the Channel made a crossing impossible until the following Tuesday, November 25. The Fish and Game boat "Yellowtail," Captain Barry in command, anchored at Becher's Bay about 9:00 A. M., and our party of archeologists, including Arthur Woodward, Marion Hollenbach and Barbara Lummis were put ashore.

The third contingent of the Museum Survey party arrived in Becher's Bay on the "Schofield" at 8:00 P. M. of November 28, the hour being too late for the party to go ashore. Landing was made early the following morning. Included in the group were: George Willett, ornithologist; Ora A. Willett, assistant ornithologist; Richard Case and Jack Couffer, assistant paleontologists.

On the return trip of the "Schofield," November 29, Arthur Woodward was landed at Hueneme. The archeological work was thereafter carried on by Marion Hollenbach and Barbara Lummis, with the occasional assistance of Harry Fletcher, Richard Case and Jack Couffer.

A site previously designated as "5 E" had been chosen for a test excavation. This was on a bluff above the sea, about three miles east of the ranch house, on Becher's Bay. The archeologists' report describes the work carried on there and elsewhere as follows:

"Measurements were taken and work begun on November 26th by Mr. Woodward, Miss Hollenbach and Mr. Fletcher. The site proved to consist of loose earth, very black with sifted charcoal, containing burned shells, particularly mussels and barnacles, and the bones of sea mammals, fish and birds. Cultural material was not very abundant, but a few items were found, such as a bone barb for a harpoon, bone awls, bone beads, and tarred pebbles for waterproofing baskets. About four feet below the surface a whole scapula and pieces of whale ribs were unearthed. These were probably the remains of a whale-bone house.

"A number of other sites on the north side of the island were 'surfaced.' One series of ten sites west and south of Skunk Point yielded large numbers of chipped stone scrapers, choppers, blades, points and drills and also bone awls and barbs for harpoons. In contrast to the other Channel Islands, shell and bone fish hooks do not appear on Santa Rosa. Only one broken bone hook was found. One of these sites ('14E') was covered with innumerable tiny stone drills and olivella shell beads in all stages of manufacture. Two hundred and thirty little stone drills were picked up in a few minutes.

"Another site at the mouth of Lobos Canyon west of Carrington Point had been exposed by rains since the previous survey. Burials, some bone implements and many beautiful flint blades and points were washing down the beach.

"We also explored Old Ranch Canyon and Water Canyon, finding two sites near the head of the latter.

"On December 7 Pearl Harbor was bombed and shortly afterwards the Fish and Game boats were taken over for patrol duty, and the use of the radio telephone forbidden, so that there was some uncertainty as to how and when the party would leave, especially as the Santa Rosa Ranch's own boat was out of commission. However, arrangements were made for the motor schooner Santa Cruz to arrive on December 14 with Mr. Woodward aboard and take the remaining members of the Museum staff to the mainland."

A RECORD OF DASYPTERUS EGA XANTHINUS FROM PALM SPRINGS, CALIFORNIA

The Sierra Laguna bat, *Lasiurus ega xanthinus,* was described as a new subspecies by Thomas (Ann. Mag. Nat. Hist., Ser. 6, vol. 20, p. 544, 1897). All existing locality records of this bat are from the southern or tropical half of the peninsula of Baja California, Mexico. It is, therefore, of special interest to record the occurrence of this bat at Palm Springs, Riverside County, California.

On the morning of November 3, 1945 a Mrs. Robert Haynes was in the back yard of her home at Palm Springs when she observed a bat attempting to fly against a northwest wind. The bat soon fluttered to earth, however, and was collected by Mrs. Haynes and presented to Dr. T. D. A. Cockerell of the Desert Museum, Palm Springs, California. Dr. Cockerell forwarded it to the Los Angeles County Museum, and, as the curator was absent at this time, I was requested to prepare and identify the specimen.

The skin, an adult ♀, No. 8153, Los Angeles County Museum, was compared with a series of *Dasypterus ega xanthinus* in the collection of the Museum of Vertebrate Zoology, and it appears to be of this race.—D. G. Constantine, 2662 Ellendale Pl., Los Angeles 7, California.

6/17/46
DGC:

A NEWLY MOUNTED SKELETON OF THE EXTINCT DIRE WOLF FROM THE PLEISTOCENE OF RANCHO LA BREA

By Chester Stock, John F. Lance and John O. Nigra

Introductory remarks: Eugene J. Fischer, veteran osteologist of the Los Angeles County Museum staff, recently completed the preparation of a second mounted skeleton of the dire wolf for the Museum exhibit collections (see Plate 8). The skeletal elements selected in the preparation of this specimen were larger than those of average size, although the completed skeleton is not the largest that can be constructed from fossil materials available in the Pleistocene asphalt.

Comparison with skeleton of modern gray wolf: Through the kindness of Dr. Remington Kellogg, Division of Mammals, U. S. National Museum, a photograph has been supplied of the side view of the skeleton of a gray or timber wolf. No. 3138, U.S.N.M. Coll. This specimen was collected at Yellowstone, Wyoming, in December 1856 by Lieutenant G. K. Warren. It has been identified as *Canis lupus irremotus* Goldman. No. 3138 represents an individual of average size. It is mounted with the back more strongly arched and with the shoulders somewhat lower than in the dire wolf skeleton. In Plate 9 the gray wolf skeleton is shown in outline,[1] while that of the Pleistocene dire wolf is reproduced in silhouette. Both specimens are drawn to the same scale. This brings out clearly the relative size and proportions of the extinct form in comparison with the modern wolf. The dire wolf, while not much taller than a present day wolf, was of sturdier build generally, with a particularly long and heavy skull, strong shoulders, deep chest, and massive pelvis. While the feet appear to be as large as those of *Canis lupus,* they are in proportion to the overall size of the dire wolf, somewhat shorter than in the present day species. The number of vertebrae in the tail of the dire wolf is not definitely known. In constructing this appendage Mr. Fischer was guided by the number of caudal vertebrae given for *Canis lupus* in Flower's Osteology. This number is 20. In the U. S. National Museum specimen, however, only 17 vertebrae appear to be present in the tail.

[1]In the drawing the position of the sternum is placed lower than in the mounted skeleton (in the latter its high position seems due to shrinkage of the cartilaginous connections with the ribs), with consequent greater display in lateral view of the costal cartilages. Moreover, no attempt is made to show the lesions present in the skeleton, particularly those of the left fibula and right tibia.

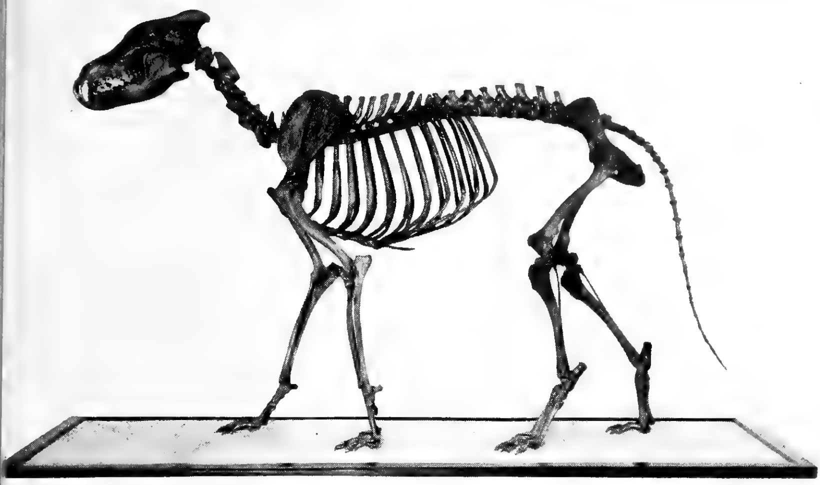

PLATE 8

Canis (Aenocyon) dirus Leidy. Skeleton as viewed from left side; approximately 1/14 natural size. Los Angeles County Museum collection; Rancho La Brea Pleistocene. Specimen prepared by E. J. Fischer.

Concluding remarks: In 1918 Merriam[2] established the genus *Aenocyon* as distinct from *Canis,* to include the three species, *dirus, milleri,* and *ayersi.* The characters given for the genus related exclusively to the skull and dentition, although Merriam stated that probably additional features would be found in the skeleton based on other material than that collected in the tar deposits of Rancho La Brea. Thus far, however, only the dire wolf from the latter locality is known by mounted skeletons. Furthermore, some doubt has been cast upon the validity of the species *Aenocyon milleri* from Rancho La Brea. Some authors have come to regard the dire wolf as not generically distinct from *Canis.* However, on the basis of the skull characters stated by Merriam and on the skeletal features given in the present paper it seems desirable to retain *Aenocyon* as of at least subgeneric rank. The common dire wolf of Rancho La Brea may then be known as *Canis (Aenocyon) dirus* Leidy.

[2]Merriam, J. C., Univ. Calif. Publ., Bull. Dept. Geol., vol. 10, no. 27, pp. 531-533, 1918.

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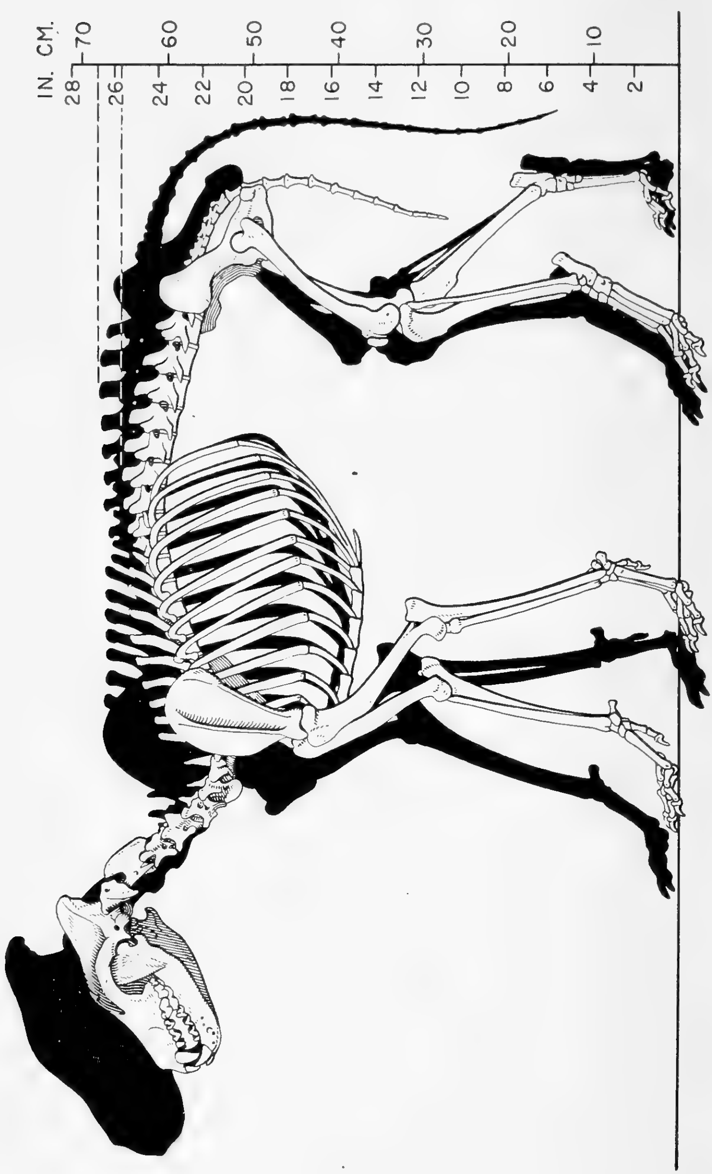

PLATE 9

Outline drawing of skeleton of modern gray wolf (*Canis lupus irremotus* Goldman), based on specimen 3138 U.S.N.M., and silhouette of skeleton of dire wolf (*Canis (Aenocyon) dirus* Leidy) from the Ranchero La Brea Pleistocene and in the Los Angeles County Museum collection showing characteristic differences.

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FOSSIL ARTHROPODS OF CALIFORNIA

10. EXPLORING THE MINUTE WORLD OF THE CALIFORNIA ASPHALT DEPOSITS

By W. DWIGHT PIERCE

The larger mammals and birds, whose bones have been found in the Rancho La Brea asphalt deposits at Hancock Park, Los Angeles, are well known, and have become a vital part of the early story of this region. But, strange to say, with the exception of the passerine birds reported by A. H. Miller in 1929 and 1932, and the rodents and rabbits reported by Lee R. Dice in 1925, no one has critically studied the small life of the pits. Some plants, a few insects, a toad, and other small animals have been reported incidentally. The same may be said of the asphalt deposits of McKittrick and Carpinteria. Many people have thought that the story of the deposits was a closed book, but, in reality, it was less than half the story, and a new chapter is opening as the microfauna and microflora are studied.

In the early days of the Rancho La Brea explorations a few large beetles were found in the marginal diggings and were listed. All, however, were species still existent. A few years ago, Miss Jane Everest began a more detailed analysis of the asphaltum and isolated many insect remains from pits A, B, and Bliss 29, and other scattered excavations. These will be reported upon in the present series, group by group.

About 30 years ago, the entire solidified bone and asphaltum mass exposed in Pit 81 was boxed and brought to the Los Angeles County Museum. This deposit was located less than 5 feet from the surface of the ground, and measured in all only 4 by 5 feet in girth and 4 feet in depth. Bones of sloth, bison, horse, camel, saber-tooth cat, and wolf, examined in the course of the excavation, indicate the Pleistocene age of the accumulation. Within the last year this bone-laden block of asphaltum has been unboxed and prepared for exhibition. In the course of preparation it was necessary to chip away certain portions of the matrix to insert reinforcements. The material thus removed consisted of clumps of asphaltum, some bearing obvious fossil fragments, but some appearing to the naked eye to be unfossiliferous. Several boxes of this material were turned over to the writer for study by Mr. Eugene J. Fischer, osteologist, and preparator in the Department of Paleontology.

Later a considerable quantity of small material was handed to the writer from Pit A. These two lots of material were treated in the same manner, which was at the time a distinct advance over previous methods. We will consider this as Process No. 1.

In October 1945, the writer visited the tar field 16 miles north of Taft in Kern County, and $^3\!/_4$ mile south of McKittrick. The asphalt has vitrified into a very hard surface layer, but at the upper end of the great field, a few hundred yards from where the University of California excavations were made, a new road had been cut through, giving a direct straight road to McKittrick. A portion of the tarry bank had split, recently, making a clean exposure of the tar, and in this were layer after layer of insect remains, with a few small bones and considerable plant material. About 42 pounds of this material were bagged and examined. The final treatment was by a new and greatly improved technique, which we will call Process No. 2.

Process No. 1 used on material from pits 81 and A was as follows: The asphalt clumps were first soaked in jars of kerosene for preliminary softening and separation. After a week in the jars, the softened contents were poured into trays which progressed in series. The oldest tray was repeatedly washed in benzene, or benzole, and the washings were poured over tray after tray. This continued washing with benzene finally removed most of the tar, leaving only the sands and biological material. The remaining tarry liquid was strained through a double thickness of cheese cloth to catch any floating particles, and was then filtered through Johns-Manville Celite, and could be used again for softening new lots of asphaltum. The solid material was allowed to dry and became the color of brown earth. The process to this point took two or three weeks for any particular bit of material.

The dry earth was passed through several sieves to divide it into convenient sizes for examination. In the coarser material, excluded by an 8-mesh screen, were larger bones, teeth, stems, etc., all easily sorted out. The 14-mesh screen excluded material which had to be sorted with a low-power lens. In this were many bones and teeth of small birds, mammals, lizards, snakes, toads, and turtles; stems, leaf fragments, seeds; insect and millipede fragments; hairs, plant fibres, etc. Finer meshes were used and disclosed many tiny bones and insect fragments, until the 60-mesh passed a fine, powdery dust, in which no specimens have yet been found. A headpiece binocular greatly facilitated the preliminary classification of the material.

In the course of this work, the writer has had the assistance of a number of students, and Mr. George P. Kanakoff, Assistant Curator in the Department of Paleontology, has aided in the last phases of the treatment of the asphaltum from Pit 81, and in all of the Pit A work. All bones were turned over to him for arrangement by elements in Riker mounts on cotton, to hold them in place, and prevent breakage. This material will be studied by vertebrate paleontologists.

There are certain factors to be taken into consideration in interpreting the results of the separation of the material from Pit 81. The block of asphaltum was enclosed in burlap in the field before boxing, and later the matrix fragments removed from the block were put in cardboard or small wooden boxes. Frequently, chips of fresh wood, burlap fibres, and pieces of cardboard were found mixed with the fragments of asphaltum. A number of flying seeds of a modern grass, which had never been saturated with tar, were found in the course of the washings. These were separated out, for it is believed that they either blew into the pit at the time of the excavation, or were on the burlap when it was being placed around the block of asphaltum.

As a final check, in an effort to eliminate introduced material, a number of large chunks of asphaltum were treated separately, after the washing of the smaller fragments. These chunks were carefully brushed off on all sides to eliminate extraneous material, and thoroughly examined externally before being washed in clean pans with fresh liquid. The specimens obtained from them were distinguished as from Pit 81X, and will be examined later.

The materials recovered from the general washings included a great variety of elements and species. The immense quantity of insect parts will be reported upon in detail in this series of articles. Many of the best of the tiny bones were found within the capsule-like bodies of Eleodes beetles, in the ring-like thoraces, and even in the head capsules of beetles. These were carefully washed out in xyline (xylol), as they always contain treasure. Among the interesting non-arthropod specimens found were leaf and stem tissues, seeds, buds, scales, spines and glands of many kinds of plants; a few shells of small fresh-water mollusks, many limb, spine, girdle, and skull parts of small batrachians, lizards, snakes, turtles, birds, and mammals; tiny pin feathers, animal hairs of many kinds. All of these, with arthropod chitin, and even a few pieces of insect wing tissue, have survived the chemical action of the tar, and the agents of disintegration, though connective tissues, muscle, and flesh have been removed. It has been observed, also, that while bones, and wood take up the tar, chitin, feathers, hair, and the shells of mollusks do not absorb it, and it can be completely washed off, leaving the original surface finish. Occasionally on insects the tiny hairs and setae remain.

Color is not always destroyed by the tar. We find natural colors in the hair when it is washed in xylol. Leaf and plant material has, of course, lost its chlorophyll, and is either brown or yellow. The xylol wash discloses the original gloss of insect chitin, and the red, blue, purple, green, yellow, brown, and black colors correspond with the colors of the nearest living species.

Process No. 2 was initiated by a suggestion and the loan of equipment by Major Joseph B. Ficklen III of the United States Public Health Service and Los Angeles County Health Department, who felt that the open tray method of handling benzene was a double hazard to health of the worker, and to safety from accidental combustion. He provided a small Soxhlet degreaser outfit, consisting of a flask, a treatment chamber, and a water-cooled condenser. The material to be treated was placed in porous filter cups in the treatment section. An electric heater with completely closed heating unit gave the heat. The liquid in the flask boils and passes as a gas up a side tube into the upper portion of the treatment section, where it enters the condenser, and is returned as a clear distilled liquid through the filter cup of asphalt material. There is an obvious movement of tar out of the filter cup, and when a certain amount of liquid has accumulated it is all drawn off by a siphon, which returns it to the flask. Thus the tar is finally all removed from the filter cup to the flask. When the siphoned liquid is clear the process is finished, and the cup can be removed and a new one inserted. After drying on filter paper the contents of the cup is so powdery that much of it acts almost as an aerosol, and passes a 100-mesh screen.

The particular apparatus used in the tests included thimbles 45x123 mm., flask capacity 300 ml. Much larger Soxhlet apparatus is available, and the principle can be applied in making equipment to handle 25 to 30 pounds of material at a time. Henceforth this type of apparatus will be used in all extraction of tar to obtain the smaller elements in the asphaltum, from all fields, although cruder methods will be necessary in the first separations.

The solvent found most satisfactory in the 300 ml. apparatus was benzine (petroleum derivative). Carbon tetrachloride was tested, and the tar dissolved, but remained at the top of the liquid and hence was not completely siphoned off. Toluene had too high a condensing point in the apparatus, and some gas escaped. Xyline was fairly satisfactory, but was superseded by the cheaper benzine, which worked perfectly in three hours or less for each lot. Thus the cup could be filled three times a day. As this rate was faster than the material could be studied, the small apparatus will serve amply in the entomology laboratory. Instead of the filter cups, some small lots of particular importance were merely wrapped in ordinary filter paper packages, and several could be treated without mixing.

The Soxhlet extraction system does away with the health hazard of breathing the fumes. It reduces the fire danger, as the system is entirely closed and the flask sits on a sand layer in a pan, so that if it should break the liquid would not come in contact with the heating element. There is no chance of pollution of the material, as there is in open trays, for everything can be done under cover.

The separation of the insect fragments must all be done with the aid of lens or microscope, and great quantities of the sand must be studied, a spoonful or less at a time. It is slow and tedious work, and the insect remains are very fragile, easily broken.

The second step is to sort the insect material, dividing it in boxes into bodies, heads, mandibles, prothoraces, sternites, legs, elytra, etc. Often the specimens have to be rewashed in xylol, and gently brushed with camel's hair or probed with fine needles to remove dirt and other particles. Some of these particles removed are quite valuable.

In order to preserve the sorted material it is first placed on cotton in Riker mounts for species sorting and primary classification. Long series of larger material are laid out in Riker mounts, but smaller more delicate material and short series are mounted under transparent plastic in pill boxes, with the most delicate, and minute material in dry cells cut from cardboard, between two microscopic slides, sealed with cellulose tape, and properly labelled. Thus mounted it can be studied on all sides.

The beetle species are numbered, using the elytra as the basic criterion, for this element has excellent diagnostic characters, and can usually be classified to the species. The elytra so far found range from 1 mm. to 25 mm. in length, and belong to well over 100 species.

By much searching through the collections, the family, and finally the genus of the elytron is located. A specimen of the nearest California species is then chosen as the basis for comparison, and is completely dissected and the parts laid out on cotton for study in a little mount. This leads to the discovery of the appropriate head, thorax, sternites, and other parts, which can be given the temporary species number pending critical descriptive study.

The problem of association of these parts is difficult, and only the students of bird stomach contents have ever had to meet it. It immediately became apparent that there is a vast amount of work to be done in comparative morphology in insects and other arthropods. The usual keys are not of much value when one has only a head, a mandible, or a sternite to identify. With better studies of our modern insects it can be done.

The insects of the tar pits belong to several distinct categories: (1) the water insects which lived in the water above the tar; (2) the scavenger insects which lived in the flesh of the animals dying in the tar before submergence; (3) the land crawling insects, which may have walked on the exposed tar; (4) strays, which got into the pools by accident; and (5) fragments of insects in the stomach contents of birds and reptiles caught in the tar.

Perhaps because chitin is harder, beetle fragments and millipede rings are most numerous; fly puparia, wasp heads, ant heads are occasionally found. Of perhaps special interest is the fact that an Hemipterous egg, the carapace of a spider, and the front end of a small centipede were found.

There are definite relationships between the Rancho La Brea and the McKittrick insects, although the proportions of the various families appear to differ greatly. In the McKittrick field the tar flowing over the bottom of lakes or pools has deposited large numbers of water forms in layers. At Rancho La Brea the tar seeping upward was often covered with water to form pools, in which many of the insects undoubtedly lived, while others lived on the carrion or the plant life which occurred in the pool.

The study of these insect fragments will have great value in modern taxonomy. Three important morphological facts have already come to light:

1. In the course of evolution beetle elytra are now seen to have been oriented upside down, with the costal margin median, and anal margin lateral, reversing the position of the veins in the under wings; and with this clear, all striae of the elytra can be properly named. This was first brought out in Article 2 of this series (Bull. So. Calif. Acad. Sci. 43 (1):5-7) in the study of a Miocene elytron, but is many times corroborated in the new materials.

2. The Silphid head must be redescribed, because of misinterpretation of the frontal and clypeal regions.

3. The Coprine head must be redescribed for the same reason.

The work will continue with studies of material from other pits at Rancho La Brea, and from the Carpinteria and McKittrick fields as well, so that these three localities can be compared in a manner comparable to the mammal and bird studies of these areas.

Some light may be thrown, by the insect remains, on problems that relate to the antiquity of the deposits, and on climatic conditions that prevailed during the periods of accumulation. An interesting clue, for example, is furnished by fossil material of the genus *Copris* (Scarabaeoidea) found in Pit A and Pit 16. This genus does not now exist in the Pacific Coast States, and the species nearest to that found in the asphaltum occur in southern Arizona and in central Mexico. The first of the critical studies to be made will therefore be a description of this interesting insect, and other related forms.

11. DESCRIPTIONS OF THE DUNG BEETLES (SCARABÆIDÆ) OF THE TAR PITS

By W. DWIGHT PIERCE
Illustrations by the author

In sorting the vast amount of insect material extracted from the asphaltum of Rancho La Brea, Hancock Park, Los Angeles, the most exciting material so far segregated is a series of fragments of five or six species of Scarabaeidae, or dung beetles, belonging to the genera *Canthon, Copris,* and *Onthophagus,* and one which must be separated as a new genus between *Copris* and *Phanaeus.*

Considering the great numbers of ungulate and other large animals which must have congregated around the water holes covering the treacherous asphaltum, it is not surprising that dung beetles should have been present.

It is interesting that three or four of these species come from Pit 81 and two from Pit A, one of which was also recovered from Pit 16, and Pit 13. Many things indicate Pit 81 to be older than Pit A. The absence today of *Copris, Onthophagus* and the new *Paleocopris* from California, and the presence of all the genera, except the new one, in Arizona, may be one of the clues we are seeking in the problem of Pleistocene climate. By table we indicate these distributional facts.

DISTRIBUTION OF SPECIES OF COPROPHAGOUS BEETLES

GENERA	PLEISTOCENE			MODERN		
	Pit 81	Pit 16	Pit A	Arizona	California	Baja Calif.
Scarabaeidae						
Scarabaeinae						
Scarabaeini						
Canthon.....	2	0	1	5	4	1
Coprinae						
Coprini						
Choeridium	0	0	0	1	0	0
Palaeocopris.	1	0	0	0	0	0
Copris......	0	1	1	2	0	0
Phanaeus...	0	0	0	3	0	0
Onthophagini						
Onthophagus	1	0	0	5	0	1

In the study which led to the identification of the genera of the fragments, another error in American descriptive literature was found. LeConte and Horn, Blatchley, Bradley, and others differentiate *Phanaeus* from *Copris* on the grounds that the former lacks tarsi on the front legs. This is not true for any North American species of *Phanaeus* seen by the writer, and only for some Central American species, as all have a small tarsus hidden by the spur. A separate article giving details on this point will be prepared in this laboratory.

I. THE CANTHONS OF THE TAR PITS

Elytra of three distinct sizes were found, three of the smallest size in Pit A, and one each of the two larger sizes in Pit 81. Also in Pit A was found a thorax with legs attached.

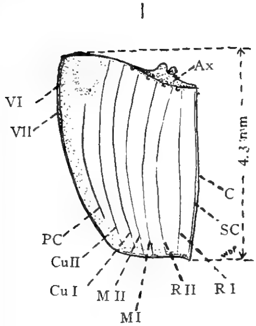
The genus *Canthon* contains about 135 species, with 16 in the United States, and 4 in California, and ranges from 41°N. to 41°S. The species recorded from California are *C. puncticollis* LeConte 1866, *C. simplex* LeConte 1857, with varieties *humeralis* Horn 1870, and *militaris* Horn 1870, *C. laevis* (Drury 1770), and *C. perplexus* LeConte 1847. *C. simplex* occurs in Los Angeles County. The material from Pit A appears to belong to *C. simplex* and will have to be so designated under subspecies name until head and other parts are found to validate or invalidate the decision.

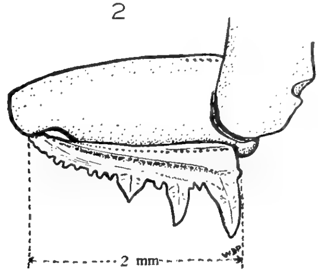
CANTHON SIMPLEX ANTIQUUS, new subspecies

The specimens are labelled as follows: one left elytron—C114*a;* two right elytra—C114*b, c;* prothorax and legs—C114*d.* The last is designated as holotype, and illustrated in Figures 2 and 3; and elytron *a* is illustrated in Figure 1 of Plate 10.

The three elytra measure as follows: length *a.*—4.3mm., *b.*—3.5 mm., *c.*—3.5 mm.; width *a.*—2.7 mm, *b.*—2.5 mm., *c.*—2.5 mm. At base there are four tiny tubercles, each in the center of interspaces 2, 3, 4, 5. The surface is very minutely and regularly granulate with dispersed clusters of 4 granules more shiny, and appearing as bare spots except under high magnification. The striae (Subcosta or sutural, Radius I, II, Medius I, II, Cubitus I, II, Postcubitus) are faintly impressed, with very faint punctures. The Vannal or lateral area is vertical, sharply marked on both edges, and with one row of deep punctures, and extends to the apex.

Pronotum 4.7 mm. in width, smooth, but with very minute reticulate granulation. An interesting point which would not be observed in a mounted specimen is that the fore coxae are attached at their lateral end only, and fit tightly into a transversely





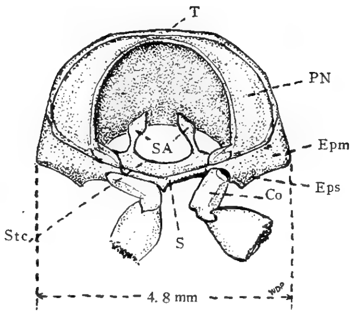


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PLATE 10

FIG. 1. Elytron of *Canthon simplex antiquus*, n. ssp. *Ax.*—axillary region; C.—costa; SC.—subcosta; RI, RII—radius; MI MII—medius; Cu I, Cu II—cubitus; PC.—postcubitus; V I, V II—vannal veins.

FIG. 2. Posterior view of first coxa, femur and tibia of *Canthon simplex antiquus*, n. ssp.

FIG. 3. Posterior view of prothorax of *Canthon simplex antiquus*, n. ssp. Co.—coxa; Epm.—epimeron; Eps.—episternum; PN.—postnotum; S.—sternum; SA.—sternal apodeme; Stc.—sternacosta; T.—tergum.

grooved sternum, being minutely separated on the center line by a fine ridge, so that when in the groove they are almost in contact. Figure 3 shows from the rear view the right coxa opened out, and the left coxa reposing in its groove.

The postnotum is an infolded perpendicular plate edged all around by ridges. The epimeron is vertical, separated only by rounded edge from the triangular episternum, which lies ventral, at the sides of the coxae, and separated by the sharp lateral margin from the tergum. Within the sternum is the sternocostal plate to which are attached two vertical sternal apodemes, spearlike in form.

Casual observation of dissected parts of various species in this group indicate that the comparative morphology of these beetles will afford much better taxonomic characters for separation of genera and species than are now in use. We must be able to separate any genus or species on the merits of any of its structural parts.

Canthon praticolus vetustus, new subspecies

This name is given provisionally to two elytra from Pit 81, which may ultimately prove to belong to two species. The specimen C117*a* is considered holotype, and C118*a* as paratype. While there is a great disparity in size the disparity is not greater than that between the largest and smallest specimens of *C. praticola* in the Museum collection, from Albuquerque, New Mexico. This species does not now occur in California. The only other species with granulate elytra of a similar nature, *C. laevis,* exceeds in its smallest specimens, the size of the elytra of the larger of the two.

Elytron C117*a* measures 4.5 mm. in greatest length, and 3.25 mm. in greatest breadth. Elytron C118*a* measures 6.2 mm. in greatest length, and 5.00 mm. in greatest breadth.

The holotype is much more pronouncedly granulate than the larger paratype. Microscopically the surface is very minutely granulate with interspersed larger and obvious granules. At the bases of the third, fifth and eighth interspaces are tiny tubercles. The vannal area is vertical and defined by two raised lines, and extends from humerus to apex. No drawing was made of this subspecies.

II. The coprine species of the pits

The finding of two large coprine beetles in Pleistocene deposits in California is of great significance. One is definitely a *Copris,* the other has some characteristics of *Phanaeus,* but in the absence of any specimens of that genus with its main characters it is called *Palaeocopris.*

The genus *Copris* has an interesting distribution. There are about 80 species, five occurring in Europe from Russia to Spain, others in Asia and Africa, but it is absent from Australia and the Oceanic Islands. In North America, north of Mexico there are eight species from Canada to Florida and Arizona, and eight species in Mexico and Central America. It is completely absent from the Pacific Coast States of the U. S. A., and does not occur in South America.

The genus *Phanaeus,* with about 80 species, is exclusively American, extending from Kansas to South America, but it is absent from Washington, Oregon and California.

The material in the first species was found in Pit 16 and Pit A, and consists of 2 ♀ heads and 4 prothoraces from Pit 16; and 6 ♀ heads, 1 ♂ horn, 2 prothoraces, 2 prothoracic fragments, a few prosternite fragments, 1 femur and 2 tibiae of the fore legs, 1 femur and 3 tibiae of the middle legs, 1 femur and tibia of the hind legs, 1 almost complete elytron, and 3 elytral fragments, from Pit A, and 1 thorax from Pit 13.

One head capsule (C49*p*) is complete, lacking only the oral appendages, antennae and eyes. This is therefore selected as holotype ♀. The other material which is considered undoubtedly of this species must therefore be considered as paratype parts. In paleontology the words syntype and cotype are often used, but they are now held to be synonymous with paratype.

The reconstruction of the insect would indicate a species much larger than any Copris in the United States, Mexico or Central America, but somewhat resembling *Copris rebouchei* Harold of Mexico, and the much smaller *Copris remotus* LeConte of Florida to Arizona. In size and proportions it equals the largest *Copris lunaris* Linnaeus I have seen from Russia, and is almost as large as *Pinotus carolinus* Linnaeus of the Eastern States.

By its shape of head it is eliminated from *Pinotus,* and allied to *Ontherus, Copris,* and *Phanaeus*. The generic classification of this group is based on antennae, mouthparts, legs, and elytra, but this type of material cannot be keyed out in the usual manner. The anterior tibiae show articulation of a tarsus, which eliminates true *Phanaeus.* Thoracic characters, sculpture, and the absence of teeth on the anterior margin of the head narrow it to the first group in the genus *Copris.*

A study of the head capsules of these fossil species and of modern beetles discloses an error in all descriptive work on this group of beetles. The flattened dorsal part of the head is not the clypeus, but the frons and parietals. The frontal suture is clearly visible on all of the specimens, and in one is actually somewhat cleft. It extends from the anterior margin almost to the frontal horn. In *Phanaeus vindex* the frontal suture passes through the frontal horn. The true clypeus is under the ledge of the frons, and completely united, but distinctly demarked from the frons. It is arched, with lateral extensions reaching the small piece bearing the anterior mandibular articulation, located at the junctions of genae, frons and clypeus behind the antennal fossae. In a complete insect the clypeus is entirely concealed by the mouthparts. Therefore the horn is not a clypeal horn but rather a frontal suture horn. This correction should be made in all descriptions of Coprini.

No fossils in this genus are reported from North America, hence the name *pristinus* is quite appropriate.

COPRIS PRISTINUS, new species

Color black. Approximate mean size 26 mm. in length, 13 mm. in breadth. Measurements of the 8 ♀ heads are as tabulated.

MEASUREMENTS OF HEADS OF COPRIS PRISTINUS FEMALES

Specimen Number C 49—	Greatest Width	Width at eye emargination	Length on center line	Height of crest	Width of crest	Source Pit
a	11.5 mm.	6.5 mm.	7.5 mm.	1.7 mm.	2.5 mm.	Pit A
b	8.7	5.7	5.8	1.5	2.0	Pit A
e	9.5	6.0	6.0	1.8	2.5	Pit 16
g	8.2	5.2	5.6	1.2	1.6	Pit 16
k	9.5	6.5	6.5	2.0	2.5	Pit A
l	8.5	6.0	6.2	2.5	2.6	Pit A
(type) p	8.8	5.5	6.2	2.2	2.2	Pit A
aa	9.7	6.0	5.7	2.0	2.5	Pit A
Minimum	8.2	5.2	5.6	1.2	1.6	
Mean	9.3	5.92	6.18	1.85	2.3	
Maximum	11.5	6.5	7.5	2.5	2.6	

The head (Figure 4 of Plate 11) is definitely transverse in its entirety, and would appear even more so in a complete insect. Dorsally, it has a narrow basal occipital and postoccipital area, a convex vertex, most of which is normally covered by the thorax, and the visible dorsum is a flattened disc laterally projecting far beyond the eyes in a rounded 60 to 70° angle. There are deep emarginations at the base of the parietal ledge for the eye sockets, which are dorsally elliptical while ventrally the ocular sclerites are spiralled around the eye sockets. The frontal suture is deep and the cleavage extends clear through the ledge to the under side. The broad frontal horn occupies the normal position of the central ocellus (when it occurs). This horn is a hollow process, elliptical at base, flattened antero-posteriorly, concavely truncate at apex like a saddle. The anterior margin is broadly curved from parietal angles, emarginate at frontal suture, and also slightly indented on median line.

The head is hypognathous, with all mouth parts, antennae, and the major portion of the eyes ventral (Figure 5 of Plate 11). The broad plate-like extension of frons and parietals extends far beyond the insertions of all appendages. The frontal suture passes just in front of the antennal sockets and makes sharp 30° angles with the epistomal suture, which extends forward in parallel lines and then abruptly arches in front of the slightly depressed clypeus. The frons is coarsely punctate beneath. In front of the clypeus there is a narrow arched band bordering the buccal cavity. Its apical angles meet the apical angles of the frons and the subgenae. The antennal sclerites are oval with kidneyform sockets. The parietals are broad in front of the eyes, narrow between the eyes and gular suture, with a broad genal area behind. The broad gula and submentum are separately convex, inserted between the genae at posterior base of head, and are present in only one specimen, there being a definite cleavage, with infolded edges, which separates them from the remainder of the head capsule. The elongate posterior tentacular pit is on the gular suture. The gula and submentum are connate, but distinguished by texture, gula being smooth, dull surfaced, while submentum is finely, closely, shallowly punctate. Anteriorly submentum is medianly lobate truncate, laterally excavate for maxillae.

Posteriorly (Figure 6 of Plate 11), the triangular subgenal areas with a narrow occipital and postoccipital band, and the gula enclose the subquadrate foramen magnum.

Fragments of 10 prothoraces are at hand, of which 6 are measureable as follows:

MEASUREMENTS OF PROTHORACES OF COPRIS PRISTINUS

Specimen Number C49—	Greatest Width	Greatest Length	Length on Center Line	Source Pit
c	14.5 mm.	...	7.7 mm.	Pit A
d	12.5	8.5 mm.	6.8	" A
f	13.0	9.5	8.0	Pit 16
g	12.0	9.0	7.7	" 16
h	13.0	8.5	7.5	" 16 (fig. 19 of Plate 13)
i	...	...	...	" 16
n	...	...	...	" A
o	...	...	...	" A
r	...	...	...	" A
cc	...	...	...	" A
dd	15.5	11.0	9.0	" 13 (fig. 18 of Plate 13)
Minimum...	12.0	8.5	6.8	
Mean.......	13.4	9.3	7.7	
Maximum..	15.5	11.0	9.0	

EXPLANATION OF FIGURES ON PLATE 11

FIG. 4. Dorsum of head capsule of *Copris pristinus*, n. sp. Cr.—crest; Fr.—frons; Fs.—frontal suture; Oc.—occiput; Os.—ocular sclerite; Pa.—parietal; Pge.—postgena; V.—vertex.

FIG. 5. Venter of head capsule of *Copris pristinus*, n. sp. As.—antennal sclerite; C.—clypeus; Es.—epistomal suture; Fr.—frons; Fs.—frontal suture; Ge.—gena; Gs.—gular suture; Gu.—gula; Hs.—hypostomal suture; I Cr.—interior of crest; Os.—ocular sclerite; Pa.—parietal; Ps.—pleurostomal suture; Sg.—subgena; Sm.—submentum; Tp.—tentorial pit.

FIG. 6. Posterior view of head capsule of *Copris pristinus*, n. sp. Gu.—gula; Oc.—occipital; Pa.—parietal; Pge.—postgena; Poc.—postoccipital.

FIG. 7. First tibia of *Copris pristinus*, n. sp.

FIG. 8. Inner side of second femur and tibia of *Copris* pristinus, n. sp.

FIG. 9. Inner side of third femur and tibia of *Copris Pristinus*, n. sp.

FIG. 10. Dorsal view of fragment of head capsule of *Palaeocopris labreae*, n. sp. Fr.—frons; Fs.—frontal suture; Os.—ocular socket; Pa.—parietal.

FIG. 11. Ventral view of fragment of head capsule of *Palaeocopris labreae*, n. sp. As.—antennal sclerite; C.—clypeus; Es.—epistomal suture; Fr.—frons; Fs.—frontal suture; Os.—ocular sclerite; Pa.— parietal.

FIG. 12. First tibia of *Palaeocopris labreae*, n. sp.

FIG. 13. Second tibia of *Palaeocopris labreae*, n. sp.

FIG. 14. Third tibia of *Palaeocopris labreae*, n. sp.

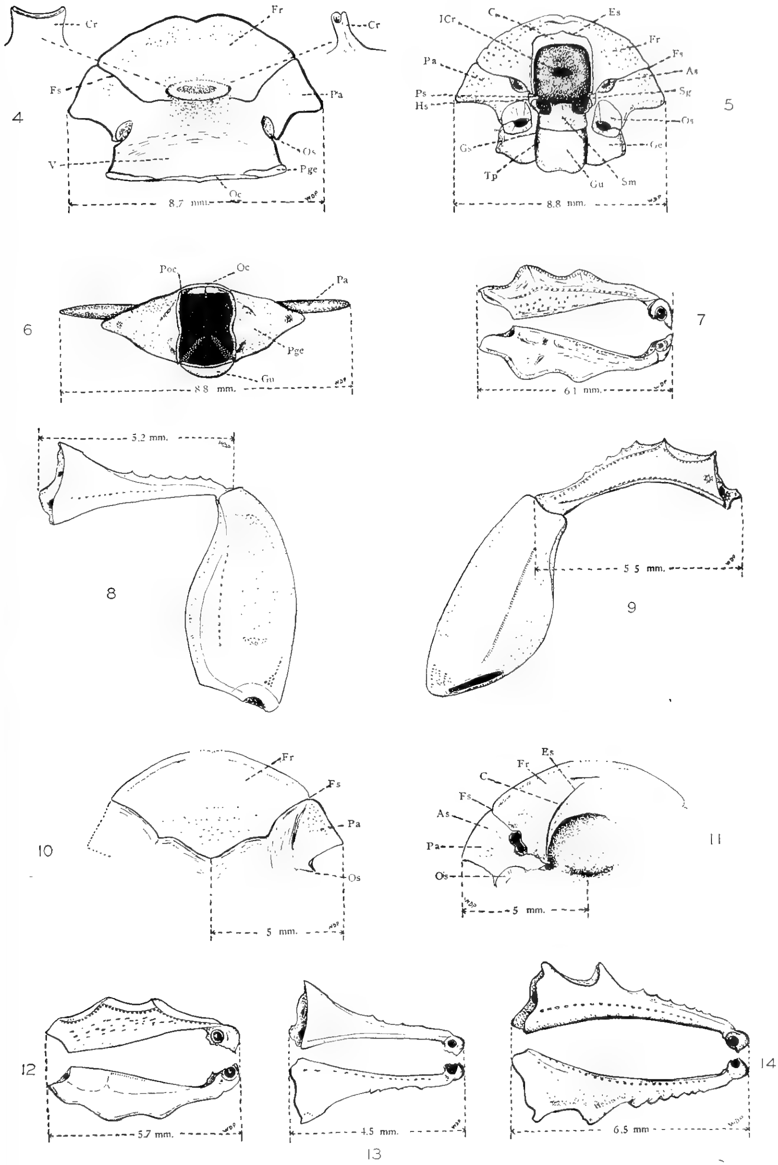
Cr
Fr
Cr
Fs
Pa
4
Os
V
Pge
Oc
8.7 mm.
C
ICr
Es
Fr
Fs
Pa
As
Ps
Sg
Hs
5
Os
Gs
Ge
Tp
Gu
Sm
8.8 mm.
Poc
Oc
Pa
6
Pge
Gu
8.8 mm.
7
6.1 mm.
5.2 mm.
8
5.5 mm.
9
Fr
Fs
Pa
10
Os
5 mm.
Es
Fr
C
Fs
As
Pa
Os
11
5 mm.
12
5.7 mm.
4.5 mm.
13
14
6.5 mm

PLATE 11

The dorsum of the pronotum is divided medianly into three visible transverse areas, the narrow anterior marginal acrotergite, with a deep antecostal suture; the anteriorly sloping prescutum bounded by the transverse notal suture, a more or less distinct ridge which may be broken on the median line (but in specimens d, f, g, i, n, o, cc and dd the ridge is complete as in figure 18 of Plate 13), and again on a line with the interior edges of the anterior lobes (these depressions corresponding in position with the notaulix); and the large scutum with the lateral depressions made by notaulix in the anterior half. The depressions of the median line and the notaulices cause the anterior ridge to appear quadrituberculate in specimens *c* and *h* (figure 19 of Plate 13), whereas in the others it is laterally bituberculate. The anterior margin is laterally lobate, medianly straight; posterior margin is broadly convex; sides convex, marginate. The surface is very shallowly pitted, with lateral ridges a short distance from margin. The postnotum is a narrow infolded band, concave transversely.

Four fragments of the elytra have been found, one almost complete. The length exceeds 13 mm., and the basal width exceeds 10 mm. for each elytron. The striae are about 1 mm. apart. In the largest fragment there are 8 striae, the ninth being at the edge of the break; another fragment has 9 striae.

First femur is 5.5 mm. long, 2.8 mm. broad at broadest point before middle; externally punctate; beneath 3-carinate; apically concave with two condylar teeth to engage the tibia. First tibia (Figure 7 of Plate 11) measures 5.8 to 6.1 mm. in length; is diagonally truncate at apex, outer margin with three broadly rounded teeth, the margin being gently wavy, 3-emarginate; the outer side is inwardly convex, coarsely punctate, and outwardly abruptly, concavely declivous from a sinuate median edge, with ridges crossing the declivity from the median line to the apices of the teeth; the apex surpasses the tarsal attachment; the base fits into the femur with an internal and external condylar pit.

Second femur (Figure 8 of Plate 11) is 6 mm. long, 2.5 mm. broad at broadest point before middle, externally convex, coarsely punctate; beneath 3-carinate; apically concave with two condyles for attachment of tibia. Second tibia measures 5.5 mm., is slender at base, flared at apex, with 6 small teeth on outer edge; apically with 2 pits, one for tarsus, the other for the spur.

Third femur (Figure 9 of Plate 11) is 6 mm. long, and 2.5 mm. wide just before the middle; dorsally sparsely punctate; externally shining with two impressed punctate lines, and internally with one impressed punctate line; ventrally bicarinate; apically concave with two condyles for attachment of tibia.

Four third tibiae measure 6.0, 6.1, 6.4, 6.4 mm. in length; are diagonally truncate at apex; dorso-externally with two large teeth, beyond the middle; and dorso-internally with 6 or 7 small

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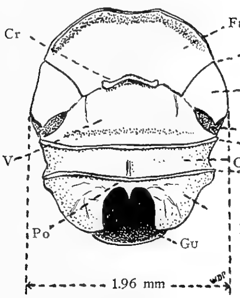

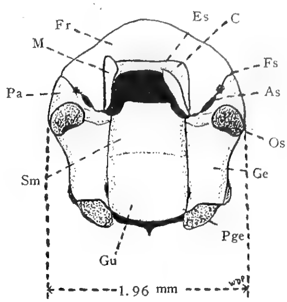

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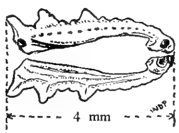

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PLATE 12

FIG. 15. Dorsal view of head capsule of *Onthophagus everestae*, n. sp. Cr.—crest; Fr.—frons; Fs.—frontal suture; Gu.—gula; Oc.—occiput; Ocs.—occipital suture: Os.—ocular sclerite; Pa.—parietal; Pge.—postgena; Po.—postocciput; Pos.—postoccipital suture.

FIG. 16. Ventral view of head capsule of *Onthophagus everestae*, n. sp. As.—antennal socket; C.—clypeus; Es.—epistomal suture; Fr.—frons; Fs.—frontal suture; Ge.—gena; Gu.—gula; M.—mandible; Os.—Ocular sclerite; Pa.—parietal; Pge.—postgena.

FIG. 17. First tibia of *Onthophagus everestae*, n. sp.

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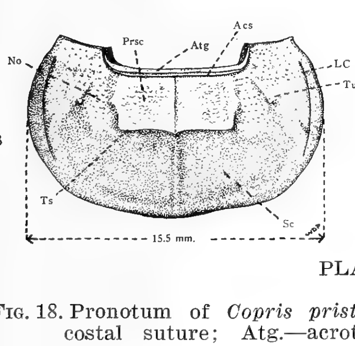

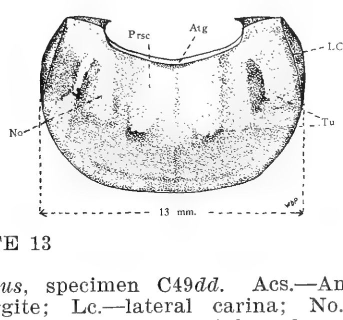

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PLATE 13

FIG. 18. Pronotum of *Copris pristinus*, specimen C49*dd*. Acs.—Antecostal suture; Atg.—acrotergite; Lc.—lateral carina; No.—notaulix; Prsc.—prescutum; Sc.—scutum; Tu.—tubercule.

FIG. 19. Pronotum of *Copris pristinus*, specimen C49*h*. Atg.—acrotergite; LC.—lateral carina; Prsc.—rescutum; Tu.—tubercles.

teeth before the middle and two large teeth beyond the middle; the dorsal surface is sharply margined, and with transverse ridges connecting the margins at the two large teeth.

PALAEOCOPRIS, new genus

Closely related to *Copris*, but with the frontal suture a raised ridge instead of crest, abruptly declivous behind. Tibial structures as in Copris.

PALAEOCOPRIS LABREAE, new species

A head fragment of a Coprine beetle female (C116*a*) found in Pit 81 is the basis of this genus and species. Four tibiae of Coprine character are assigned to this species, as no true *Copris* parts were found in Pit 81. These consist of one first tibia (C116*b*), one second tibia (C116*c*), and two third tibiae (C116*d, e*). The complete absence of horn indicates an approach to Phanaeus, but other evidences point to *Copris*.

Based on half measurement the head is 10 mm. wide (Figure 10 of Plate 11), and in general shape and size is very much like *Copris pristinus* but there is a complete absence of horn, the frontal suture forming instead a broad angled ridge as illustrated, sharply declivous behind, slowly sloping in front.

Beneath, the smooth clypeal area is more ogival than in *C. pristinus.* (Figure 11 of Plate 11). The antennal sockets are somewhat peanut-shape. Only a part of the eye socket is preserved.

The tibiae attributed to this species are typically Coprine and are illustrated in Figures 12, 13, 14 of Plate 11. The first measures 5.7 mm., the second 4.5 mm., the third 6.5 mm. The first is undulately three toothed. The second tibia flares at apex, and has four minute teeth on outer margin. The hind tibiae has two large teeth (apical and post median), and seven tiny teeth in basal half. All three tibiae have tarsal sockets.

III. AN ONTHOPHAGINE BEETLE FROM THE TAR

One little head, and one small front tibia from Pit 81 belong to the genus *Onthophagus.* This genus contains about 600 species, mostly Old World, although many occur in North, Central and South America. But the genus is completely absent from Washington, Oregon and California.

This species is dedicated with pleasure to Miss Jane Everest, who initiated the modern study of the Rancho La Brea fossil insects in 1941-42, extracting hundreds of insect fragments, which are only now being critically studied.

ONTHOPHAGUS EVERESTAE, new species

Recovered by the writer from Pit 81. Holotype head (C115*a*), and paratype first tibia (C115*b*).

The head (Figures 15, 16 of Plate 12) measures 1.96 mm. in greatest width, and 2.12 mm. in length. Dorsally it is characterized by a low arcuate ridge on the frontal suture, and two transverse ridges behind the eyes, on the occipital and postoccipital sutures. There is a short median ridge extending forward from the post-occipital ridge. The eye sockets are laterally open, dorsally diagonal, and ventrally lentiform. The parietals are not extended far beyond the eyes, but form with the frons an anterior process, which makes the mouth parts entirely ventral (hypognathous). In the specimen found, it is fortunate that the flat, ensiform mandibles, and the broad gula-submentum are in position. Clypeus is, as in *Copris,* a smooth arched plate, completely concealed when the mouth parts are in position.

The anterior tibia (Figure 17 of Plate 12) is typical, and has three large rounded teeth, two small teeth between the first two large ones, and five rounded teeth of diminishing height in basal half. The length is 4 mm.

12. DESCRIPTION OF A SERICINE BEETLE FROM THE TAR PITS

By W. DWIGHT PIERCE

Among the scarabaeoid fragments isolated from Pit 81, Rancho La Brea, Hancock Park, Los Angeles, was one tiny head, which differed quite materially from the coprophagous beetle heads discussed in Article 11. Studies of heads of beetles in the Museum collection has resulted in assigning this head to genus *Serica* (Scarabaeoidea. Melolonthidae, Sericinae). This genus is not unexpected, as the beetles are tree defoliators, and the larvae feed at the roots of trees. In California, *Serica anthracina* LeConte, is a serious defoliator of oak, manzanita, and other trees. The head capsule found in the tar is quite close to this species, which is also black. Oaks were present in the Pleistocene period, and many fragments have been found in the tar.

This species is described in honor of Mr. George P. Kanakoff, who has assisted the writer in the washing, sorting, and assembling of the vast amount of minute biological material from the asphaltum of Pits 81 and A. His help has been invaluable, and there are few men with the patient, untiring persistence that he has shown in this work.

Serica kanakoffi, new species

Described from specimen C107*a* from Pit 81. Head capsule black, 2.7 mm. wide and almost as long. The dorsum (Figure 1 of Plate 14) is divided into three areas: occiput, vertex, frons. The broad occiput, normally completely covered by the pronotum, is convex and occupies over one third of the dorsal area. The occipital suture is only indicated by a change of texture. The vertex, is convexly curved behind and concavely in front, and laterally emarginate by the eye sockets, in front of which are the parietal processes guarding the eyes anteriorly. The frontal suture is broadly curved, separating the vertex from the plate-like frons, which is sharply ridged on its anterior and lateral margins, making the frons somewhat depressed.

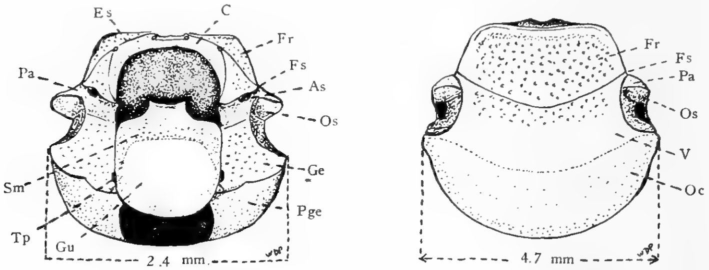

PLATE 14

Fig. 1. Dorsal view of head capsule of *Serica kanakoffi*, n. sp. Fr.—frons; Fs.—frontal suture; Oc.—Occiput; Os.—ocular sclerite; Pa.—parietal; V.—vertex.

Fig. 2. Ventral view of head capsule of *Serica kanakoffi*, n. sp. As.—antennal sclerite; C.—clypeus; Es.—epistomal suture; Fr.—frons; Fs.—frontal suture; Ge.—gena; Gu.—gula; Os.—ocular sclerite; Pa.—parietal; Pge.—postgena; Sm.—submentum; Tp.—tentorial pit.

A front view of the head discloses a vertical concave triangular area broadest above, with apex ventral. This is probably part of frons.

Ventrally (Figure 2 of Plate 14) this head differs from the Coprine heads in that the arched clypeus reaches the anterior margin at the apex of the above mentioned vertical area. The frons appears as lateral frontal triangles on the under side, with a second large triangular area bounded by clypeus, frons and gen, with apex at the tentorial pits, and base in contact with the antennal sclerite. Behind the more or less flattened frontal lobe the head suddenly deepens, so that the genae in the zone of attachment of the mouth parts, antennae and eyes are sharply declivous. The gula-submentum is very broad and convex. The posterior portion of the head is closed at the sides of the foramen magnum by the postgenae.

AN ANNOTATED LIST OF *CARABINÆ* KNOWN TO OCCUR IN NEVADA

(COLEOPTERA: CARABIDÆ)

By IRA LA RIVERS
Berkeley, California

CARABIDÆ

CARABINÆ

To this group belong the largest carabids in the State, distinctive in appearance, active in habits, and widespread in occurrence. Many are of importance in working out problems of speciation, distribution, and probable ports of entry of special groups. Species now isolated on montane islands throughout the State throw considerable light on the significance and effect of Pleistocene glaciation on animals of the western Great Basin, information which is more directly traceable to its antecedent factors than such data usually sought in more conspicuous but less significant groups such as birds and mammals.

I am indebted to Dr. E. C. Van Dyke of the California Academy of Sciences for aid and suggestions.

TRACHYPACHINI

1. *Trachypachus inermis* Motschulsky 1845. Washoe County (*Verdi,* 16/V/40, el. 5000 ft.—LaR). My single specimen was taken in the needle matting on the floor of a Jeffrey pine forest (*Pinus ponderosa jeffreyi*) on the extreme eastern slope of the Sierra Nevadas, and the species is apparently not common on the Nevada side of the range. *Inermis* is very closely allied to the Palearctic *zetterstedti* (Gyllenhal) 1827. Hatch (1933) regards them as co-specific, which would assign an Holarctic distribution to the species. Previously known from Nevada (Leng 1920).

CYCHRINI

2. *Scaphinotus obliquus convergens* (Casey) 1897 (*Brennus*). Washoe County (near *Verdi,* 9/X/45, el. 4800 ft.—T. J. Trelease). Casey described the species from four specimens from "California (Siskiyou Co.)" and this Nevada record seems to be the easternmost known locality. According to the collector, Thomas J. Trelease, the solitary specimen was taken near the mouth of Truckee Cañon, along the banks of the Truckee river,

under a rock. Nothing is known of its food habits in this area. No previous records.

Carabini

3. *Carabus taedatus oregonensis* LeConte 1854. Elko County (*Ruby Mountains,* Lamoille Cañon, 25/VI/41, el. 7000 ft.—LaR & G. C. Christensen). *Oregonensis*, smaller than *franciscanus*, is a high montane form of the Great Basin, first described from eastern Oregon, and known from British Columbia, Washington, Idaho, Utah, Arizona and New Mexico. This is the only Nevada record, first reported by Dr. Van Dyke (1944). The small series was taken under logs littering a grassed cirque at the head of Lamoille Cañon—although it was midsummer, snow still lingered in the shade, and the environment was correspondingly chilled.

Carabus taedatus franciscanus Casey 1913. Douglas County (*Lake Tahoe,* near Zephyr Cove, 6/VIII/41, el. 6400 ft.—LaR & T. J. Trelease). This form barely enters Nevada at the State's deepest penetration of the Sierras. In 1944, Dr. Van Dyke mentioned "Glenbrook, Nevada." The original description was based on a single male from the coast region of California, near San Francisco.

4. *Carabus nemoralis* Müll. 1776. Washoe County (*Truckee Meadows,* 1/VII/40, el. 4500 ft.—LaR). This is the only record of this European species in Nevada, but it is well-established along the Pacific Coast, being especially abundant about Puget Sound where I have taken large series preying extensively on earthworms. That the Nevada record is not merely representative of a single isolated instance of nursery stock introduction, its generally-accepted method of transport to new, distant regions, is attested by the fact that the specimen was taken in an alkaline saltgrass area several miles from Reno at the junction of a sagebrush-saltgrass association, actively associated with such indigents as *Cicindela willistoni amargosae, C. plutonica leachi, Edrotes ventricosus,* and various species of *Eleodes.*

In a short note on the species, Horn (1892) mentioned seeing, in 1875, a single specimen in a London collection labelled "Hudson's Bay," but remained rather dubious of the locality until 1891, when he obtained two specimens collected the previous year by C. B. Riker at St. Johns, New Brunswick, where it was common. In 1944, Dr. Van Dyke wrote: "Among my specimens, my oldest record is St. Johns, N. B., 1870." It has been well-established on the Pacific Coast for the past quarter century, appearing first in the northwest.

5. *Calosoma frigidum* Kirby 1837. Elko County (*Ruby Mountains,* Lamoille Cañon, 25/VI/41, el. 7000 ft.—LaR & G. C.

Christensen). Two specimens were taken several feet above ground in Quaking Aspens (*Populus tremuloides*), one while feeding on remnants of one of the many cicadas (*Okanagana bella*) then swarming over trees and surrounding brush. *Frigidum* is a northern United States—southern Canada species, common east of the Rockies, but known, to my knowledge, from only two States in the West. The California Academy has seven specimens from Utah: (*Wasatch Mountains,* Provo Cañon, 2/VI/30, two specimens; Timpanogoa, 16/VI/38, one specimen; same, 6/VI/26, four specimens), all in the Van Dyke Collection. The Nevada record is the species' westernmost known penetration, and the first notice for the State.

6. *Calosoma parvicollis* Fall 1940. Humboldt County (*Paradise Valley* sand dunes, 18/VI/41, el. 4800 ft.—LaR & G. C. Christensen); Lincoln County (*Alamo,* 18/VI/40, el. 3800 ft.—LaR); Mineral County (*Walker Lake,* south end, 7/VII/41, el. 4050 ft.—LaR & G. C. Christensen). This interesting desert species shows an almost statewide distribution, possibly surpassing the so-called "*Callisthenes*" group in this respect. It was originally described from southern California, and from what is known of its distribution in Nevada, gives evidence of having worked northward into the western Great Basin from southwestern desert stock, its known Nevada occurrences coinciding in general with the extent of a conspicuous route of biological ingression known as the Sonoran Trailway which enters the southwestern border of the State and extends northward to the basin of extinct Pleistocene Lake Lahontan. From this point, emigrant species have access to another trailway angling diagonally across the State from southwest to northeast, the Valley of the Humboldt, once largely inundated by Lahontan waters. The conspicuous lack of water in Nevada renders such biological routes easier, perhaps, to trace than in more humid regions. The species reaches its climax population in southern California and Arizona, and no Utah penetrations are known.

At the southern end of Walker Lake, *parvicollis* was found preying on the very numerous *Acheta assimilis* and the common spider *Arctosa littoralis,* the latter being available in large series hiding under cowchips along the littoral zone during daytime. The California Academy has three specimens from Nye County (*Tonopah,* June, el. 6000 ft.—) in the Blaisdell collection No other records are known.

7. *Calosoma elemens* Casey 1914. Washoe County (*Truckee Meadows,* 4/VII/40, el. 4500 ft.—LaR). I have specimens only from the vicinity of Reno, taken about lights at night during the summer. The California Academy has one specimen from Nye County (*Tonopah,* June, el. 6000 ft.) in the Blaisdell collection,

probably taken by F. W. Nunenmacher during his collecting trip of 1908. Casey described the species from one specimen taken at Las Vegas (Clark County) by Spalding.

8. *Calosoma parviceps* Casey 1897. Washoe County (*Truckee Meadows,* 9/III/41, el. 4500 ft.—LaR). A small species, apparently another southern form working northward along the Sonoran Trailway. The California Academy has three specimens from Esmeralda County (25/III/08, F. W. Nunenmacher).

9. *Calosoma obsoletum* Say 1823. Elko County (*Elko, 26/-V/39,* el. 5000 ft.—LaR). I have but one specimen. No previous records.

10. *Calosoma tepidum* LeConte 1852. Washoe County (*Truckee Meadows,* 13/V/41, el. 4500 ft.—LaR). This species, of sporadic occurrence in the Great Basin, is of Pacific Coast stock, commonly found from southern California to British Columbia. The California Academy has one specimen from Utah (*Ogden,* 1/VII/33—M. A. Cazier) and one from Idaho (*Coeur d'Alene*—H. F. Wickham) representing, respectively, the eastern and northernmost known records for the Great Basin. It was described from Oregon, and is also known from Montana and Colorado.

11. *Calosoma cancellatum* Eschscholtz 1829. Lander County (*Buffalo Valley,* 22/VI/41, el. 4600 ft.—T. J. Trelease); Mineral County (*Walker Lake,* south end, 7/VII/41, el. 4050 ft.—LaR & G. C. Christensen); Washoe County (*Truckee Meadows,* 3-11/V/41, 1/VI/41, el. 4500 ft.—LaR). This is the commonest member of the subgenus *Calosoma* about Reno. The California Academy has one specimen from Utah (*Brigham,* 4/VI/11 (edge of salt water)—J. M. Aldrich) and three specimens from Idaho (*Coeur d'Alene,* 11/VI/27—E. C. Van Dyke); as in the case of *tepidum,* these represent extreme known penetrations of the Great Basin of this West Coast species. At Walker Lake, *cancellatum* was found feeding on *Acheta assimilis* in company with *parvicollis.* Both *Calosomae* avoided the multitudinous, large *Eleodes armata* (*E. striatipennis* Blaisdell) which were everywhere about the sanded margins of the lake.

12. *Calosoma zimmermanni monticola* Casey 1897. Humboldt County (*Paradise-National Summit,* 20-22/VI/41, el. 7600 ft.—LaR & G. C. Christensen); Washoe County (*Truckee Meadows,* 19/II/40, 16/III/40, 7/IV/40, 18/V/40, el. 4500 ft.—LaR). *Zimmermanni,* in its two phases, is by far the commonest *Calosoma* in Nevada, and probably the most widely distributed. While it is readily taken in sagebrush (*Artemisia tridentata*) areas about Reno, elsewhere in the State has usually been found only as

a montane species. In the Santa Rosa Mountains (Paradise-National locality), it was found preying upon the common *Coniontis lariversi* and hunting *Aphodius fimetarius* under cowchips in an open meadow. The former species, like *zimmermanni*, is common to sagebrush habitats about Reno, but montane elsewhere. The California Academy has several *monticolae* from Washoe County (*Pyramid Lake*, 30/V/38, el. 4000 ft.—D. Tillotson; *Ross Ranch*, 20 miles north of Reno, 15/VI/38, el. approx. 4500 ft.—(?); *Spanish Springs Valley*, 1938, el. approx. 4500 ft.—R. Saarni; *Verdi*, April (probably taken by Dr. F. E. Blaisdell); *Winnemucca Valley*, 25 miles northeast of Reno, 26/VI/38, el. approx. 4500 ft.—(?); also *Reno*).

In 1943, Dr. Van Dyke mentioned the Winnemucca, Reno and Verdi localities for the form. About Reno, I have found it preying upon various insects during daytime, such as *Eleodes hirsuta, E. pimelioides, E. tenebrosa, Coniontellus ampliatus, Philonthus furvus californicus, Hippodamia convergens, Meloe,* and various cutworms, wireworms and scarab larvae. *Monticola* was described from a single specimen taken at Reno by Casey.

Calosoma zimmermanni nevadense (Casey) 1913. Lander County (*Buffalo Valley*, 26/VI/41, el. 4600 ft.—T. J. Trelease); Washoe County (*Truckee Meadows*, 11/IX/40, el. 4500 ft.—LaR). A smoother form than *monticola, nevadense* has not been taken in any numbers, and is not as abundant as the rougher variety. Casey's type was a solitary specimen from "Nevada (near Reno) —Wickham."

13. *Calosoma lariversi* Van Dyke 1943. Elko County (*Ruby Mountains*, Lamoille Cañon, 25/VI/41, el 7000 ft.—LaR & G. C. Christensen). Apparently the predominant *Calosoma* of eastern Nevada, and a marked montane isolate. In his discussion of the species, Dr. Van Dyke (1943) places it close to *luxatum*, a mid-west species, so that its affinities lie east, and not with the western Pacific species. As such, it would indicate that the two *"Callisthenes," zimmermanni* and *luxatum* probably share the Great Basin between them, the former predominating in the western half, the latter's stock appearing more strongly as the Rocky Mountains are approached. Beyond the Rockies, *luxatum* is the only species present. *Lariversi* seems to be a remnant of *luxatum* stock, isolated on montane areas of eastern Nevada by Pleistocene glaciation and cut off from its neighbors in post-glaciation periods by the increasing aridity of the Great Basin.

Dr. Van Dyke (1943) points out that our wingless, stubby species of *Calosoma* "do not belong at all in the Old World genus *Callisthenes*," but appear to be of west American origin.

Elaphrini

14. *Elaphrus laevigatus* LeConte 1849. Washoe County (*Truckee Meadows,* 12/V/41, el. 4500 ft.—LaR). I have but one specimen of this rare species (in Nevada); originally described from California, it is apparently limited to the Pacific area, and this is its easternmost known record. It is intermediate in size between the two following species, and much darker. Like them, its typical habitat is sandy bars and beaches along the Truckee river.

15. *Elaphrus lecontei* Crotch 1874. Washoe County (*Truckee Meadows,* 11/V/40, 29/III/41, el. 4500 ft.—LaR). Common along sandy beaches of the Truckee river about Reno. No previous records.

16. *Elaphrus riparius* Linné 1761. Washoe County (*Truckee Meadows,* 28/IV/40, 2/VI/40, el. 4500 ft.—LaR). This is the smallest of the three species, and the commonest of the group. No previous records.

Nebriini

17. *Nebria eschscholtzi* Menetries 1844. Washoe County (*Pyramid Lake,* 31/VIII/41, el. 3800 ft.—LaR & T. J. Trelease; 6/V/45—LaR). In a discussion of the species, Dr. Van Dyke (1943) mentions it as being common "along the streams flowing into the Pacific ocean from Alaska to southern California but except in the north where it follows the branches of the Columbia and other streams inland, it does not extend much east of the Cascades or Sierra Nevada mountains." He mentions the Pyramid Lake occurrence, and, referring to its relationship with the extinct Pleistocene Lake Lahontan, suggests that the species entered the Great Basin from the Pacific area via an "outlet to the northwest" (of Lake Lahontan), which furnished contact with the Columbia river drainage system. While there is no geological evidence that such a contact existed, the Lahontan waters generally being regarded as an euendorheic system, this northern divide separating the Lahontan basin from the extreme northern Great Basin in its widest sense is the lowest of the barriers the species would have to surmount to effect entry. Other passes to be considered, which at this time seem improbable but not impossible points of entry, are all openings in the Sierra Nevada mountains bordering the Great Basin to the west;

1) Up the North Fork of the Feather river to the source of the Susan river which flows east into Honey Lake, the westernmost remnant of Lake Lahontan—

2) Up the American and Yuba rivers for contact with the Truckee which flows eastward as the Lahontan basin's chief contributor—

3) Up the Stanislaus and Tuolumne rivers to the headwaters of the Walker river system, the latest Lahontan tributary.

Since only a slight increase in annual rainfall over what now exists in western Nevada would be sufficient to initiate filling of the Lahontan basin, it seems probable that the Pleistocene lake shores were as barren of vegetation as are the present-day remnants, Pyramid, Honey and Walker lakes and consequently would present much the same xerophytic aspect they do today. This would mean that *eschscholtzi* would have to spread over several hundred miles of xerosere to reach its present distribution in west-central Nevada, which it may have been able to do by utilizing the vast lake shores to satisfy its water requirements. Much more collecting will have to be done before any significant data bearing conclusively on the problem will be available, but perhaps it is significant that the best-known Nevada locality for *eschscholtzi*, that at Pyramid Lake, and the only one yet known to me, is but a few miles from the mouth of the Truckee river, and but a little farther removed from the Sierras, an easily-followed route had the species surmounted the Sierras in its easterly expansion. About Pyramid Lake, it is entirely confined to the lake shores, exemplifying its water needs, and in the spring of 1945, was found preying upon *Hippodamia convergens* as well as eating the exuviae of freshly-emerged libellulides. I suspect their food in this situation may be, at times, predominantly herbivorous.

PROMECOGNATHINI

18. *Promecognathus laevissimus* Dejean 1829. Washoe County (*Truckee Meadows*, 13/IV/41, el. 4500 ft.—LaR). I have but one specimen of this unique species from Nevada, the first record. It has previously been known only from the Pacific coast. Its associates are those of a typical Jeffrey pine forest.

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A FEW PESTS OF SUNFLOWER IN CALIFORNIA

By JOHN A. COMSTOCK

In 1874 Grote described a noctuid moth, *Stibadium spumosum,*[1] from an example taken by Prof. Snow in Kansas.

Dr. Holland states[2] that the insect "ranges from New York to Colorado and southward," and reports it as "very abundant in southern Indiana, where it comes freely to sugar."

Dyar[3] gives the range as So. Atlantic states and Colorado.

Actually the moth ranges across the United States from the Atlantic to the Pacific. Its rarity in western collections is due to the fact that it very seldom comes to light, and, since sugaring is not effective as a collecting method in arid regions it is not procurable by that means.

The only reference to its life history that I have found in the literature is that of Mary E. Murtfeldt,[4] published in 1894.

Therein she states that she "found a large proportion of the heads of the sunflowers infested with some insect which ejected its castings upon the surface of the flower, which, mingled with

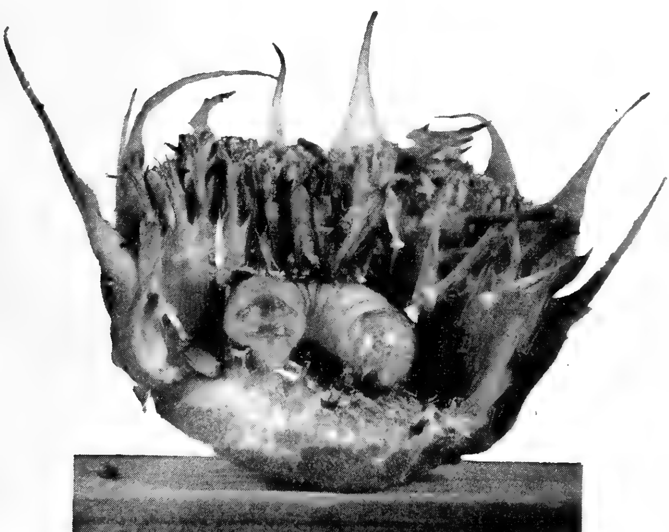


PLATE 15

Larva of *Stibadium spumosum* Grt. in the flower head of *Helianthus annuus* L.

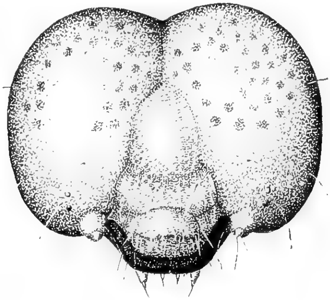
the withered florets, formed a dry, matted crust that in time became more or less moldy. Upon breaking open the injured disks one or more short, thick, and grub-like lepidopterous larvae were disclosed. These had been feeding upon the achenia from the under side and forming cavities and channels in the spongy receptacle."

Miss Murtfeldt found her larvae in flower heads of the Russian Sunflower at Kirkwood, Missouri. The very large heads of that species of sunflower probably accounted for the occasional presence of more than one larva to a flower. With our native western species of *Helianthus*, including the introduced *H. annuus*, the flower heads are too small to harbor more than one larva.

The position of the larva in its chamber at the base of the seeds is shown in our Plate No. 15.

Miss Murtfeldt's description of the mature larva is brief, but accurate. She writes:

"The full grown larvae were about one inch in length by one-fourth inch in diameter, with very large golden brown head and broad corneous collar of a darker shade of the same color. Other-



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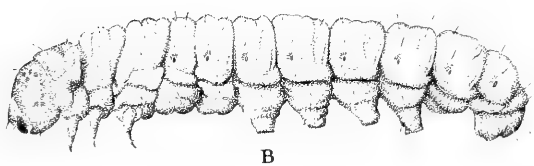

B

PLATE 16

Larva of *Stibadium spumosum* Grt.

A. Head enlarged X 12.
B. Mature larva, lateral aspect, enlarged X 2⅝.

Drawing by J. A. Comstock

wise they were of an opaque cream white, in some cases with a slight dorsal rosy suffusion." To this I can add a few details.

The upper portions of the cheeks are mottled with dark brown dots.

Mandibles, black. Ocelli concolorous with head, a few slightly darker on the tips. Figure A of Plate 16 shows an enlarged drawing of the head. A lateral view of the larva is shown on Figure B of the same plate.

Further details of the larval appearance are given by Miss Murtfeldt, but of the pupa she notes only that it is "short, thick with a glassy appearance, of a shaded brown color with tinge of green on the thorax and abdomen." Our figures of the pupa given on Plate 17 will furnish other details.

As previously stated by the above quoted author, the larva "when full grown—dropped from the flowers and burrowed into the earth to the depth of two or three inches, where they enclose themselves in broad, oval, thick, felt-like cocoons, which were outwardly encrusted and disguised with earth."

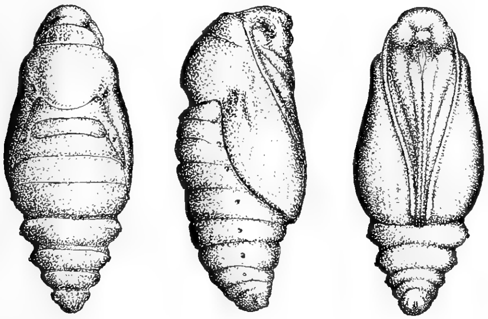

PLATE 17

Pupa of *Stibadium spumosum* Grt.
a. dorsal, *b.* lateral, and *c.* ventral aspect, enlarged X 3½.
Drawing by J. A. Comstock

Larvae are procurable in the fall when the sunflower seeds are maturing. They remain for a year in the chrysalis.

Many other lepidopterous larvae occur on sunflower, among which may be mentioned:

Chlosyne lacinia, of three forms, namely, *rufescens* Edw., *crocale* Edw., and *nigrescens* Ckll., the caterpillars of which may be found in the fall throughout the Imperial and Coachella Valleys, feeding on the leaves.

The best description of the life history of this species was published by W. H. Edwards in 1893.[5] Both the larva and pupa are extremely variable in pattern and color. Our Plate No. 18 illustrates the two extremes of pattern in the chrysalis.

PLATE 18

Pupa of *Chlosyne lacinia*, enlarged X 3¼.

Suleima baracana Kft., was reared from larvae boring in the upper parts of the stalks of *Helianthus annuus*. Our examples emerged in August, 1944. They were collected from sunflowers growing wild in fields near Van Nuys, Calif., and were taken at the same time that considerable numbers of the larvae of *Stibadium spumosum* were secured.

J. F. Gates Clarke recorded the habits and life history of this species in 1934[6] from examples collected at Pullman, Wash.

Along with the last named species a number of larvae of *Suleima helianthana* Riley were reared from borings in the stalks. These emerged on various dates in September, 1944.

Other species reported as feeding on or in sunflower, but not as yet recorded for California are: *Homoeosoma electellum* Hlst., in flower heads; *Eucosma rorana* Kft., boring in roots; and *S. cinerodorsana* Heinr., boring in stalks.

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PHLEGETHONTIUS RUSTICA Fabr. IN CALIFORNIA

(LEPIDOPTERA; SPHINGIDÆ)

By JOHN A. COMSTOCK

It is not generally known that the large black and white sphinx moth, *Phlegethontius rustica,* occurs in southern California.

Commander Dammers captured a freshly emerged example in the San Felipe wash, San Diego County, on August 19, 1936, and Don Meadows took a single specimen at Laguna Beach on August 15 of the same year.

Dr. Holland records its range as extending from the New England states, through the southern states, to Central America, and reports having taken it "not infrequently" in southern Indiana. Dyar reports it for the southern states and South America. Prof. Carlos C. Hoffmann, in the Anales de Instituto de Biologia, XIII: (1) 219, 1942, lists it as occurring in all parts of Mexico, from the coldest to the most tropical zones. E. Graywood Smyth states that it is a common species in the coastal arid regions of Peru. The Biologia Centrali Americana records it from numerous countries of Central and South America. It is obviously therefore one of the most widely distributed sphinges of the American continent.

Many papers have been published on the life history of the species, as will be noted in the bibliography at the end of this article. A black and white drawing of the imago, larva and pupa by Titian R. Peale was published in the Entomological News, Vol. 2, p. 192, 1892, and a colored plate by Ellison A. Smyth, Jr., together with descriptions of the egg, larva in various instars, and pupa, was published in the Entom. News, Vol. 11, pp. 485-488, 1900.

Eight mature larvae were collected by Lloyd Martin and the author on September 15, 1945. These were feeding on *Chilopsis linearis* DC. (Desert Willow) in Box Canyon, at the north end of Mason Valley, San Diego County. They pupated and emerged on various dates in April, May and June of the following year. Photographs were taken of the larva and pupa which are here reproduced as Plates 19 and 20.

The larvae are fairly easy to locate owing to the fact that *Chilopsis* usually grows in sandy washes where the ground is free of vegetation under and around the trees. The larval droppings are very conspicuous on the light colored sand and the caterpillars will be found directly above the freshest excreta.

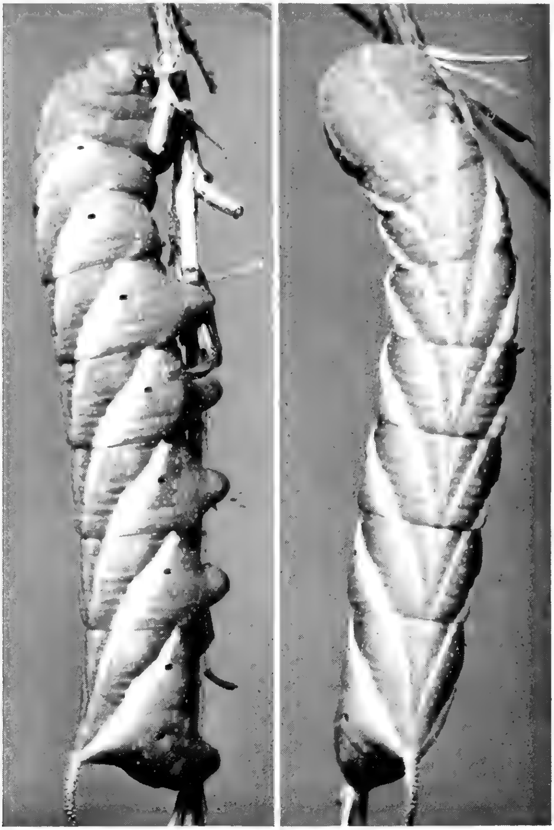

PLATE 19

Mature larva of *Phlegethontius rustica* Fabr., lateral and dorsal aspects. Figures slightly reduced .

The foodplants thus far recorded for *P. rustica* are:

Privet, lilac, heliotrope, crape myrtle, *Jasminium, Helianthus annuus, Callicarpa americana, Chionanthus,* and in South America, several species of the family *Anonaceae.* d'Almeida reports the larva feeding on *Verbena triphylla* in Brazil. Our record of *Chilopsis* is new.

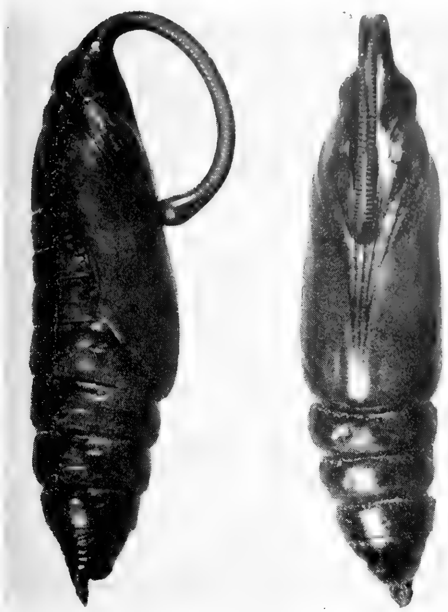

PLATE 20

Pupa of *Phlegethontius rustica* Fabr. natural size

The following bibliography is probably far from complete, but it gives the important works dealing with the metamorphosis of *Phlegethontius rustica.*

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AGARICUS VERSUS PSALLIOTA

By Louis Cutter Wheeler
Department of Botany, University of Southern California

The common edible mushroom, which has long been known as *Agaricus campestris*, has been referred to with increasing frequency as *Psalliota campestris*. The Nomenclature Committee of the British Mycological Society states that " . . chiefly owing to the use of works such as Ricken's *Blätterpilze* [1910-1915] and Rea's *Basidiomycetae* [1922], the name *Psalliota* has come into very general use in recent years, and is now found even in academic textbooks." (Wakefield 1940 pp. 290-291).

There is an obstacle to the use of *Psalliota*. Since Fries (1820) used *Agaricus* in a very inclusive sense, division of the genus into many genera by subsequent mycological writers was virtually inevitable. During this process of division *Agaricus* was abandoned by some authors, which is a violation of the provisions of the International Rules of Botanical Nomenclature, Article 51: "When a genus is divided into two or more genera, the generic name must be retained for one of them, or (if it has not been retained), must be re-established. When a particular species was originally designated as the type, the generic name must be retained for the genus including that species. When no type was designated, a type must be chosen according to the regulations given (Appendix I)." (Briquet 1935). Unhappily "Appendix I" has never been published. However, the criteria used are to some extent a matter of agreement especially among American authors who pioneered in the field of formal typification. See Wheeler (1943 pp. 457-458) for discussion and synopsis of literature.

Agaricus was applied by Karsten (1879) in a restricted sense, which might be taken as typification by implication since *Psalliota* Fr. and "Pratella Gill." are cited as synonyms of "Agaricus (Linn.) Karsten" (p. 483). *Agaricus* and *Psalliota* were acceptably typified by the same species (*Agaricus* or *Psalliota campestris*) by Clements and Shear (1931 p. 350), consequently these two genera are precisely identical nomenclaturally. The two genera thus typified being identical, and since *Agaricus* must be used for something, *Psalliota* must be relegated permanently to synonymy under *Agaricus*. This opinion is not without precedent. Hotson & Stuntz (1938) used *Agaricus* because of the provisions of Art. 51. The Nomenclature Committee of the British Mycological Society concurs with these statements: "There is no doubt that the name *Agaricus,* according to the current Rules, ought to have been retained when the group was divided, and there seem to be good reasons for applying it to the genus containing *Agaricus campestris* Linn. ex Fr., which may be chosen as lectotype . . . *Recommendation*: The majority opinion of this committee is that *Agaricus* should be typified by *Agaricus campestris* Linn. ex Fr. *Agaricus* Linn. ex Fr., with the date from 1821, will then be the valid name for the genus that includes the common mushroom, and need not be conserved against either *Psalliota* (Fr.) Quel. (1872) or *Pratella* (Pers.) S. F. Gray emend. Gillet (1874."

The attribution, of many authors, of *Psalliota* in generic rank to Fries, is an error even though it may be customary. If, as these authors imply, Fries published *Psalliota* as a genus at the same time that he published the genus *Agaricus*, the two genera would be likely to have different type species and, if so, both might be used, though not to include the same species. Fries (1820) divided *Agaricus* into several named series and divided the series into "tribes." Among these "tribes" was *Psalliota* (pp. 11 and 280). All the binomials under this, as well as under all the other "tribes" of *Agaricus*, begin with *A.* for *Agaricus*. Since Fries specifically stated (p. 280) the rank of *Psalliota* to be that of "Trib." and since the binomials under it begin with *A.* for *Agaricus*, it is obvious that Fries did not publish *Psalliota* as a genus. Dodge (1934) discusses the invalid custom of many mycologists of erroneously ascribing to Fries as genera the Friesian "tribes" of *Agaricus*, and Heim (1934 p. 16) defends it.

Although *Agaricus* was included in the list of "Nomina generica conservanda proposita" (Briquet 1935 p. 123) it was not, as supposed by some, conserved. The only action taken by the last International Botanical Congress concerning this list was to refer all the genera proposed in it for conservation to the appropriate Special Committee, in this case, for Fungi (Sprague 1936 p. 77 (15) (18)). Assuming typification of the genus by *Agaricus campestris*, conservation of *Agaricus* is entirely superfluous, and the effect of conserving *Agaricus* would be mainly to confer a sort of Torren's title on it since its use is already required by Art. 51. Violent exception to this simplification of the problem by typification will probably be taken by some authors who feel that the nomenclature of the fungi is particularly esoteric. In order to present both sides of the case it should be mentioned that, as noted by Wakefield (1940 p. 289): "The converse proposal, to conserve *Psalliota* Quel. against *Agaricus* Fr., was made by the late Professor Jaczewski in a list which was sent in too late for inclusion with the other proposals in the Rules. It was published by Briquet in his *Rec. Syn.* 1930, p. vii." It is wholly unlikely that Jaczewski's proposal will ever be accepted and the proposal is obviously an admission that *Agaricus* takes precedence over *Psalliota*.

The effect of Art. 13 (Briquet 1935), which provides that the order of categories sanctioned by custom must not be altered and that systems in which the customary order is violated are inadmissible, on Fries, *Systema* is uncertain. Since there seems to be no penalty provided for violation of this rule and no example of the application of the rule is known to the writer except where binomials were directly involved, it seems best to accept Fries' genera and species. It is pretty certain that mycologists would not tolerate the rejection of the entire work on the ground that it was an aberrant system of classification.

The exact meaning of Art. 20 (Briquet 1935) which specifies the dates to be taken for the commencement of the nomenclature of the various groups of plants is a moot question in the case of the following part: "(*f*) *Fungi caeteri.* 1821-32. (Fries, *Systema mycologicum*)." Ramsbottom (1934 pp. 314-315) has ably analyzed the three possible interpretations:

"(1) The date (*i. e.* year) is the important point.

(2) As in (1), but a start is not made until the mentioned work appears.

(3) The work itself is the important point, the date being significant only in so far as it specifies the work from which the nomenclature begins."

Ramsbottom favors the last interpretation, since, as he maintains, the beginning date was obviously derived from the work. Ramsbottom (in Anonymous 1935 p. 67) made a formal proposal to have Fries, *Systema* taken as the basis of the nomenclature of the "*Fungi caeteri*" with the emphasis on the work rather than the date. Dodge (1934 p. 709) made a diametrically opposed proposal favoring (1) of Ramsbottom's analysis quoted above. Martin (1943, p. 78) favors Dodge's proposal. Both proposals were, according to Sprague (1936 p. 77) referred to the Special Committee for Fungi which means that action on the matter is indefinitely postponed. If the rule is interpreted as meaning the date, Fries, *Systema* volume one, and all the genera (including *Agaricus*) and the species published in it were issued prior to the beginning date for the nomenclature of these fungi, which would mean that none of these names would be considered valid. Rogers (1941) presents fairly convincing evidence that volume one of Fries, *Systema* was published late in 1820. In addition to the evidence presented by Rogers is the (prepublication?) announcement of the work in Flora, Regensburg 3(2 No. 27): 426. 1820 (July 21) which supports Roger's contention. However, it is obvious that mycologists would not allow volume one of Fries, *Systema* to be excluded merely because of an error in the date of publication stated on the titlepage.

If 1821 were rigidly enforced as the beginning date the valid name for the concept otherwise known as *Agaricus* or *Psalliota* would be *Pratella* S. F. Gray (1821 p. 626) and the name for *Agaricus campestris, Pratella campestris* S. F. Gray, l. c.

SUMMARY

Agaricus is the valid generic name for *Agaricus campestris*. Conservation of *Agaricus* is unnecessary since the International Rules of Botanical Nomenclature, by the provisions of Article 51, require the use of *Agaricus* for something, and *A. campestris* is the type species which fixes the application in the customary sense.

The substitution of *Psalliota* for *Agaricus* is an error.

Fries, *Systema* volume one seems to have been published in 1820 rather than 1821 as stated on the title-page. If the *date* (1821) is deemed more important than the *work* (Fries, *Systema*) given by the Rules, Art. 20 (*f*), for the commencement of the nomenclature of the "*Fungi caeteri*," the nomenclature of the Agaricaceae will be further needlessly complicated since Fries, *Systema* volume one will be excluded.

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THE EUROPEAN BROWN SNAIL IN OAKLAND, CALIFORNIA

By WILLIAM MARCUS INGRAM
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The data included here were based on field and laboratory studies on the serious garden pest, the European Brown Snail, *Helix aspersa* Müller, in the gardens in Oakland, California. Lists of plants found to be eaten or ignored as food plants by the European Brown Snail are included. Additional information on this pest to that already available in North American publications concerning human-snail relationships, life history data, and behavior were gathered between January 1, 1941, and December 6, 1945. Basinger, 1923; 1931; 1940; Ingram, 1942; Lang and MacLeod, 1941; and Hanna, 1939).

The most generally comprehensive of the above publications is that by Basinger (1931); thus observations made by him were especially noted by the writer, to discover variations in the yearly life of the European Brown Snail. Because of numerous, not readily understood ecological factors, several of my observations differ from those of Basinger's (1931). This is not to be taken as criticism of his fine paper, but merely indicates that the responses of *Helix aspersa* Müller are apparently greatly varied. Thus these observations, as Basinger's, should be considered as adding general data, without specifically accounting environmental factors.

COPULATION AND NEXT LOCATION

Concerning copulation Basinger (1931) states, "During mating mutual fertilization takes place and both individuals may lay eggs." Mutual fertilization does not always take place, although it may be the rule. Pairs of *Helix aspersa* have been observed both in the field and in the laboratory where fertilization was not mutual, one individual acting as a male and the other as the female. Mating does not necessarily begin during the night as Basinger (1931) indicates when he states, "Mating requires from 4 to 12 hours, and begins during the night, but snails are often seen in coition in the morning because the process of fertilization was not completed before the presence of the day." The writer has observed eleven pairs start coition during the daylight hours. In three instances snail pairs were observed to start copulation between the hours of from one to three in the afternoon; these pairs continued into the night. The snails observed copulating in the field have continued coition between 6 and 9 hours. The length of coition in terraria was not recorded. Copulation in terraria in the laboratory took place at all hours, although pairs most commonly began the act during the hours of darkness.

Twenty-five egg masses were found in the field. With the exception of three, these were left undisturbed for specific life history studies not yet completed. The nests were generally found in the well-worked ground of cultivated areas; four were found in the loam soil of a creek bed. Grassy fields were avoided by snails about to lay eggs. Basinger (1931) states concerning the final concealment of the nest by snails on completion of egg laying, "As a final effort in concealing the nest, a quantity of excrement is placed on top, and the operation of nest-making and oviposition is completed." The writer found that a *Helix* may deposit from four to six fecal strings in a period of twelve hours after food has been removed. Snails in the act of egg laying quite naturally deposit fecal strings during the egg laying process and when they are scraping soil back into the egg cavity in the ground. It seems to the writer that no effort is made by the snail in depositing strings of fecal matter on top of a newly filled nest to conceal it. When strings do appear in such a position they are quite naturally deposited in the process of normal defecation.

BEHAVIOR

Helix aspersa is not strictly nocturnal; Basinger (1931), "The species is distinctly nocturnal. Occasional individuals may be seen moving about during the daytime, but they are the exception, for most snails leave their hiding places after dark and retreat before daybreak." In Oakland hundreds of individuals have been observed during the spring, autumn, and winter months slowly crawling about, idly distended, copulating, feeding, or depositing fecal strings during the daylight hours. It may be that during the daylight hours in Basinger's (1931) Southern California region one may not expect to find as many snails active in the daylight hours, because of a generally higher temperature and lower humidity; however, *Helix aspersa* is both diurnal and nocturnal in its movements. In fact a good many land snails which have been called distinctly nocturnal are qnite active during daylight hours, although it is quite true that they are not as obvious to collectors as those seen by a spotlight at night, because many tend to crawl beneath humus, logs, grass, or to move in deep forest areas and weedy fields away from the direct sun's rays. Ingram (1941).

SEASONAL AESTIVATION AND MOVEMENT

Enthusiastic gardeners in the region of the Mills College campus, Oakland, have observed that snail populations have decreased

1. I wish to thank Miss May Lee, Miss Barbara Merritt, and Miss Mary Isabelle Gifford for aiding me in making possible the laboratory observations on potential food plants of *Helix aspersa*.

by as much as from fifty to seventy-five per cent in garden areas during certain seasons. A question was often asked the writer, "If snails nearly disappear in the summer months why are our gardens so infested in the fall after the first rains or during moist summer days?" A part of the answer to this question was soon revealed locally and was reported by Basinger (1931) in his study in Southern California. During the dry summer months the snails aestivate. They do not feed extensively, and because of a cessation of activity gardeners do not observe them, although many are about in secluded garden areas. With the first rains when moisture is precipitated the snails come out from their hiding places and begin to feed in the garden. Thus there is a startling "overnight" invasion of a garden by snails that had secluded themselves during adverse weather conditions in the garden, but whose presence was not ascertained by the gardener.

Certain gardens were over-run more than others when snails appeared from aestivation with raised summer humidity or in the fall with the first rains. This happening called for further investigation to reveal possible "garden snail reservoirs." It was found that gardens with numerous low-lying plants, with dense upright ones, and with extremely broad leafed ones supported the greatest population of *Helix*. Plants notably sought after by *Helix* for a summer shelter were: low-lying mosses, ivy, wandering jew, dense privet hedges, calla-lilies, and petunias. Old lumber piles, loose flagstones, meter boxes, walls with overhanging tops, and the undersurfaces of window sills also provide shelter from the sun's rays and dry summer conditions. *Helix aspersa,* more than the native snails, needs a broad flat surface to seal its aperature to conserve the body moisture, for unlike the native snails, *Helix* rarely forms complete epiphragms. If a complete epiphragm is formed, the moisture conserving property is poor, for in *Helix* the epiphragm is extremely thin and fragile, while members of the common native Helicidae, Helminthoglyptidae, secrete relatively thick epiphragms; if sudden temperature changes bring about even drier weather it is not uncommon for the Helminthoglyptidae to secrete successive epiphragms to seal the aperture. Several species of *Helminthoglypta* have been taken with from nine to five epiphragms placed at the aperture of the shell. Ingram (1941).

By marking snails it was ascertained that from 50 to 80 per cent of the population of garden snails may move from certain gardens to more appropriate aestivating areas during the summer and fall months. Mortality among snails remaining in such gardens has been as high as 30 per cent of the population. Snails occupying newly landscaped gardens where plant shelter is not adequate and where general garden debris has not as yet accumulated have been observed moving into uncultivated plant areas during the start of dry periods. In this region *Helix* under favorable conditions avoids uncultivated areas, preferring to remain associated with the delicacies provided by the gardener on cared-for ground. On the resumption of moist weather snails have been observed to return to the gardens.

In an experimental garden plot forty-five marked snails were observed in their early summer and early fall movement. A stream whose banks were covered by grasses, poison oak, and grass and branch debris piles passed within fifty feet of this plot. The clay making up the stream bed remained moist throughout the summer and fall. With the onset of hot weather the marked snails moved as far as 300 feet from the experimental plot to take shelter in selected areas in the stream bed. The snails, reaching the moist clay bottom, did not all aestivate, but moved about; some in less favorable areas of the stream's banks sought shelter under plant debris piles and aestivated. Numerous fecal string masses found in the creek indicated that the active snails feed throughout the summer on uncultivated plants; these were undetermined.

RELATIONSHIP OF *Helix* TO CULTIVATED AND UNCULTIVATED AREAS

In the Mills College region of Oakland, *Helix* has not been observed to make any great attempts to establish itself in the "wild plant areas" bordering cultivated ones. In this respect the introduced *Helix* is not as adaptable as the common local native snails which, moving from native plant areas, have apparently adapted themselves well to planted and cultivated areas. Native snails found on the Mills College campus in cared-for plant areas are: *Haplotrema minimum* Ancey, *Helminthoglypta arrosa holderiana* Cooper, *Helminthoglypta diabloensis* (Cooper) and *Ariolimax columbianus* Gould. Ingram (1942). These mollusks, with the exception of the slug *Ariolimax,* have been commonly taken from under eucalyptus bark lying on the ground or from sprung bark attached to trees. All have been taken from beneath wandering jew, and from beneath brush piles, and stacked cord wood.

PLANT FOOD

To test certain plants found in Oakland that *Helix* might feed on, snails were brought into the laboratory and were placed in glass covered terraria filled with moist earth; some of the most readily available plants were added to the terraria from time to time. Three snails were placed in each of many terraria. The terraria were kept at room temperature. The feeding experiments were carried on from March 15, 1944 to December 6, 1945. Seventy-nine species of plants were tested. Of this number fourteen were fed upon with apparent relish (i. e., as lettuce is); eleven species were partially consumed; twenty species were merely nibbled at; and thirty-four species were not touched. The writer has found from several years of experience that land snails and slugs do not always "perform" consistently; thus it may be that certain of the plants listed here as eaten might on occasion not be fed on, and to the contrary, some of the plants not eaten might possibly be eaten on another occasion.

The tested species of plants are listed below in the above categories.

PLANTS MADE AVAILABLE TO HELIX ASPERSA FOR FEEDING

ACERACEAE—Maple family
Acer macrophyllum Pursh—Big-leaf maple (C)

AIZOACEAE—Carpet-weed family
Mesembryanthemum crystallinum L.—Ice plant (D)

ANACARDIACEAE—Sumac family
Rhus integrifolia B. and W.—Lemonade-berry (D)

APOCYNACEAE—Dogbane family
Vinca major L. (D)

ASCLEPIADACEAE—Milkweed family
Asclepias sp.—Milkweed (C)

BERBERIDACEAE—Barberry family
Berberis nervosa Pursh—Oregon grape (C)

BETULACEAE—Birch family
Betula fontanalis Sarg.—Water birch (C)

BORAGINACEAE—Borage family
Cynoglossum grande Dougl.—Western hound's tongue (C)

CARYOPHYLLACEAE—Pink family
Silene californica Dur.—Indian pink (C)

COMPOSITAE—Sunflower family
Agoseris hirsuta (Hook.) Greene (A)
Artemisia vulgaris discolor Hall, Var. *heterophylla* Jepson—California in mugwort (D)
Chrysanthemum segetum L.—Chrysantheum (C?)
Lactuca pulchella DC.—Wild lettuce (B)
Lactuca scariola L.—Prickle lettuce (B)
Picris echioides L.—Bristly ox-tongue (A)
Senecio fremontii T. and G. var. *occidentalis* Gray (C)
Senecio vulgaris L.—Common groundsel (D)
Taraxacum laevigatum (Willd.) DC.—Red-seeded dandelion (A)

2. In the plant list A stands for relished; B for partially consumed; C for nibbled at; D for not touched.

CONVOLVULACEA—Morning-glory family
Convolvulus luteolus Gray—Bindweed (A)
Convolvulus occidentalis Gray (D)
Convolvulus subacaulis Greene (A)

CRUCIFERAE—Mustard family
Brassica arvensis B.S.P.—Charlock (A)
Brassica campestris L.—"Common yellow mustard" (A)
Brassica nigra (L.) Koch.—Black mustard (A)
Capsella bursa-pastoria (L.) Moench.—Shepards purse (D)
Lepidium nitidum Nutt.—Common pepper-grass (D)
Raphanus sativus L.—Wild raddish (B)

DIPSACEAE—Teasel family
Scabiosa atropurpurea L.—Mourning bride (B)

ERICACEAE—Heath family
Rhododendron californicum Hook.—California rose bay (D)
Rhododendron occidentale Gray—Western Azalea (B)

EUPHORBIACEAE—Spurge family
Euphorbia sp. (D)

FAGACEAE—Oak family
Quercus agrifolia Nee—Coast live oak (D)

GARRYACEAE—Silk tassel family
Garrya fremontii Torr.—Bear bush (C)

GERANIACEAE—Geranium family
Erodium circutarium L. 'Her.—Red-stem filaree (D)
Geranium richardsonii F. and T.—Geranium (A)

GRAMINEAE—Grass family
Avena fatua L.—Wild oat (D)
Bromus carinatus H. and A.—California brome grass (D)
Bromus hordeaceus L.—Soft cheat (D)
Bromus rigidus Roth.—"Ripgut grass" (C)
Dactylus glomerata L.—Orchard grass (C)
Danthonia californica Boland—Oat grass (?) (D)
Elymus canadensis L.—Rye grass (D)
Elymus glaucus Buckl.—Western rye grass (D)
Festuca myuros L.—Rat's-tail fescue (D)
Hordeum murinum L.—Wall barley (D)
Hordeum nodosum L.—Meadow barley (D)
Lolium multiflorum Lam.—Australian or Italian rye grass (D)
Poa annua L. (D)
Poa pratensis L.—Kentucky blue grass (D)
Syntherisma sanguinalis (L.)—Crab grass (D)

Iridaceae—Iris family
Sisyrinchiumbellum sp. Wats.—Blue-eyed grass (C)

Juglandaceae—Walnut family
Juglans californica Wats.—Southern California black Walnut (D)

Labiatae—Mint family
Stachys bullata—Benth.—Hedge nettle (D)

Lauraceae—Laurel family
Umbellularia californica Nutt.—California laurel (D)

Leguminosae—Pea family
Cercis occidentalis—Torr.—Western red-bud (C)
Cytisus scoparius Link.—Scotch broom (B)
Medicago hispida Gaertn.—Burr clover (D)
Vicia exigua Nutt.—California vetch (A)

Liliaceae—Lily family
Brodiaea hyacinthina (Lindl.). Baker—White Brodiaea (D)

Malvaceae—Mallow family
Malva borealis Wallm.—Blue mallow (A)
Malva parviflora L.—Cheese-weed (C)

Papaveraceae—Poppy family
Eschscholtzia californica Cham.—California poppy (A)

Pinaceae—Pine family
Pinus radiata Don.—Monterey pine (D)

Plantaginaceae—Plantago family
Plantago lanceolata L.—Ribwort, English plantain (C)

Platanaceae—Plane family
Platanus racemosa Nutt.—Western sycamore (C)

Polygonaceae—Buckwheat family
Rumex acetosella L.—Sheep sorrel (D)
Rumex crispus L.—Curly dock (D)
Rumex occidentalis Wats.—Western dock (A)
Rumex pulchera L.—Fiddle dock (B)

Portulacaceae—Purslane family
Montia perfoliata (Donn.) Howell—Miners lettuce (A)

Primulaceae—Primrose family
Dodecatheon hendersonii Gray var.—Mosquito Bills (C)

SAPINDACEAE—Buckeye family
Aesculus californica (Spach.)—Buckeye (D)

SCROPHULARIACEAE—Figwort family
Digitalis purpurea L.—Foxglove (B)
Scrophularia californica Cham. (B)

SOLANACEAE—Nightshade family
Petunia parviflora Juss.—(B)
Solanum xantii Gray (C)

STERCULIACEAE—Sterculia family
Fremontia californica Torr. var. *mexicana* Jepson n. comb.—Flannel bush (B)

UMBELLIFERAE—Parsley family
Sanicula menziesii H. and A. Gamble weed (C)

VIOLACEAE—Violet family
Viola beckwithii T. and G.—Violet (C)

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