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Flight Characteristics of *Enoclerus lecontei*, *Temnochila virescens*, and *Tomicobia tibialis* in Central California

(Coleoptera: Cleridae, Ostomidae; Hymenoptera: Pteromalidae)

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Field experiments on the response of some predators and parasites of bark beetles to various chemical attractants (Rice, 1969) provided opportunities to observe diurnal flight patterns and flight ranges of these insects. Sex ratios of responding insects were also calculated. The predators *Enoclerus lecontei* (Wolcott) (Coleoptera: Cleridae), and *Temnochila virescens chlorodia* (Mannerheim) (Coleoptera: Ostomidae), and the parasite *Tomicobia tibialis* Ashmead (Hymenoptera: Pteromalidae), were studied at the Boyce Thompson Institute Forest Research Laboratory, Grass Valley, California, during 1965 and 1966.

All observations and experiments were performed in the Boyce Thompson experimental forest at elevations of 2,200 to 2,500 feet. The forest stand is comprised primarily of second growth ponderosa pine, *Pinus ponderosa* Lawson, intermixed with incense cedar, *Libocedrus decurrens* Torr., sugar pine, *Pinus lambertiana* Dougl., and Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco. Occasional stands of California black oak, *Quercus kelloggii* Newb. are also present. Prevailing winds during the summer months are generally upslope from the southwest, varying from 0 to 5 mph during the day.

Flying insects were normally collected in field olfactometers (Vité, Gara and Kliefoth, 1963) which were baited with chemical attractants or with bark beetles feeding in logs. Counts were made hourly and all insects collected were removed from the trapping area to avoid influencing later collections. For flight range and dispersal studies, the two predator species were marked by spraying the chilled, immobile insects with flourescent aerosol paints (Chapman, 1966) just prior to release.

Diurnal Flight Characteristics

Enoclerus lecontei (Wolcott).—Hourly collections of *E. lecontei* attracted to traps baited with male *Ips confusus* (LeConte) were made from sunrise until dark on several days during 1965 and 1966.

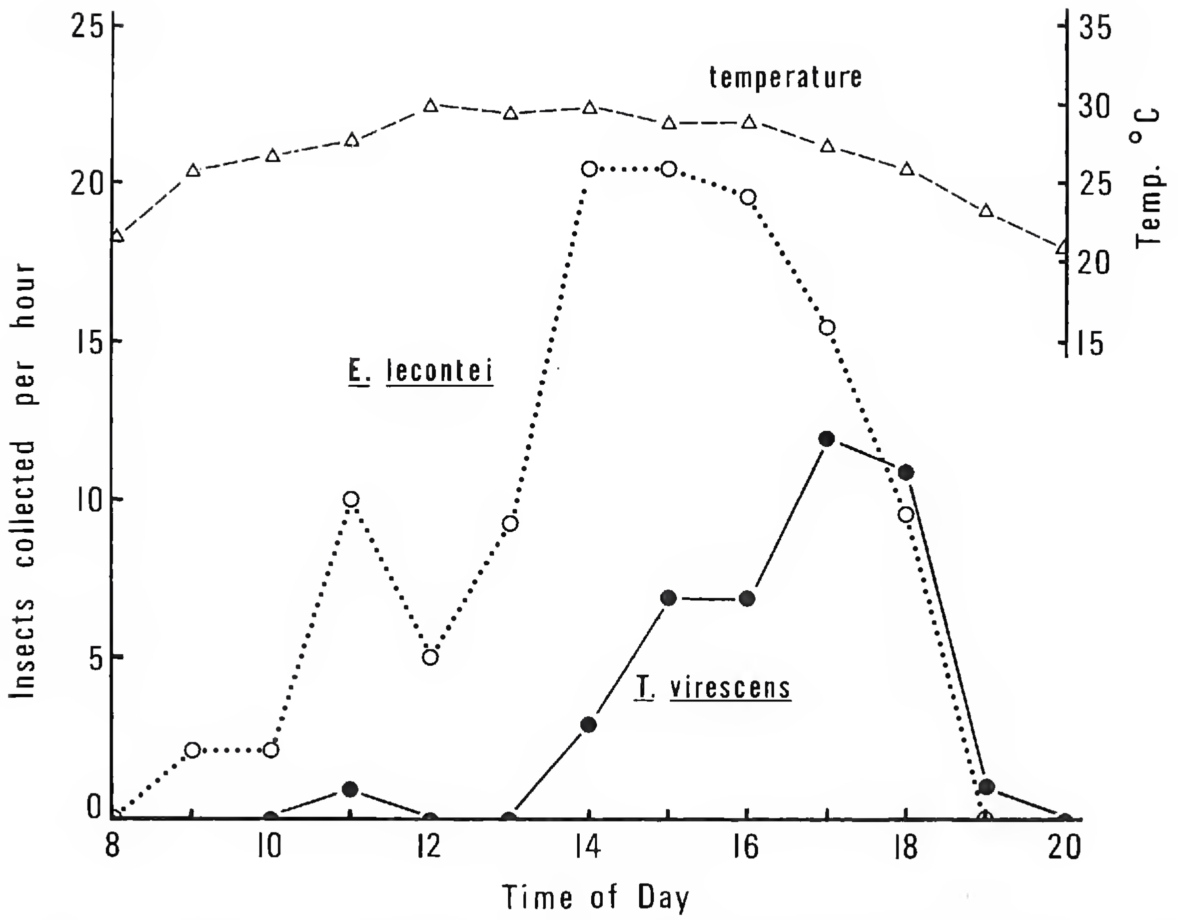

FIG. 1. Diurnal flight patterns of *Enoclerus lecontei* and *Temnochila virescens*. 28 August 1965; Grass Valley, California.

The diurnal flight pattern for *E. lecontei* (Fig. 1) is characteristic of the flights observed for this insect throughout the summer collecting periods. Flight normally started during morning hours when the temperature approached 23° C. The number of clerids collected would build up to a small peak at approximately 1100 hours then decrease toward midday. During the early afternoon clerid flight again increased and reached a maximum at approximately 1500 hours. The number decreased as sunset approached; by sundown very few *E. lecontei* were collected regardless of the temperature. Clerids were not collected after dark. During midsummer *E. lecontei* was collected at temperatures as high as 35° C. Minimum temperatures at which this predator was collected were in the range of 21° to 22° C. These collections occurred during midday in late October.

The sex of attracted *E. lecontei* was determined using the method of Berryman (1966). Of 116 clerids field-collected on 8 and 9 June 1966, 66 were males, 50 were females, for a sex ratio of 1.3 males to 1.0 female. A Chi-square test indicates that this ratio is not statistically significant however, and a 1:1 sex ratio should be expected.

Temnochila virescens (Mannerheim).—The collections from three olfactometers for one day were pooled in order to provide sufficient data on the diurnal flight of *T. virescens*. One olfactometer was baited with 200 *I. confusus* males in ponderosa pine logs, one with turpentine, and the third with *n*-heptane. The turpentine and heptane were placed in 50 ml beakers containing 40 ml of dry packed ponderosa pine sawdust soaked to saturation with the liquids.

A characteristic flight pattern (Fig. 1) is shown for *T. virescens*. During the two summers of field work at Grass Valley, only slight activity by ostomids was observed in the morning hours regardless of the temperature. The main flight during summer commenced at approximately 1400 to 1500 hours and reached a peak at about 1700 hours. Ostomids were often collected after sundown when temperatures remained high enough, but were not attracted to the traps after darkness.

In addition to the differing flight patterns shown by collections in olfactometers, the late afternoon and evening activity of *T. virescens* on bark beetle infested trees was considerably greater than that of the clerids. Infested trees were observed during these periods or at night with a flashlight. Ostomids could be found moving rapidly over the bark, while clerids were seldom seen after sundown except when hiding under bark scales. Clerid activity on trees was greater during midafternoon and seemed to decrease starting at about 1700 to 1800 hours when the ostomids' greatest flight occurred. Activity of ostomids on the olfactometers was similar to that observed on trees. *Temnochila virescens* attracted to traps during the early afternoon would often seek a crack or hole where they could hide and would then come out after midafternoon and begin feeding on bark beetles lying on the apron of the olfactometer.

Temnochila virescens had previously been observed in flight at temperatures between 24° to 34° C (Gara and Vité, 1962). This predator was collected during this study at temperatures ranging from 21° to 35° C. Overwintered adults collected in the early spring would commence flight when temperatures rose above 21° to 22° C regardless of the time of day. This resulted in peaks of flight during midday rather than in the late afternoon as with adults which emerged during the summer.

The sex of *T. virescens* collected in *Ips confusus* baited olfactometers during portions of the 1965–66 seasons was determined using the method of Struble and Carpelan (1941). Of 760 ostomids sexed, 386 were males, 374 were females, for a 1:1 sex ratio.

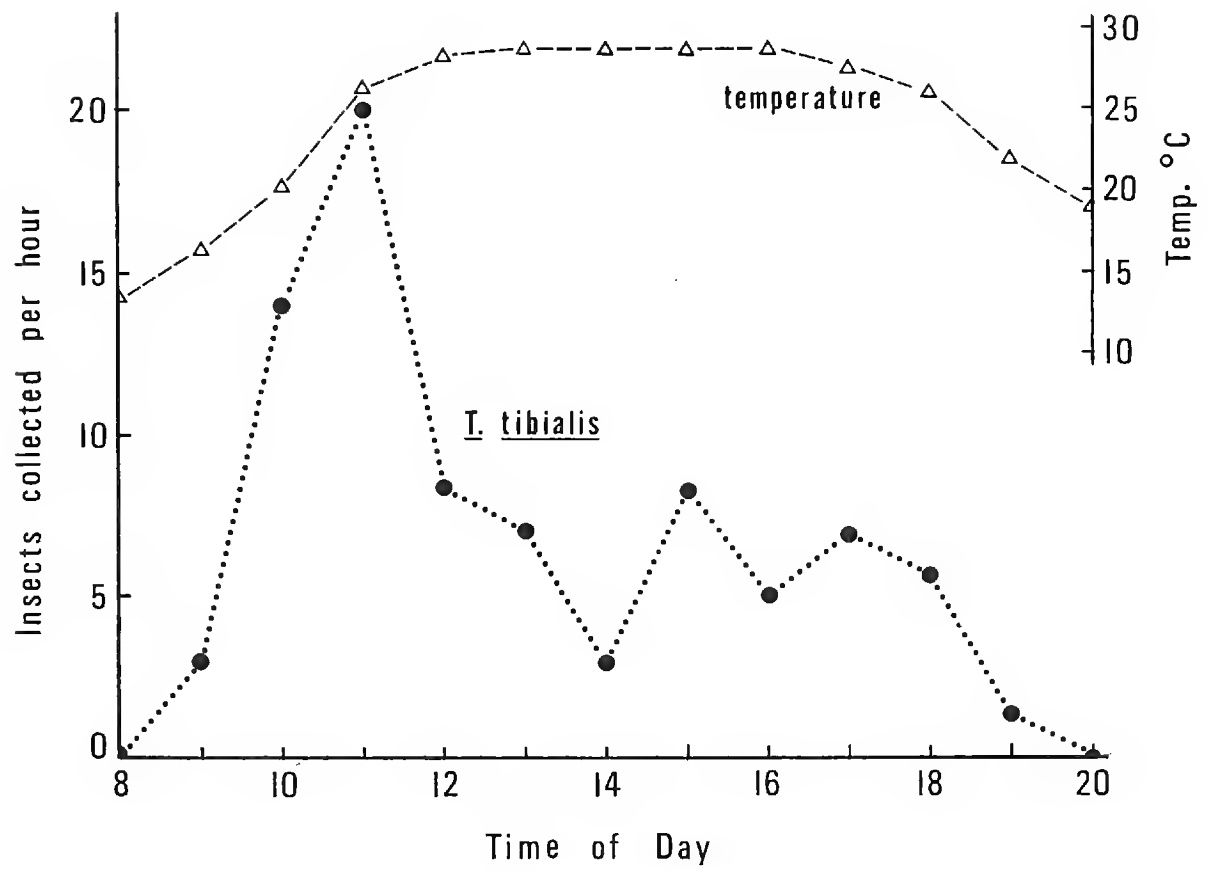

FIG. 2. Diurnal flight pattern of *Tomicobia tibialis*. 7 October 1965; Grass Valley, California.

TOMICOBIA TIBIALIS Ashmead.—The diurnal flight pattern of this parasite was determined by baiting field olfactometers with male *Ips confusus* feeding in ponderosa pine logs. No significant seasonal changes or deviations from the typical flight pattern (Fig. 2) were observed in the field during 1965 and 1966.

The data indicate that *T. tibialis* is capable of initiating flight at approximately 16° C. The number of parasites collected increased with temperature until approximately 1000 to 1100 hours. After this time the numbers collected each hour decreased, reaching the zero point at approximately sunset each day. The sharp midday decrease in collections (Fig. 2) was apparently not due to high temperatures, as similar drops in numbers of responding *T. tibialis* were observed when midday temperatures were only 22° to 23° C. Also, low numbers of the parasites were often collected when midafternoon temperatures were in the range of 33° to 34°C.

It was observed that *T. tibialis* tended to leave the smooth surfaces of the olfactometers as late afternoon approached even though attractive odors were still being emitted. Although these insects were often observed on mass-attacked logs during late afternoon and evening, they

TABLE 1. Changes in the sex ratio of *Tomicobia tibialis* Ashm. collected at different seasons of the year. Grass Valley, California.

Date		Number Collected	Ratio of *T. tibialis* males : females
1965:	Sept. 13	150	1.00 : 2.96
	Oct. 8	106	1.00 : 2.54
1966:	May 20	72	2.42 : 1.00
	24	64	2.54 : 1.00
	June 11	42	1.34 : 1.00
	27	138	1.00 : 1.38
	July 19	62	1.00 : 1.22
	Sept. 22	35	1.00 : 2.51

were usually gone from the traps by shortly after sunset. However, they would begin returning by dawn if the temperature was above 16° C.

The sex of *T. tibialis* attracted to *Ips confusus* males was determined on several occasions during this study (Table 1), and showed a striking shift in the ratio between the spring and fall collections.

SEASONAL OCCURRENCES OF PREDATORS AND PARASITES

Temnochila virescens overwinters as an adult and begins flight in the spring with the onset of warm weather (Struble, 1942). This predator

TABLE 2. Summary of predator dispersal studies, Grass Valley, California. 1965 and 1966.

Date Released		Temp. ° C[1]	No. Predators Released	No. Predators Re-captured	Date Recaptured	Distance from Release (m)
1965:	Aug. 31	25 ± 1	120 *T. virescens*	2	Sept. 1	31
				3	Sept. 2	31
				1	Sept. 3	122
	Sept. 11	17 ± 7	75 *T. virescens*	1	Sept. 15	229
				1	Sept. 22	229
				1	Sept. 23	229
1966:	May 2	28 ± 1	356 *T. virescens*	12	May 3	101
	Aug. 9	27 ± 7	140 *T. virescens*	1	Aug. 10	490[2]
			75 *E. lecontei*	1	Aug. 10	2094
	Aug. 19	23 ± 8	45 *T. virescens*	1	Aug. 20	730
			40 *E. lecontei*	1	Aug. 20	730

[1] Daytime temperature mean and range while olfactometers were operating.
[2] Recaptured downwind from release point; all others upwind.

and six species of bark beetles were observed at Grass Valley in flight and on a mass-attacked log on 31 March 1966. *Temnochila virescens* was subsequently collected in baited traps throughout the spring and summer until mid-October with no complete break in continuity.

Enoclerus lecontei was first collected on 3 May 1966, approximately 5 weeks after the first collections of *T. virescens*. This late emergence and flight probably affects the overall efficiency of *E. lecontei* as a natural control agent on scolytids because this predator is absent during the first bark beetle mass attacks in the spring. Collections of *E. lecontei* continued through October, when trapping was terminated in both 1965 and 1966.

Tomicobia tibialis was collected in olfactometers on 4 April 1966 and thereafter until late October. The number of parasites collected started to decrease sharply from about mid-September on as the maturing larvae began to enter diapause (Bedard, 1965) resulting in fewer numbers of emerging adults.

Predator Dispersal

Several releases of marked predators were made to study the long-range dispersal of the two species. Predators marked with different colors of spray paint were released at varying distances from olfactometers baited with *n*-heptane, monoterpenes and *Ips confusus* males in ponderosa pine logs. The released beetles were placed either on logs or on a 2 ft^2 canvas in direct sunlight and were allowed to fly at will. The results of the dispersal studies are given in Table 2.

It is apparent from these data that movement in the forest of both *T. virescens* and *E. lecontei* can be fairly rapid under favorable weather conditions. Most of the studies were made when daytime temperatures were averaging well above the minimums for good predator activity. Under marginal temperature conditions however, such as experienced following the 11 September 1965 release, movement is much slower, and at least *T. virescens* is capable of remaining in the release area for several days until conditions for flight improve.

Discussion

The three insect species considered in this study are often directed, in response to their various attractants, to exactly the same host location. As a result it might be predicted that a high degree of interspecific competition for hosts could exist between these species. However, it was shown by this study that the diurnal flight characteristics, daily activity rhythms on trees, and response to environmental factors (such as temperature) of the two predators and the parasite differ considerably. These behavior patterns would tend to separate the three species, thereby reducing competition among them. It would also seem to increase their combined effect on their common scolytid hosts, in that at least one of the three species is actively flying and searching for hosts at any given time of day, given suitable temperatures.

The flight distance-time relationships shown by the two predators were not too unexpected, as both of these species are strong, active fliers. It was somewhat surprising though to find that *T. virescens* would apparently stay in the release area as long as it did (up to 12 days), even under relatively cool temperature conditions.

The reasons for the seasonal shift in the sex ratio of *T. tibialis* are not known at this time. In the way of conjecture, it might be surmised that this is a simple case of arrhenotoky, such as occurs among many other parasitic Hymenoptera. Because of the preponderance of females in the population in the fall, as shown by the data, it would seem logical to assume a similar dominance of diapausing female prepupae in the winter, and female adults in the first spring generation. Relatively low numbers of males in the spring would then tend to let many females go unmated, resulting in a greater proportion of males in the second generation. Such seems to be the case, as shown in the May and early June collections. As the season progressed, however, more females would become mated, resulting in the shift in the late summer and fall back to greater numbers of females. That such a system of parthenogenesis is in fact operating in *Tomicobia tibialis* should be studied in greater detail both in the field and laboratory.

Acknowledgments

Appreciation is expressed to the Boyce Thompson Institute for providing facilities and financial support for this work, and to Dr. G. B. Pitman and Dr. J. P. Vité of the Boyce Thompson Institute, and Dr. F. E. Strong, University of California, Davis, for their many helpful suggestions during these studies.

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Insect Distribution Studies II

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Behavior of any species of insect or other organism when introduced into a new territorial environment is often, but not always, inconsistent with its previous history. A careful study of distributional data along with behavioral phenomena of introduced insects is at the same time very interesting and frustrating. When conclusions are reached, although these can be only tentative, they may be helpful in learning to live with the introduced pest species.

An earlier study (Allen, 1963) analyzed the history of olive scale in the United States, and included essential background material applicable to this and future efforts. This paper will attempt to bring up to date the history and distributional patterns of several more introduced insects. Coverage will be limited to California. This will not be so lengthy as the work on olive scale; partly because the patterns seem less complicated, and partly in the interest of covering more species. Species to be considered here are unrelated but have the following in common: (1) They have all been introduced into California within the last 75 years. (2) They have attracted considerable attention as actual or potential plant pests. (3) They have been in California long enough that a pattern is discernible.

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Collection records of the California Department of Agriculture, and personal observations in the field, are the primary sources of this material. These are supplemented with records as they appeared in current literature. Information and advice from many Agricultural Commissioners, Farm Advisors, coworkers and other friends are gratefully acknowledged.

GRAPHOLITHA MOLESTA (Busck) (oriental fruit moth)

Introduced into the United States sometime prior to 1915, oriental fruit moth gradually spread to all peach-growing areas east of the Rocky Mountains (Metcalf and Flint, 1962). This oriental pest of rosaceous fruits also occurs in Europe, Australia, North and South America. It is known primarily as a pest of peaches, doing serious damage by mining the twigs and burrowing in the fruit. It is a small olethreutid producing one to seven generations per year.

The first collection of oriental fruit moth in California was in Orange County late in 1942. Subsequent intensive survey efforts disclosed light infestations in neighboring Los Angeles, Riverside and San Bernardino counties early in 1943. Before the end of that year collections in Kern, Tulare, Stanislaus and Sutter counties precluded any possibility of an eradication program which had been considered. Continued intensive survey through the 1945 season added Kings, Fresno, Sacramento, Placer, Merced and Santa Clara counties. Some of the collections were single adult specimens from infestations so light that no more were taken until years later. Meanwhile oriental fruit moth was found for the first time in Colorado, Idaho, Oregon and Utah.

Until 1954 the pest was all but forgotten, although occasional collections of strays came from the southern counties. Large scale liberation of the introduced hymenopterous parasite *Macrocentrus ancylivorus* Rohwer may have helped to keep the population to a minimum. Somewhat contrary to expectations, the parasite became established and has persisted in some native host larvae, apparently from the last releases in 1946 to the present.

In 1953 bait trapping in Tulare, Fresno and Merced county orchards known to be infested several years earlier produced no specimens. But late in the 1954 season the first heavy outbreak in the state appeared at Kingsburg, involving Fresno, Kings and Tulare counties (Summers *et al.*, 1956). Oriental fruit moth then spread throughout the peach-growing portions of these three counties becoming heavy and general by 1961. Riverbottom lands suffer much the worst in these counties, with peaches some distance from major streams consistently being only lightly infested.

Fifteen years after collection of a lone adult at Denair, Stanislaus County, oriental fruit moth appeared northeast of Modesto in 1958. The following year it was troublesome. Infestation around neighboring Escalon, San Joaquin County, was very heavy in 1963. Spread through Madera and Merced counties also had occurred, so that 1963 was a bad year throughout the San Joaquin Valley, including Kern County.

A similar pattern, centering around Gridley in Butte County, developed in the Sacramento Valley. Infestations apparently followed the channels of fruit movement, developing from the first collection about 1958 to major proportions in 1962–63. This center also involves peach-producing areas of Tehama, Sutter, Yuba, Placer and Sacramento counties.

Apparently oriental fruit moth now occupies most of its potential territory in central California, and has belatedly fulfilled expectations as a major pest of deciduous fruits, especially peaches.

Elsewhere, especially nearer the coast, oriental fruit moth so far has not appeared or has been negligible. There are scattered collection records from San Diego, Santa Barbara, Monterey, San Benito, Santa Clara, San Mateo and Colusa counties.

PARAMYELOIS TRANSITELLA (Walker) (navel orangeworm)

The taxonomic history of this phycitid moth dates from 1863, while a summary of distributional records indicates its occurrence from the southern United States to central South America (Heinrich, 1956). Attention was attracted in southern Arizona in 1921 by the larvae working in navel orange fruits. Although infestation was almost entirely limited to splits, fungus-infected or other previously damaged fruit, California authorities issued a Quarantine Circular against Arizona citrus. This was in effect from 1922 until 1930, when navel orangeworm was decided to be only a scavenger and the restriction lifted. Many other hosts are recorded. These could be summarized as almost any damaged, overripe or mummified fruit which is neither too wet nor too dry.

First California collections of navel orangeworm in Orange County late in 1942 attracted little attention. Adults appeared frequently during the next three years in diamalt bait traps used in large numbers for oriental fruit moth. Larvae were noted in their normal role as scavengers. Earliest records for Los Angeles, Riverside and San

Bernardino counties came in the summer of 1943; for Imperial and San Diego, in February 1944.

First indications of navel orangeworm as a serious pest came with a few collections in walnuts in Ventura and Santa Barbara counties in late 1947. The only previous record in walnut was in Orange County in 1943. The known host range was extended to include almonds in the Antelope Valley of Los Angeles County early in 1948.

Appearance of navel orangeworm at Fresno in late 1948 was followed by a survey which disclosed it in mummy fruits and walnuts at a few scattered locations, but not of general distribution. By 1949 it was spreading rapidly and recognized not only as a walnut pest, but threatening to almonds. New county records during that year were Tulare, Kern, Madera, Merced, Stanislaus, San Joaquin, Sacramento, Tehama, and Contra Costa. In the latter county it did not reach the walnut orchards in the western portion for several more years. In the Sacramento Valley, fill-in was rapid.

With minor exceptions, all walnut- and almond-growing areas in California are now considered infested, with greater damage to almonds in the more northern counties. Navel orangeworm is reported as of little importance in Yolo and Shasta counties. It often penetrates walnuts through codling moth entrance holes.

Central coast counties from Santa Cruz to San Luis Obispo are uninfested or practically so. No records from the north coast counties are known. Thus an insect known only as a scavenger has developed into a serious pest of walnuts and almonds in a 20-year period (Wade, 1961).

Potentialities of navel orangeworm as a citrus pest may have been discounted too early. Substantial losses of navel oranges due to larval infestation were reported late in 1969 from Oroville, Butte County, and Gustine, Merced County.

RHAGOLETIS COMPLETA Cresson (walnut husk fly)

Walnut husk fly, a serious pest of walnuts and occasionally found in late peaches, apparently is native to the Great Plains states (Boyce, 1934). It has a definite preference for soft-hulled over hard-hulled walnuts, with the soft blacks an important factor in population build-up and spread. Walnut husk fly first appeared in California in the Chino-Ontario-Pomona area in the fall of 1926, and soon became established as a troublesome pest. Early collection records indicate that it reached Riverside County in 1930, Orange County in 1937, and San Diego County in 1939. Some climatic limitation appeared to be in operation, for walnut husk fly was not found in Ventura County until the fall of 1948.

The appearance of an infestation in Somona County, 300 miles farther north, in late 1954 seemed to justify an eradication attempt. This was unsuccessful. During 1957 the fly not only reached adjoining Napa County, but appeared in distant Santa Clara, Stanislaus and Merced counties. Collections in Santa Barbara County beginning in 1956 perhaps were the result of natural spread from Ventura.

Extension over the remainder of the state has been gradual, but by no means consistent. Populations in Merced County were heavy in the late 1950's, but with an abundance of effective traps in operation each season, the fly was not collected in Madera, Fresno, or Tulare counties until 1963 or 1964, or in Kings County until 1965. Infestations in Fresno, Kings and Tulare counties are still scattered and light. In Kern County, midway between heavy infestations of long standing, walnut husk fly has not yet been found on the floor of the San Joaquin Valley. Several collections were taken 1955–1957 in fringe and mountainous areas on both sides, including Bodfish, Tehachapi, Caliente, Frazier Park, and Maricopa.

Extension into some northern California counties may have been from either south or north, since walnut husk fly appeared in Oregon for the first time at Medford, in 1963. Although some more or less isolated walnut plantings seemingly have escaped infestation so far, there are now collection records from nearly all California counties where walnuts are grown. Trinity and Inyo seem to be exceptions. Tehama County, with considerable walnut acreage and a diligent trapping program, did not produce a collection record until September 1968. Northern county records vary from recent collections of a few stray adults (Del Norte, Siskiyou, Humboldt, Lassen, Shasta, Glenn, Colusa) to fairly heavy though spotty infestations of several years' standing (Butte, Lake, Mendocino). Sierra foothill counties from Fresno to Sierra all have light to heavy infestations in the lower portions where there is host material.

Of special interest are numerous collections of adult walnut husk fly under seemingly impossible conditions, and 50 or more miles from any possible host material. Adults are wanderers and strong fliers, but no explanation is offered for their presence in high mountain and desert areas. The most striking records, all since 1961, are: Coleville, Mono County; Markleeville and Fredericksburg, Alpine County; at 7,200 feet on the Sonora Pass Highway, and at 7,500 feet on the Tioga Pass Highway in Yosemite National Park, Tuolumne County. The latter collection was repeated at the same location after a two-year interval. The upper limit for black and English walnuts at these latitudes is about 3,000 feet.

Cnephasia longana Haworth (omnivorous leaf tier)

The earliest American appearance of this European tortricid moth was in 1929 in the Willamette Valley of Oregon, from whence it spread over a large part of western Oregon and southwestern Washington (Edwards and Mote, 1936). Young larvae mine leaves; older larvae spin loose webbing and generally feed on growing foliage tips, and flowers. The host list is almost interminable, but strawberries have been the only fruit seriously attacked. There is but one annual generation. Eggs and young larvae spend summer, fall and winter in crevices of bark, cracks in posts and similar places. Small larvae are wind-dispersed on threads in early spring. This accounts for infestations being heaviest near trees, fences, and wooden pole lines.

Omnivorous leaf tier first was recognized in California in the spring of 1947 near the Stanford University campus. Obviously this appearance was due to introduction rather than to natural spread. In this portion of San Mateo County it did considerable damage to flax. The following year the known range was extended northward to San Francisco, with serious losses to flower growers in the Millbrae area (Middlekauf, 1949). In the early summer of 1949 large strawberry plantings near Sunol, Alameda County, were heavily infested, with considerable fruit being unmarketable (Allen, 1952). About the same time omnivorous leaf tier appeared in strawberries and numerous flower hosts from Santa Cruz southward into northern Monterey County. For several years there were apparently two separate infestations, centering around San Francisco and Monterey bays, respectively. Careful inspection up to 1950 indicated the northern and eastern limits to be Petaluma in Sonoma County, Napa in Napa County, Rockville in Solano County, and Livermore in Alameda County.

Considering the great abundance of host material, and the history in Oregon, 20 years have not added greatly to the known distribution of omnivorous leaf tier in California. There have been no outbreaks approaching those of 1948–49. Strawberry growers have had some sporadic trouble, but now keep this moth completely in check with insecticides. The moth obviously requires a coastal climate and is unlikely to move farther inland, although it occurs farther inland in Oregon. Failure to extend its range appreciably up and down the coast is less understandable. The two original infestations came together some years ago in Santa Clara and Santa Cruz counties. Recent surveys in wild flowers indicate that continuous infestation extends no farther than Healdsburg in Sonoma County, Oakville in Napa County, San Juan Bautista in San Benito County, and Greenfield in Monterey County. However, stray collections have been taken at Stafford 14 June 1960 and Loleta 25 May 1965 in Humboldt County, and at Edna 28 April 1967 in San Luis Obispo County.

CEUTORHYNCHUS ASSIMILIS Paykull (cabbage seedpod weevil)

This small gray European weevil in the larval stage is destructive to cruciferous seed crops. The first North American record (1931) was in the heart of the major cabbage seed-growing area in Washington state, and subsequent losses were sometimes of major proportions (Hanson *et al.*, 1948). Rapid spread is augmented by the general abundance of wild hosts, particularly mustards and radishes. Subsequently the weevil appeared in Idaho and Oregon.

Appearance of cabbage seedpod weevil in the San Francisco Bay region in the mid-1940's was obviously due to an introduction (Hagen, 1946). Infestation in Del Norte, western Siskiyou and northern Humboldt counties by 1950 probably was the result of natural spread from Oregon. The earliest California record is Brentwood, Contra Costa County, May 1945. By 1950 the weevil had spread to include parts of Marin, Sonoma, Napa, Solano, Sacramento and Yolo counties. Movement southward in the San Joaquin Valley ended with very light populations in Merced County. Attempts to repeat collection of the species at Santa Rita on Highway 152, based on a stray adult taken in May, 1950, have been futile. Apparently the line has held ever since.

Cabbage seedpod weevil spread farther southward in coastal counties, including Santa Clara and northern San Benito, but reached a temporary limit for some years in the vicinity of King City, Monterey County. In 1956, what appeared to be a local infestation developed near Arroyo Grande, San Luis Obispo County. The earliest Santa Barbara County collection record is from Gaviota in 1961. Distribution gaps in intervening coastal territory gradually filled in. Careful survey in the spring of 1967 indicated that the distribution of the weevil was continuous as far south as Ventura and Sespe in Ventura County, where it abruptly terminated. However, there are collection records from Buena Park and Fullerton in Orange County, 50 miles farther southeast, dated early 1965; there are none from Los Angeles County.

Since populations in central coast counties and in Washington have been heavy, rapid and thorough occupation of intervening territory would be logical. This has not been the case. After 20 years, distribution is more or less continuous through the north coastal counties, but populations are not heavy. The weevil is continuous northward in the Sacramento Valley only to Marysville and Yuba City. Numerous efforts have turned up but a few isolated collections in Lake, Butte, Tehama and Shasta counties, and none in Colusa or Glenn. The weevil has penetrated the Sierra Nevada foothills, with collections recorded from western Nevada, Placer, Amador, Calaveras and Tuolumne counties.

Cabbage seedpod weevil activities in California are now of little more than academic interest. Growers of cruciferous seed crops in the central coast area have had sporadic trouble with this weevil in past years. Acreages of these crops have declined, and those remaining are well protected with insecticides.

Lepidosaphes ficus (Signoret) (fig scale)

Fig scale, probably of Mediterranean origin, is thought to have been introduced into California at Fresno in 1905 on fig cuttings from Algeria (Simmons *et al.*, 1931). It spread very slowly, the known infestation having a radius of less than a mile in 1917. By 1931 it had spread some 60 miles to the southeast. The pest gradually spread over the east side of the San Joaquin Valley from Stockton to the Kern County line. Fig scale is usually found on the leaves, twigs and fruit of figs, but there are a few records for elm and walnut. Dispersal beyond those geographical limits has been almost negligible, although there is no lack of host material in most parts of the state. Fig scale was not found in Bakersfield until 1952, and it never has been a problem in Kern County. Although continuous on the east side, fig scale never has been found on the west side of the San Joaquin Valley.

Within these limits fig scale apparently spread slowly but surely, and became a serious pest where host material was contiguous. This accounts for the spread and build-up in the fig-growing portions of Fresno, Madera, Merced, and Tulare counties. It seems unable to move more than very short distances unless carried. Occurrences of fig scale outside the contiguous area are limited to very small widely scattered spot infestations. A few specimens were taken on a ranch in central Santa Clara County in 1939. However, a thorough search of the locality in 1966 indicated that the scale had disappeared completely. A small infestation found at Orland, Glenn County, in 1947 persists but has spread little in 20 years. Fig scale was found in San Diego County as early as 1941. By 1953 there were infestations of minor significance in Vista, Carlsbad, and Escondido. About the same time, specimens were taken at three locations in central Orange County. In the city of Sacramento, two small separated infestations appeared in 1964. An isolated fig tree in the mountains above Jackson, Amador County, was found to have fig scale in 1960.

Infestation of figs in the central San Joaquin Valley was generally heavy and troublesome during the 1930's and 1940's. Since 1950 populations have lagged, although occasional local outbreaks have required insecticides. A logical explanation for the decline is the introduction of a hymenopterous parasite, *Aphytis* sp., in 1949 (Doutt, 1954). Previous attempts to establish parasites were unsuccessful, but this one soon began to produce results.

There may be some climatic limitation on the spread of fig scale out of the San Joaquin Valley. Sporadic outbreaks in its present range are to be expected, but the presence of effective parasites may keep it below economic levels.

ASTEROLECANIUM ARABIDIS (Signoret) (pit-making pittosporum scale)

Of European origin, this pit-making scale is also known in several eastern states. The earliest American record is in 1925. The mature scale is small, convex, creamy-white to tan, with a delicate white fringe around the margin. The host list is very diverse, but only a few common hosts will be considered here. Conspicuous symptoms of infestation are pitting, swelling, and distortion of the host plant.

Two separate patterns of distribution in California must be considered: in native and in cultivated hosts. Deerweed, *Lotus scoparius* (Nutt.) Ottley, a common native legume, is not the only wild host but is the most important one. Cultivated hosts include a great diversity of families and species, usually grown at a considerable distance from wild hosts.

The earliest official collection of *A. arabidis* in California was in western Contra Costa County on deerweed in 1940 (Essig, 1945). Later surveys disclosed infestations on the same host in Alameda, Marin, San Mateo, Santa Clara and Santa Cruz counties. *A. arabidis* was found at Stockton in 1944, seriously damaging *Pittosporum tobira* Aiton (the most commonly infested cultivated host) and privet (*Ligustrum* sp.). Small scattered infestations in cultivated hosts were found in Alameda, Contra Costa, Marin, Napa, Santa Clara, Solano and Sonoma counties by 1950. Only at Stockton has infestation in cultivated hosts become widespread, and privet attacked to any extent. From 1944 to the early 1950's most *P. tobira* and privet in that city were badly distorted from scale infestation. There are no known wild hosts in the vicinity.

Deerweed is a common shrub in the Coast Ranges, from Humboldt County to the southern end of the state, and somewhat less abundant in the Sierra foothills. Occurrence of pit-making scale on this host is rather general from the Mendocino-Sonoma county line south to the Carmel Valley in northern Monterey County. Although the distribution of host material is continuous there are no records from coastal areas farther south, excepting one on cultivated *Pittosporum tobira* at Paso Robles, San Luis Obispo County, in 1963. Scattered Sierra foothill records on deerweed, mostly dating back many years, include El Dorado, Amador and Mariposa counties.

Infestation in cultivated plants has been of much concern because of the severity of damage and the wide host range. Early records in San Joaquin and the bay counties were followed by collections in the counties of Sacramento, 1947; Yolo, 1948; Tulare, 1948; Tuolumne, 1951; Fresno, 1951; El Dorado, 1952; Butte, 1956; Yuba, 1956; Sutter, 1959; Mendocino, 1960 and Glenn, 1969. While in mountain counties infestation could have spread from native hosts, those on the valley floor probably resulted from movement of scales on cultivated host material. Only infestations in established plantings are here considered; many collection records and a greater host list could be reported from nursery surveys. Large gaps in the distribution within the San Joaquin Valley have been partially filled with collections in the counties of Stanislaus, 1958; Kern, 1965, and Kings, 1969. There are no records from farther south.

Although no effective parasites are known, pit-making scale has declined sharply in recent years. Infestations are much less common and severe, even in Stockton. Good trimming and treatment of infested shrubs greatly reduce severity, and sometimes seem to eliminate the scale. Present infestations in cultivated hosts, however severe, are spotty and scattered. There is no satisfactory explanation for the means of dispersal, the geographic limits or the current decline of this species. Pit-making scale is a pest which might get out of control at any time.

Lecanium kunoensis Kuwana (kuno scale)

Although kuno scale was not described until 1907, from Japanese material, early authorities reported what undoudtedly was this species in the Oakland hills in 1896 (McKenzie, 1951). Principal hosts are rosaceous, especially plum, peach, apple, pear, quince, cherry, almond, hawthorn, and *Cotoneaster*. There are records on English walnut, and California buckeye (*Aesculus californica* (Spach) Nutt.). Kuno scale builds up heavy populations, produces honeydew, and causes serious loss of tree vitality.

Kuno scale is known to occur only in Japan and California. Delimitation surveys in 1946 indicated an extent of about 100 square miles involving western Contra Costa and northern Alameda counties, at elevations not exceeding 500 feet. With an abundance of host material in all directions, there seems to be no explanation for the failure of this scale to spread farther by natural means in a period of 70 years.

Limited distribution in one area is no proof that an insect will not live or do well in another. Kuno scale was found in Butte County at Chico, 160 miles farther north and under central valley conditions, in 1960. The following year it appeared at Paradise, 15 miles northeast of Chico, in the foothills, and at an elevation of 1,700 feet. Infestation at Chico was limited to a few contiguous hosts in a residential district, and apparently has been eradicated by the Butte County Department of Agriculture. The scale has been more severe and widespread at Paradise, and a considered eradication attempt was precluded when the native plum *Prunus subcordata* Benth. was found to support scale populations.

In 1966 kuno scale appeared at Lakeport, elevation 1,300 feet, in Lake County. This is about 80 miles west of Paradise, and the same distance north from the original Alameda-Contra Costa infestation. Infestation apparently is limited to a few small properties, and eradication by county authorities is under consideration.

Sudden extension of range and distant outbreaks of a pest long resident to a limited area are unexplainable phenomena with which entomologists have to deal. There is no real basis for prediction, but kuno scale could follow the pattern of walnut husk fly and sooner or later become general in distribution.

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Extended Diapause in *Coloradia pandora* Blake

(Lepidoptera: Saturniidae)

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The pandora moth, *Coloradia pandora* Blake, is a periodic pest of pine forests in western United States. It is one of the largest defoliating insects in North America and an obvious food source for many forest dwellers, including man; Aldrich (1921) and Essig (1934) have documented its use by Indian tribes. Principal hosts are ponderosa pine, *Pinus ponderosa* Laws., Jeffrey pine, *P. jeffreyi* Grev. & Balf., and lodgepole pine, *P. contorta* Dougl. Larvae feed in fall, overwinter, and feed again in spring in an exposed position on pine branches. Pupae are formed in early summer in loose mineral soil at a depth of 1 to 5 inches where they overwinter.

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Damaging infestations were at first recorded only for southcentral Oregon and eastcentral California. In an Oregon outbreak during 1918–26, subsequent damage to ponderosa pine stands caused by bark beetles (genus *Dendroctonus*) was far greater than the primary damage by the defoliator (Patterson, 1929). In 1937–39, an extensive outbreak occurred in northcentral Colorado, the first recorded in the Rocky Mountains, and around 4,000 lodgepole pines died as a result of the defoliation (Wygant, 1941). In 1959–66, small outbreaks occurred in Oregon, California, Colorado, Wyoming, and Utah; the Rocky Mountain outbreaks were of longest duration (Carolin and Knopf, 1968). Outbreaks have occurred only in areas of loose soils, such as those formed from pumice or decomposed granite.

After studying an outbreak in Oregon's Klamath County, Patterson (1929) stated "The generations of *Coloradia pandora* are biennial, the life cycle of the species covering a period of exactly two years. . . ." He observed that flights occurred in the even-numbered years in this particular area, although "a few stragglers departed from the cycle of the main broods and emerged in the odd years." Wygant (1941), studying an outbreak in Colorado, also found major flights in the even years but noted that a small proportion of the pupae remained in the soil through two winters, with adults emerging the following summer. Massey[1] estimated this holdover population in the same outbreak as "apparently less than 5 percent."

In recent widespread series of flare-ups, occasional deviations from the even-year flight patterns were evident. In 1961, numerous moths were collected at light traps in the Custer National Forest, Wyoming (Terrell, 1962). In 1962, both second-year larvae and adults were reported in an infestation along the Colorado-Wyoming border (U. S. Forest Service, 1963). Then, in 1964, surveys of pupal density in June and September in the Sequoia National Forest, California, revealed many unemerged pupae remaining after moth flight, indicating either a population holdover until the third year or high mortality in the pupal stage.[2] In 1965, an off-year flight occurred on the Winema Forest near Chemult, Oregon (Orr, 1966). On the basis of these reports and a study still in progress, Carolin and Knopf (1968) concluded that in some areas at least, a substantial part of the generation remains in the soil for two years and some individuals for three and four years.

Flexibility in the life cycle of the pandora moth is now apparent from

[1] Unpublished M. A. thesis, "The Pandora Moth (*Coloradia pandora* Blake), a Defoliator of Lodgepole Pine in Colorado." Duke Univ., Durham, N. C. 1940.
[2] Insect Evaluation Report, U. S. Forest Service, California Region, 1966.

the record by Aldrich (1921), which noted large larvae in the Mono Lake, California, area only in even-numbered years. It is further supported by unpublished records,[3] beginning in 1957, which show major flights occurring in odd-numbered years in the Mt. Laguna area of southern California and a similar incidence in 1937 for a locality near Prescott, Arizona.[4] These various deviations from the normal periodicity in flight years could have significant impacts on survival of the pandora moth, damage to host trees, and abundance of animals that feed on this insect.

Insight into variation in population behavior, specifically in regard to pupal diapause and moth emergence, has been obtained from a 5-year study of a sample of pandora moth pupae collected near Chemult, Oregon, on 25 August 1964. A large moth flight, occurring as expected in an even-numbered year, was just ending. Two of our entomologists, R. L. Furniss and R. G. Mitchell, were visiting the area and on inspiration dug into the soil to search for unemerged pupae. A total of 168 unemerged pupae was collected with little difficulty and turned over to the author for analysis as to viability and survival.

Methods

At the start, obviously dead pupae were discarded and, over a period of two months, seven apparently sound pupae were dissected anteriorly to determine viability as indicated by pulsing of the aorta. The remaining pupae were placed on moist soil in sturdy cardboard boxes, overwintered in a large open shed at Portland, Oregon, and brought into a basement laboratory room early the following summer (1965) for moth emergence. The boxes were stacked on a frame in a muslin-covered cage with a sliding screened door; the soil and pupae were moistened at approximately 7-day intervals. A single, overhead bulb provided continuous subdued illumination, and laboratory temperatures ranged from 21° to 25°C. over the 2-month holding period. Three weeks after the last moth emerged, apparently dead pupae were dissected and remaining pupae were returned to the outside shed. This procedure was repeated through the summer of 1969.

Results

Most of the pupae proved to be holdovers, and some emergence occurred every summer for five consecutive years. After initial dis-

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[3] Summary of Pandora Moth Detection Records, California Region, dated 8 March 1967, and provided by U. S. Forest Service, Division of Timber Management, San Francisco, California.

[4] Personal communication from George R. Struble, Research Entomologist, Pacific Southwest Forest and Range Experiment Station, Berkeley, California.

TABLE 1. Emergence of *Coloradia pandora* from holdover pupae collected near Chemult, Oregon, in August 1964.

Year	Pupae in rearing	Adults emerging		Pupae dissected	
		Males	Females	Living	Dead
		Number			
1964	168	–	–	7	11
1965	150	19	8	0	13
1966	110	26	15	2	9
1967	58	4	9	0	0
1968	45	5	16	0	5
1969	19	2	8	1	8
Totals	168	56	56	10	46

sections in 1965, 150 apparently sound pupae remained. From this number of pupae, 112 adults were reared and 38 pupae were dissected or broken open to verify obvious or suspected mortality. One pupa remained alive after emergence ended in 1969 but was dissected.

The sex ratio of adults obtained was equal for the 5-year period, with 56 males and 56 females emerging. However, males predominated in the first two years, when emergence was heaviest; and females predominated in the next three years. The incidence of female emergence increased from around 30 percent in 1965 to around 80 percent in 1968 and 1969. Data are summarized in Table 1.

No attempt was made to mate insects in 1965, but in 1966 and 1967 some females were mated and laid fertile eggs. In 1968, male and female emergence intermeshed, and it was assumed that mating would take place without stimulation, such as exercising the males. However, no mating occurred. In 1969 only two males were available for mating; one was crippled at emergence and the other emerged when no females were available.

Oviposition from 1966 and 1967 matings appeared normal. Four gravid females in 1966 laid an average of 77 eggs, and two gravid females in 1967 laid an average of 118 eggs. Most of the eggs hatched, and larvae fed normally on pine foliage provided them. Another female in 1967 found a mate after it had laid infertile eggs, and five of 14 eggs subsequently laid proved fertile.

Discussion and Conclusions

Diapause of pandora moth pupae collected after moth flight in 1964 lasted as long as five years, with a single living pupa going into its sixth year in diapause. Since the age of these pupae was unknown when collected, the duration of diapause could be six years or longer. Diapause under field conditions could be further extended by lack of suitable soil temperatures for physiogenesis. In studies on *Saturnia pyri* Schiffermüller, Rivnay and Sobrio (1967) found that termination of diapause and activation of physiogenesis took place within a restricted temperature range.

Some emergence of pandora moth must take place every year. And, in so-called "flight years," the adults must stem from pupae of different ages. The majority, however, are probably from pupae which have been in the soil one year, as indicated by earlier observers.

These results indicate that pupal density surveys to estimate adult populations will overestimate these populations in flight years and fail to consider off-year flights. Until more is known about the diapause components in different populations, correction factors should be determined by rearing overwintered pupae found in the surveys to estimate percent emergence for the coming summer.

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A New California Species of *Silis*[1]
(Coleoptera: Cantharidae)

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The interesting little *Silis*, herein described, was taken on a collecting trip in the San Bernardino Mountains by Frank M. Beer, Oregon State University, and me in 1969. The excellent revision of the genus by J. W. Green in 1966 permits the ready recognition of almost any male, except those in which Green himself admitted difficulties with species complexes. The terminology utilized here will follow pretty much that of Mr. Green.

Silis (Silis) greeni Fender, new species
(Figs. 1–4)

Black. Pronotum pale rufous, explanate anterior and anterolateral margins paler; head in front of antennae and basal two antennal segments testaceous beneath; thorax pale rufous beneath; pubescence cinereous, depressed, fine, short and inconspicuous. Length 5 mm.

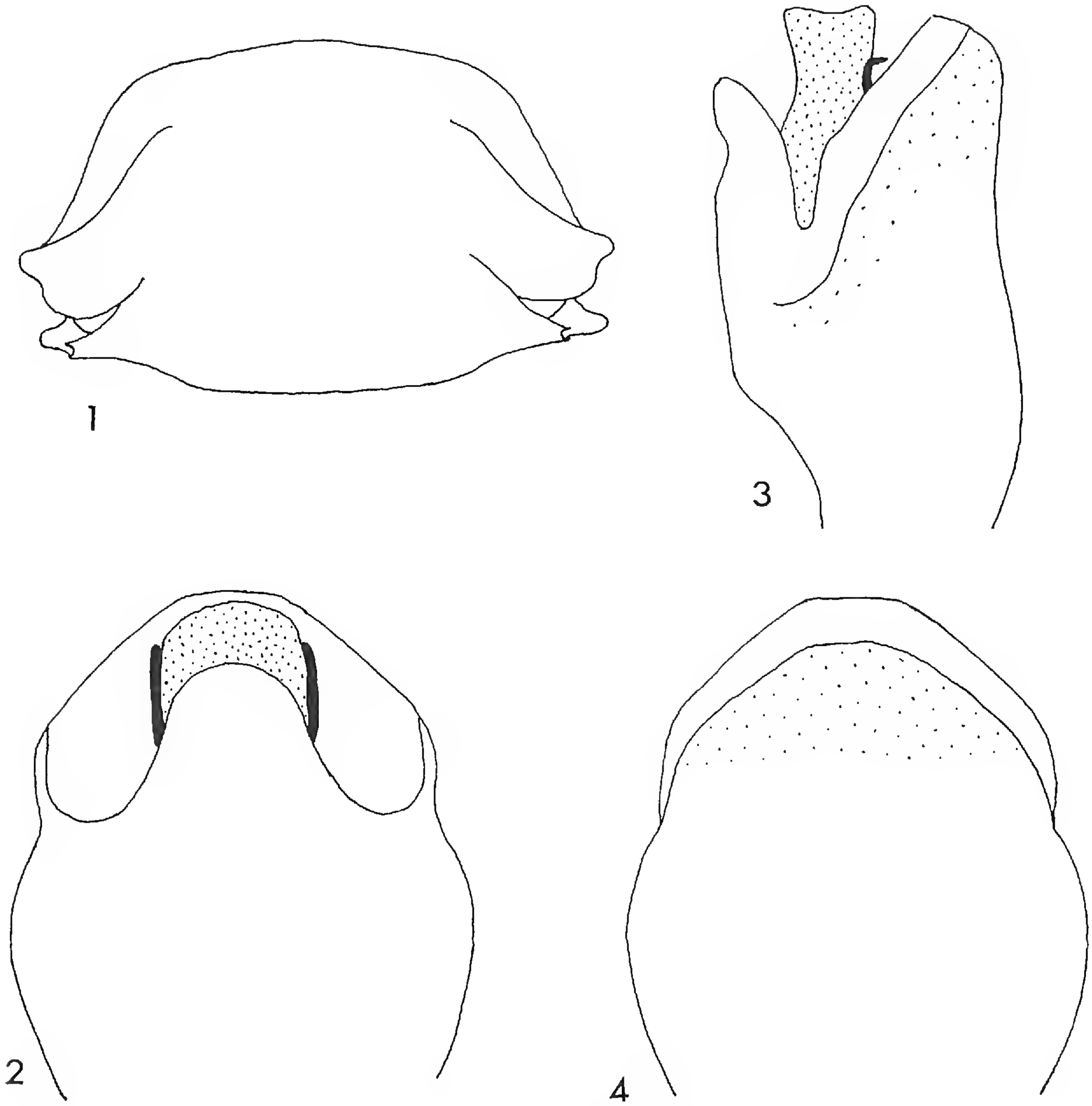
MALE.—Length : width ratio about 2.75 : 1. Antennae slender, filiform, nearly as long as body, intermediate segments about four times as long as wide, vestiture short and decumbent. Pronotum (Fig. 1), anterior process broad, elevated, somewhat backwardly extended, with small marginal indentation towards outer side; excision of lateral margin narrow; apical margin of posterior process shallowly concave. Genitalia (Figs. 2–4). Dorsal plate not emarginate, apically rounded; laterophyses short, acute, abruptly turned up near apices, not very conspicuous, not extending beyond apical margin of dorsal plate when viewed from above; basophyses concealed in type.

FEMALE. Unknown.

Holotype male, SEVEN OAKS, SAN BERNARDINO COUNTY, CALIFORNIA, 5,250 ft., 27 June 1969, collected by F. M. Beer and K. M. Fender, in the collection of the California Academy of Sciences.

This species is most closely related to *S. arizonica* Van Dyke and *S. fenestrata* Van Dyke. From each of these it may be separated by the broad, somewhat backwardly extended anterior process with a small indentation towards the outer side. The anterior process has a narrow backward extension without an indentation towards the outer side in *S. arizonica* and *S. fenestrata*. The laterophyses are conspicuous and extend beyond the apical margin of the dorsal plate when viewed

[1] This study was supported by National Science Foundation Grant: GB-6283X.



FIGS. 1–4. *Silis* (*Silis*) *greeni* Fender, holotype. FIG. 1. pronotum, dorsal view. FIG. 2. male genitalia, ventral view. FIG. 3. same, lateral veiw. FIG. 4. same, dorsal view.

from above in *S. arizonica* and *S. fenestrata.* The male of *S. fenestrata* has the pronotum pale fulvous with all margins black.

This species is named for Mr. J. W. Green in acknowledgment of his fine work with the Lycidae, Lampyridae and Cantharidae.

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GREEN, J. W. 1966. Revision of the Nearctic species of *Silis* (Cantharidae: Coleoptera). Proc. Calif. Acad. Sci., 32(16): 447–513; 65 figs.

Two New Species of *Chrysura* from Western North America
(Hymenoptera : Chrysididae)

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The following two species are described to make the names available for biological studies now in progress on nearctic *Chrysura*.[1]

The more unfamiliar terms and ratios used in the descriptions, or those which need precise definition are: Coarse puncture: large puncture, usually at least 0.40 times midocellus breadth. Dense punctation (spacing): punctures nearly contiguous. Fine puncture: very small puncture, usually less than 0.20 times midocellus breadth. Head length: maximum length from vertex to anterolateral corner of clypeus (Fig. 10, HEL). Head width: maximum width in front view (Fig. 10, HEW). Least interocellar distance: shortest distance between inner margins of lateral ocelli (Fig. 10, GID). Least interocular distance: least distance between inner margins of compound eyes (Fig. 10, LID). Length: maximum length with head vertical, clypeus to apical margin of tergite III. Malar space: shortest distance between bottom of compound eye and mandibular articulation (Fig. 10, MS). Medium puncture: average size puncture, about 0.30 times midocellus breadth. Moderate punctation (spacing): punctures separated by about one puncture diameter. Ocellocular distance: least distance from inner margin of compound eye to lateral ocellus (Fig. 10, OOD). Scapal basin: in general, the area beginning a short way below midocellus, between compound eyes, and above antennal sockets. Scape: length of first antennal segment measured in dorsal view. Sparse punctation (spacing): punctures separated by an average of two or more puncture diameters. Subantennal distance: distance from bottom of antennal socket to lower clypeal margin (Fig. 10, SAD). Width: maximum distance at posterior margin of tergite I.

The shape of the inner, apical, and outer margin of the cuspis (Fig. 6 a–c) and the gonostyle (Fig. 7 a–c) are of fundamental importance in the definition of male *Chrysura*. The digitus (Fig. 6 d) is nearly uniform in the nearctic species, both in length and the number of tooth-like projections. For this study, the genitalia were cleared in hot five per cent potassium hydroxide for ten minutes, dehydrated with absolute

[1] Part of a dissertation, Biosystematics of the Nearctic *Chrysura* with a Consideration of Related Palearctic Forms (Hymenoptera : Chrysididae), submitted to the University of California, Davis, as a partial fulfillment for the Ph.D. degree, 1969.

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alcohol, transferred to xylene, mounted on slides, with the aedeagus flattened, and with the gonostyle separated from the cuspis and digitus.

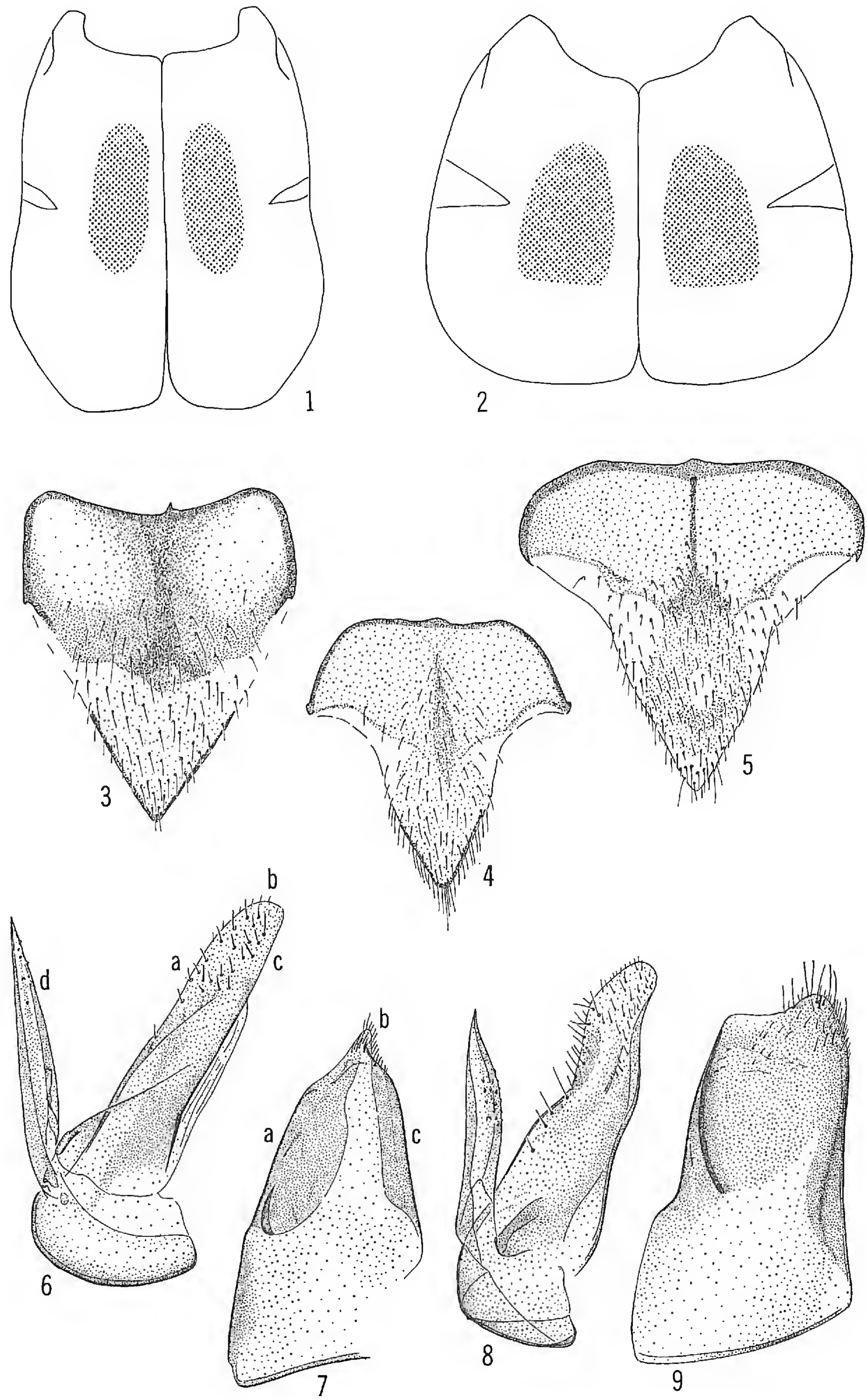
The mean of the ratios, and the standard deviation of the mean for the series examined follows the ratio for the holotype, i.e., head 1.2 ($\bar{x}$ = 1.2 ± 0.04) times broader than long. The length and width of specimens varies considerably, but the length–width ratio is relatively constant.

Chrysura crescentis Horning, new species

MALE.—Length 3.7 mm (2.5–5.0 mm, $\bar{x}$ = 4.0 mm, n = 7), width 0.9 mm (0.8–1.2 mm, $\bar{x}$ = 1.1). Light bluegreen on vertex, green on scapal basin and face venter; sternite II with two elongate, noncontiguous dark violet spots (Fig. 1); legs blue-green, tarsi reddish-brown; flagellomeres I–III green dorsally; wings uniformly subfuscous except darker marginal cell; scapal basin with scattered light brown semi-erect hair, long erect brown hair on vertex and sides of head, similar hair on thorax, whitish on abdomen. Punctures of head and thorax moderate, of two sizes: larger ones on vertex, sides of head, pronotum, and metanotum, medium and nearly touching; smaller punctures on frons and face below compound eyes more separated; abdomen with dense punctation, nearly equal, but more separated on posterior margin of tergite II; tergite III with very fine, dense punctures behind pit row. Head 1.0 ($\bar{x}$ = 1.0 ± 0.06) times broader than long; head width 1.9 ($\bar{x}$ = 1.9 ± 0.06) times least interocular distance; scape 2.5 ($\bar{x}$ = 2.4 ± 0.12) times and ocellocular distance 1.4 ($\bar{x}$ = 1.8 ± 0.29) times least interocellar distance, respectively; flagellomere I 1.9 ($\bar{x}$ = 2.0 ± 0.14) times as long as II in dorsal view, 1.2 ($\bar{x}$ = 1.1 ± 0.18) times as long as malar space; subantennal distance 1.8 ($\bar{x}$ = 1.8 ± 0.24), and malar space 2.4 ($\bar{x}$ = 2.8 ± 0.30) times midocellus breadth, respectively; scapal basin with a small median vertical carina (Fig. 10), limited above by a prominent, rounded brow just above midpoint of compound eyes, as seen in an oblique lateral frontal view; propodeal teeth distinct, oblique, not hooked at ends; hind femur somewhat elongate, 3.3 ($\bar{x}$ = 3.1 ± 0.19) times its greatest width. Tergite II with a hardly developed longitudinal carina, extending into tergite I; tergite III, in profile, sloping evenly to transverse row of pits, with median pits deeper and somewhat elongate, lateral pits smaller; pits not confluent; apical margin a smooth crescent (Fig. 12); sternites II, VIII, and genitalia (Figs. 1, 3–4, 6–7).

FEMALE.—Length 3.8–5.0 mm ($\bar{x}$ = 4.2 mm, n = 6), width 0.9–1.1 mm ($\bar{x}$ = 1.0 mm). Color, vestiture, and punctation similar to males. Flagellomere I 1.1 ± 0.04 times as long as malar space; malar space 2.6 ± 0.08 times midocellus breadth. Spots on sternite II nearly absent; thorax generally darker blue, abdomen of some specimens dark violet dorsally; tergite IV green to golden, exerted in all specimens examined.

VARIATION.—The elongate spots on sternite II range from distinct to nearly absent due to the lack of pigmentation. The vertical median carina on the scapal basin is absent in some specimens. The green on the lower part of the scapal basin may have golden highlights.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This species may be distinguished from other nearctic *Chrysura* by the unusually slender form, the fine, even punctation on the abdominal tergites, the elongate and somewhat pointed third tergite, its crescent shaped apical margin (Fig. 12), and the reduced pit row.

MATERIAL EXAMINED.—7 males, 6 females. Collection data as given below extend from 29 March (Samuel Springs, Napa Co., California) to 8 July (Tanbark Flat, Los Angeles Co., California).

Holotype male, (UCD) JOHNSDALE (2 MI. E.), TULARE COUNTY, CALIFORNIA, 27 April 1964, on *Ceanothus* sp. (C. A. Toschi).

PARATYPES.—CALIFORNIA: *Los Angeles Co.*: Altadena, 4 April 1911, (USNM); Big Tujunga Canyon, 11 April 1953, (LACM); mountains near Claremont (CORN); Santa Susana Pass, 4 June 1961, (M. E. Irwin, UCD); Tanbark Flat, 8 July 1950, (B. J. Adelson, UCD), 22 June 1950, (J. W. MacSwain, CIS). *Mariposa Co.*: Miami Ranger Station, 9 June 1942, (UCD). *San Benito Co.*: Pinnacles National Monument, 24 April 1948, (J. W. MacSwain, CIS). *San Luis Obispo Co.* : La Panza Camp, 25 April 1968, (P. A. Opler, CIS).

RANGE.—Foothills of central and southern California in the Upper Sonoran and Transition zones.

FLORAL RECORDS.—*Ceanothus* sp., *Rhus diversiloba.*

BIOLOGY.—No host known.

Chrysura boharti Horning, new species

MALE.—Length 7.0 mm (5.5–8.5 mm, $\bar{x} = 7.5$, $n = 13$), width 2.4 mm (1.9–3.1 mm, $\bar{x} = 2.6$ mm). Light green with scattered golden reflections; sternite II with two medium size, median dark spots (Fig. 2); legs green; first tarsal segment green dorsally, remaining segments dark reddish-brown; flagellomeres I–II greenish dorsally, remaining flagellomeres dark reddish-brown; wings uniformly subfuscous except fuscous marginal cell; scapal basin with scattered, white erect hair, more abundant on vertex, similar hair on rest of body, semi-erect and shorter on abdomen. Punctures of head medium, median area of clypeus with coarser moderate punctures, fine dense punctures laterally and below antennal sockets; pronotal punctures coarse, intermixed with finer ones, medium and moderate on scutum, coarse, nearly touching punctures on scutellum and metanotum; abdomen with medium, moderate punctures, slightly coarser on tergite I. Head 1.2 ($\bar{x} = 1.2 \pm 0.04$) times broader than long; head width 2.0 ($\bar{x} = 2.0 \pm 0.06$) times least interocular distance; scape 2.7 ($\bar{x} = 2.5 \pm 0.20$) times and ocellocular

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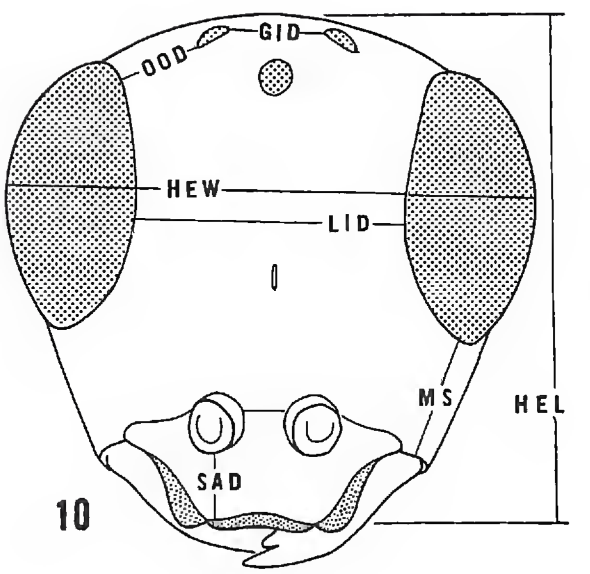
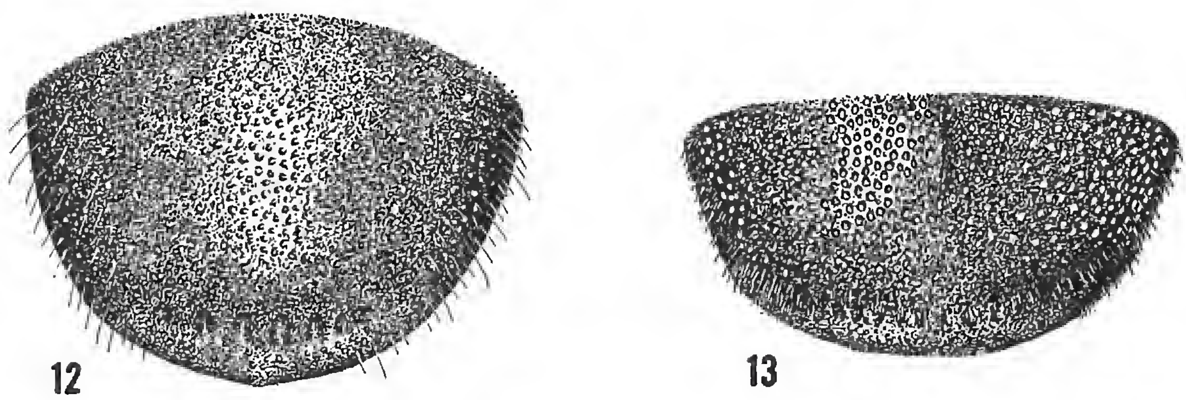
FIGS. 1–9. *Chrysura crescentis* n. sp. FIGS. 1, 3–4, 6–7. FIG. 1. Sternite II. FIG. 3. Sternite VIII, typical form. FIG. 4. Sternite VIII, variation from Big Tujunga Canyon, Los Angeles Co., California. FIG. 6. Left digitus (d) and cuspis (a = inner margin, b = apical margin, c = outer margin) of male genitalia. FIG. 7. Right gonostyle (a = inner margin, b = apical margin, c = outer margin). *Chrysura boharti* n. sp. FIGS. 2, 5, 8–9. FIG. 2. Sternite II. FIG. 5. Sternite VIII. FIG. 8. Left digitus and cuspis of male genitalia. FIG. 9. Right gonostyle.





FIGS. 10–13. *Chrysura crescentis* n. sp. FIGS. 10, 12. FIG. 10. Male, front view of head. FIG. 12. Male, tergite III. *Chrysura boharti* n. sp. FIGS. 11, 13. FIG. 11. Male, front view of head. FIG. 13. Male, tergite III.

distance 1.3 ($\bar{x}$ = 1.3 ± 0.05) times least interocellar distance, respectively; flagellomere I 2.0 ($\bar{x}$ = 2.0 ± 0.16) times as long as II in dorsal view, 1.6 ($\bar{x}$ = 1.7 ± 0.15) times as long as malar space; subantennal distance 1.5 ($\bar{x}$ = 1.7 ± 0.19), ocellocular distance 2.0 ($\bar{x}$ = 2.3 ± 0.17), and malar space 1.8 ($\bar{x}$ = 1.9 ± 0.17) times midocellus breadth, respectively; scapal basin nearly flat, with a small median carina (Fig. 11), with very faint cross striae below ocelli, brow not prominent; propodeal teeth distinct, oblique, ends rounded as viewed dorsally; hind femur elongate, 3.3 ($\bar{x}$ = 3.1 ± 0.12) times its greatest width. Tergite III sloping evenly to transverse row of irregular, very small pits, some contiguous especially medially; apical margin arcuate, no median indentation (Fig. 13); sternites II, VIII, and genitalia (Figs. 2, 5, 8–9).

FEMALE.—Length 7.2–9.5 mm ($\bar{x}$ = 8.1, n = 11), width 2.3–3.1 mm ($\bar{x}$ = 2.6 mm). Similar to males. Flagellomere I 1.6 ± 0.09 times as long as malar space; malar space 2.2 ± 0.14 times midocellus breadth. Color more green blue with less golden reflections except on face; flat golden green shiny spot above antennal sockets; vertex hair light brown. Tergite III arcuate but more pointed medially; punctures on pit row more evident than for males, but still indistinct.

VARIATION.—Some specimens are entirely medium green with no golden highlights. The tegulae may be light green or may have a dark blue to purple spot. The large, dark spots on sternite II vary in intensity but they are always distinct. The metanotum is distinctly to moderately conical.

This species can be separated from other *Chrysura* by the distinctly arcuate third tergite and near absence of pits on the pit row. It can be best separated from the closely related *C. pacifica* (Say) by the malar space being 1.9 times the midocellus breadth (2.5 times in *C. pacifica*). The male genitalia closely resemble those of *C. pacifica.* However, in *C. boharti*, the cuspis has a characteristic bend (Fig. 8) and the apical margin of the gonostyle is broad (Fig. 9), with no definite indentation as in *C. pacifica.*

MATERIAL EXAMINED.—15 males, 12 females. Collection data as given below extend from 25 May (Hansen, Twin Falls Co., Idaho) to 23 July (Bannock Pass, Lemhi Co., Idaho).

Holotype male, (UCD) CROOKED CREEK LABORATORY, 10,150 FT., WHITE MOUNTAINS, MONO COUNTY, CALIFORNIA, 23 June 1961, (J. Powell).

PARATYPES.—CALIFORNIA: *Lassen Co.*: Hallelujah Junction, (D. R. Westrom, UCD); county only, 4 June 1913, (F. W. Nunemacher, CAS). *Mono Co.*: Crooked Creek Laboratory, 10,150 ft., White Mountains, 20–29 June 1953, (J. W. MacSwain, UCD, CIS, CNC), (G. W. Frankie, UCD, CIS), 23 June 1961, (J. S. Buckett, UCD), 26 June 1961, (J. Powell, UCD), 26 June 1961, (G. I. Stage, CIS), 16 July 1961, (W. A. Foster, CIS). *Nevada Co.*: Sagehen Creek near Hobart Mills, 23 June 1962, (M. E. Irwin, UCD), 9 July 1954, (J. A. Powell, UCD). IDAHO: *Butte Co.*: Craters of the Moon National Monument, 15 July 1957, (A. R. Gittins, IDAHO). *Lemhi Co.*: Bannock Pass, 23 July 1965, (R. L. Westcott, IDAHO); Meadow Lake—Gilmore (6 mi. w.), 20 July 1964, (R. L. Westcott, IDAHO). *Twin Falls Co.*: Hansen, 26 May 1929, light trap, (USNM). UTAH: *Cache Co.*: Logan, 5 June 1952, (G. E. Bohart, E. A. Cross, UCD). *Kane Co.*: Navajo Lake—9,000 ft., 19 June 1940, (R. M. Bohart, UCD). WASHINGTON: *Lincoln Co.*: Sprague, 20 June 1920, (M. C. Lane, USNM). WYOMING: *Albany Co.*: Foxpark—9,100 ft., 15 June 1920, (UCD). CANADA: *British Columbia*: Copper Mountain, 29 June 1928, (G. Stace-Smith, CNC).

RANGE.—*C. boharti* has been collected at somewhat forested, higher elevations in the western United States and Canada. It appears to be principally a Great Basin species.

FLORAL RECORDS.—*Achillea* sp., *Viola* sp.

BIOLOGY.—No host known.

I take pleasure in naming this species for Dr. R. M. Bohart, University of California, Davis, who has contributed to our knowledge of Chrysididae.

ACKNOWLEDGMENTS

Material has been examined and deposited in the following institutions: California Academy of Sciences (CAS); University of California at Berkeley (CIS); Canadian National Collection, Ottawa (CNC); Cornell University (CORN); University of Idaho, Moscow (IDAHO); Los Angeles County Museum (LACM); United States National Museum (USNM); University of California at Davis (UCD).

I appreciate the help of Mr. R. O. Schuster and Miss Susan K. Senser who gave assistance in the preparation of the illustrations.

A Synopsis of the Nearctic Species of *Antichaeta* Haliday with One New Species

(Diptera : Sciomyzidae)

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University of California College of Biological and Agricultural Sciences, Riverside

We refer the North American species of *Antichaeta* to black forms (our designation) and the "yellow forms" of Steyskal (1960) as follows: The black forms (*A. johnsoni* (Cresson), *A. melanosoma* Melander, *A. canadensis* (Curran)) are the dominant species east of the Rocky Mts., and the "yellow forms" (testaceous is more accurate) (*A. fulva* Steyskal, *A. borealis* Foote, *A. testacea* Melander, *A. robiginosa* Mel., and *A. vernalis* Fisher and Orth[2] n. sp.) are the dominant representatives of the genus from the Rocky Mts. to the Pacific Ocean. Steyskal (1960: 25) based his interpretation of the phylogeny of the "yellow forms" in part on the status of the anterior surstyli. We have seen males of all five "yellow forms" and agree that these structures are lacking in *A. fulva*. However, both left and right anterior surstyli are present in the four remaining species.

[1] Specialist and Laboratory Technician, respectively.
[2] Fisher and Orth hereafter abbreviated F. & O.

Five of the eight species of *Antichaeta* known to occur in North America have been collected only above 40° N. Latitude.[3] The southernmost record known in California is that of *A. testacea* from the Laguna Mts., San Diego Co., approximately 15 miles north of the Mexican border, 33° N. Latitude. *Antichaeta testacea* is the most widespread and numerous species collected in California, approximately 300 specimens have been collected since 1962. It occurs the length of the state and has been taken from sea level to 7,000+ feet elevation. *Antichaeta vernalis* and *A. robiginosa* (except for an isolated male labelled Woodlake, Calif., approximately 36° 30′ N. Latitude) occur north of 39°. *Antichaeta borealis* was collected only once in extreme northeastern California.

A few reference specimens of most species were loaned to us by L. V. Knutson (United States National Museum) and B. A. Foote (Kent State University, Kent, Ohio). Our assessment of these specimens along with published keys and descriptions were used to formulate a key based on reasonably constant gross (external) characters by which the eight North American species can be separated. Determinations can be confirmed by examination of the male postabdomen at 40–70× magnifications following excision and light boiling in 10% KOH.

The bicolored character of the 3rd antennal segment is most pronounced in *A. borealis* and *A. fulva*, less so in *A. robiginosa* and *A. testacea*, and least in *A. vernalis*.

In the testaceous ("yellow") species, females are commonly more intensely colored than the males. The eighth and last sterna are also helpful in distinguishing females, but are not highly reliable characters. The aristal plumosity, i.e., length of longest aristal hairs, which grades from rather long, as in *A. robiginosa* (Fig. 6) and *A. testacea*, to short in *A. vernalis* (Fig. 7) is more reliable. Lengths of longest aristal hairs of *A. borealis* and *A. fulva* fell between the extremes and in that order.

On the basis of characters of the immature as well as adult stages, Knutson (1966: 72) considered *Hemitelopteryx brevipennis* (Zett.) as congeneric with *Antichaeta analis* Meigen, the type species of *Antichaeta* Haliday. This corroborated the work of Steyskal (1960) who had transferred *Hemitelopteryx johnsoni* to *Antichaeta* (subgenus *Parantichaeta*).

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[3] Six species of this holarctic genus have been described from northern and central Europe, the southernmost being *A. analis* (Meigen) from Lake Balaton, Hungary (47° N. Latitude)—(Knutson, 1966:73).

Key to the Nearctic Species of Antichaeta

1. Scutellum with 2 bristles. 1 pair dc. Head and palpi black; 1 pair fo; antennae yellowish, aristal hairs short, dense, black. Thorax testaceous; dorsum with 2 broad blackish stripes joined at anterior margin. Fore coxae whitish; legs yellowish, except for black fore tibiae and tarsi. Abdomen blackish brown. Massachusetts, New Hampshire, New York, Ontario. [Cresson, 1920: 51; Steyskal, 1960: 19] .... *johnsoni* (Cresson)

   Scutellum with 4 bristles. 2 pairs dc. 2

2. 1 pair fo. Head: frons and palpi black; anterior and ventral margins of eyes with whitish-pruinose border; antennae yellowish, aristal hairs short, dense, black. Thorax black; forelegs black distad of middle of femur, basal half of fore femur and middle and hind legs yellowish except for brownish 4th and 5th tarsal segments. Abdomen black. Michigan, New York, North Dakota, Ohio, Ontario, Quebec, Utah, Wisconsin. [Melander, 1920: 318; Steyskal, 1960, Fig. 1] .... *melanosoma* Melander

   2 pairs fo. 3

3. Head: frons blackish, anterior margin extensively to slightly yellow; medifacies black to yellow; anterior fo one-half to two-thirds length posterior fo; palpi brown to black; antennae yellow; aristal plumosity short, dense, black. Thorax black. Forelegs black distad of middle of femur; basal portion of fore femur and middle and hind legs yellowish except for brownish 4th and 5th tarsal segments. Abdomen black. Alberta, Maine, Manitoba, Michigan, North Dakota, Ontario, Saskatchewan, Wisconsin. [Curran, 1923: 277; Steyskal, 1960: 20, Fig. 8] .... *canadensis* (Curran)

   Head yellow to testaceous; aristal hairs black. Thorax and abdomen mostly testaceous; dorsum with 2 narrow brown median vittae bordered by broader, pruinose stripes; legs yellowish to testaceous, 4th and 5th tarsal segments brownish, forelegs infuscated (tibia and tarsus black in *A. borealis* female). Females usually more intensely pigmented than males. ("yellow forms" of Steyskal, 1960) 4

4. Anterior fo approximately half length posterior fo. Antenna testaceous, 3rd segment blackish on apical half, more or less; aristal plumosity short, sparse (longest hairs average length 0.073 mm; range of 2 specimens 0.070 mm–0.075 mm). Abdomen brown, infuscated; male andrium and terminal segments of female testaceous. Idaho, New York. [Steyskal, 1960: 20, Figs. 2–4] .... *fulva* Steyskal

   Anterior and posterior fo nearly equal in length 5

5. Thoracic dorsum mostly testaceous 6

   Thoracic dorsum mostly cinereous blue 7

6. Antenna testaceous, 3rd segment blackish on apical half, more or less; aristal plumosity sparse, somewhat longer than in *A. fulva* (longest hairs average 0.095 mm; range of 3 specimens 0.090 mm–0.100 mm). Distal portion of foretibia and entire tarsus black in female, infuscated in male, as in other "yellow forms." California, Idaho, Montana, Ohio, New York. [Foote, 1961: 161–2, Fig. 1] .... *borealis* Foote

Antenna testaceous; 3rd segment lightly tinged with black on apical half, more or less; aristal plumosity sparse, long (as in *A. robiginosa*) (longest hairs average 0.116 mm; range of 15 specimens, 0.112 mm–0.127 mm). Abdomen testaceous, mottled; andrium uniformly testaceous. California, Idaho, Montana, Oregon, New Mexico, South Dakota, Utah. [Melander, 1920: 318; Steyskal, 1960, Figs. 5–7] .... *testacea* Melander

7. Antenna testaceous; 3rd segment usually tinged with black on apical half, more or less, occasionally only lightly tinged with brown; aristal plumosity, long, sparse (Fig. 6) (longest hairs average 0.129 mm; range of 16 specimens, 0.120 mm–0.142 mm). Thorax testaceous; dorsum with 2 narrow brownish vittae bordered by much broader pruinose cinereous-blue vittae. Sides of thorax whitish-pruinose, except for upper half of pro-, meso-, and pteropleuron. Male postabdomen, Figs. 1–4; female terminalia, Fig. 5. California, Montana, Oregon, Washington, Nova Scotia (Stone, et al., 1965: 688). [Melander, 1920: 317] .... *robiginosa* Melander

Apical half to two-thirds of 3rd antennal segment at most lightly tinged with brown; aristal hairs sparse, short (Fig. 7) (longest hairs average 0.062 mm; range of 7 specimens 0.055 mm–0.067 mm). Thoracic dorsum as in *A. robiginosa*; female, sides of thorax pruinose, cinereous-blue; upper third of pro-, meso-, and pteropleuron testaceous. Lateral coloration not as pronounced in male, similar to male of *A. robiginosa.* Male postabdomen, Figs. 8–11; female terminalia, Fig. 12. California, Idaho, Oregon, Washington (see section on variant) .... *vernalis* Fisher and Orth, n. sp.

Descriptions

The original description of *Antichaeta robiginosa* Melander was based on a single female labelled 3-Forks, Montana, 1 August 1918 (Melander, 1920) [Three Forks, Gallatin Co.]. A male labelled Roberts, Marion Co., Oregon, 5 March 1940 (coll. R. E. Rieder) assumed to be this species, was figured by G. C. Steyskal (1960, Figs. 10–11) and those drawings formed our concept of the species until late May 1969.

During a survey of the family Sciomyzidae in California,[4] a form which did not fit the published descriptions of species of *Antichaeta* was collected. We considered it to be a new species and the first draft of the present paper was prepared in that context. However, after L. V. Knutson compared Melander's holotype female and several male specimens of *A. robiginosa* in the collection of the United States National Museum with drawings of our proposed new species, he (correspondence with R. E. Orth, 27 May 1969) concluded that our presumed "new species" actually was *A. robiginosa* and that Steyskal (1960) had inadvertently figured our *vernalis.*

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[4] University of California, Agriculture Experiment Station Project No. 2037.

We have seen the specimen from Roberts, Oregon, that Steyskal figured, and it fits our concept of *A. vernalis*. *Antichaeta robiginosa* and *A. vernalis* n. sp. are closely similar in gross aspect. Consequently, a photo only of *A. robiginosa* is shown (Fig. 13).

The original description of *A. robiginosa* is insufficient to separate it from closely related species. Accordingly, we are redescribing the species on male characters, and are designating a neallotype male.

ANTICHAETA ROBIGINOSA Melander

NEALLOTYPE MALE.—*Head.* Frons subshiny, yellowish except for shiny meso- and parafrontal stripes and very narrow whitish-pruinose stripes bordering eyes. Occiput in oblique view (looking directly down onto frons) with brown median area bordered by two elongate whitish-pruinose spots; ochraceous laterally. Face strongly pruinose, medifacies and oral margin largely yellow, parafacies whitish. Palpi testaceous. Antennae testaceous; first segment very small; second bowl-shaped, shorter than high; third compressed, ovoid, nearly twice as long as high; first and second segments lightly pruinose; third segment pubescent, apical ½ to ⅔ tinged with black; arista black, plumose (Fig. 6). Two pairs of fronto-orbital bristles; anterior pair approximately 0.75 length of posterior pair.

Thorax. Testaceous laterally; pleura heavily pruinose below, lightly so above; sternopleura and hypopleura darkened, pruinosity silvery. Dorsum with two parallel brownish vittae, bordered by broader pruinose cinereous-blue vittae; testaceous and pruinose laterally. Scutellum brownish. Forelegs brownish, partially infuscated; mid- and hind femora and tibiae ochraceous, tarsi lightly ochraceous, fourth segment partially infuscated, terminal segment wholly infuscated. Halters testaceous. Wing, 5.0 mm.

Abdomen. Testaceous, mottled; andrium uniformly testaceous. Postabdomen as figures 1–4. Wing length, 11 ♂—4.8 mm–5.5 mm (average 5.2 mm).

FEMALE.—Color as male. Wing length, 7 ♀—5.2 mm–5.5 mm (average 5.3 mm). Terminalia as in figure 5.

NEALLOTYPE MALE.—Collected two miles south of Alturas, Modoc Co., California, elevation 4,300 feet, Latitude 41° 28′ North, Longitude

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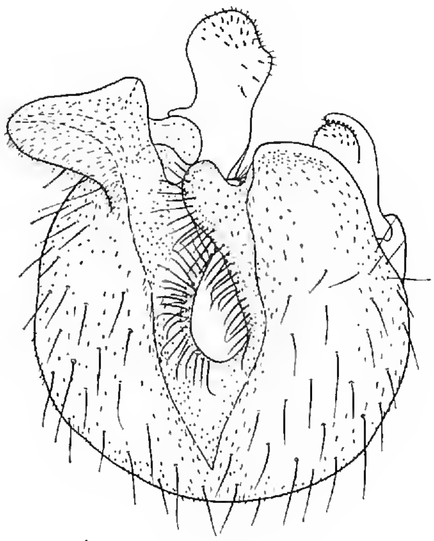
FIG. 1–4. *Antichaeta robiginosa* Melander. Allotype, male. U.S.A., Calif., Shasta Co., 5¼ mi. NW/Anderson, 480 feet elev., 24 May 1967 (T. W. Fisher and R. E. Orth), AS-571. FIG. 1. Postabdomen, posterior view, inverted; FIG. 2. Postabdomen, dextral view; *as*, anterior surstylus. FIG. 3. Postabdomen, sinistral view; *as*, anterior surstylus. FIG. 4. Fifth sternum. FIG. 5. *Antichaeta robiginosa* Melander. Female. U.S.A., Calif., Modoc Co., 2 mi. S/Alturas, 4,300 feet elev., 6 June 1967 (TWF & REO), AS-593. Terminal sterna. FIG. 6. *Antichaeta robiginosa* Melander. Female. U.S.A., Calif., Mendocino Co., 2 mi. N/Willits, 1,330 feet elev., 12 June 1966 (TWF & REO), AS-482. Dextral antenna. FIG. 7. *Antichaeta vernalis.* Paratopotype, female. U.S.A., Calif., Mendocino Co., 2 mi. N/Willits, 1,300 feet elev., 11 April 1967 (R. A. Shippey, U. C. Agr. Ext.). Dextral antenna.



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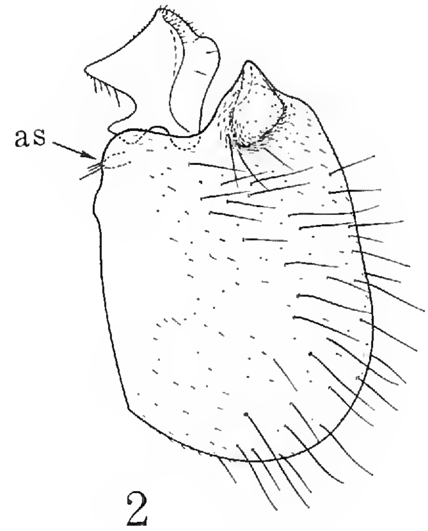

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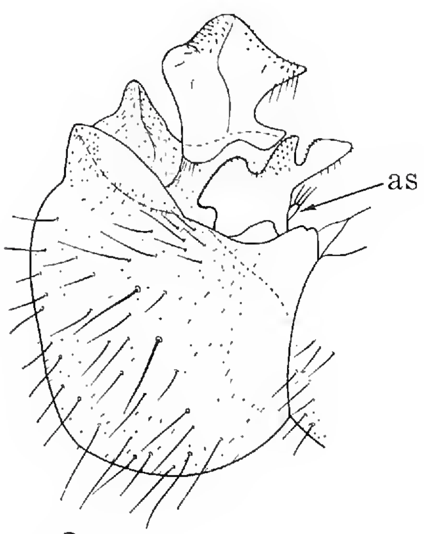

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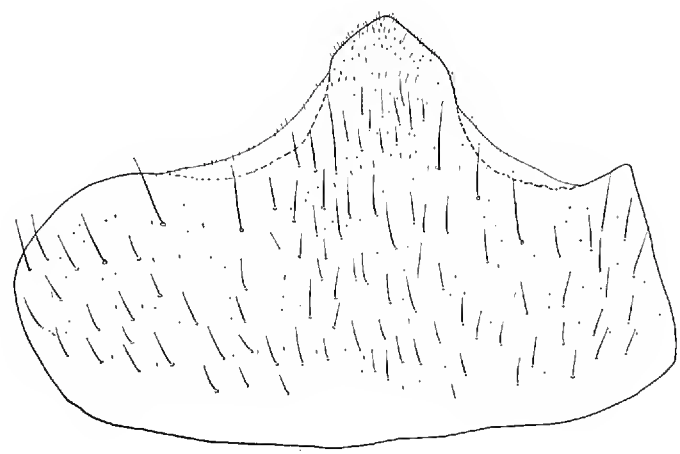

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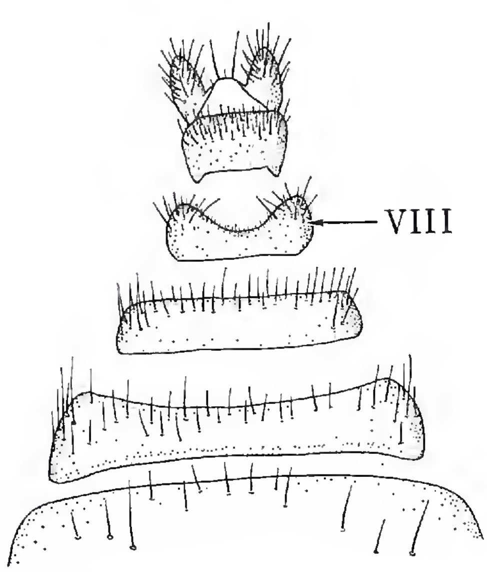

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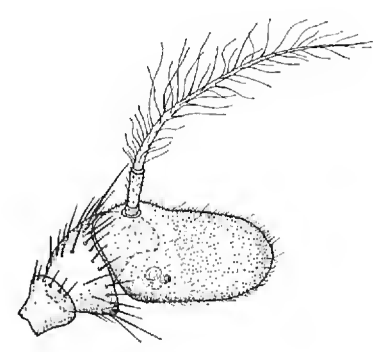

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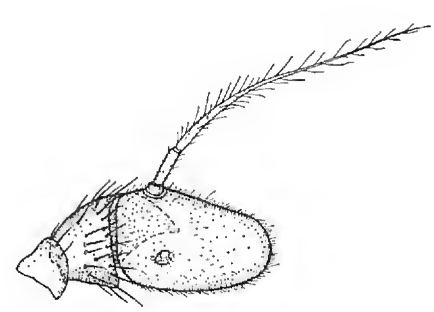

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120° 32′ West approximately, 10 June 1966 (T. W. Fisher and R. E. Orth) Field Accession No. AS-463.

DISTRIBUTION.—CALIFORNIA: *Inyo Co.*: 1 ♂, Deep Springs Lake, Buckhorn Springs, 5,000 feet, 16 April 1966 (F. & O.), AS-413. *Mendocino Co.*: 1 ♀, 2 mi. north of Willits, 1,330 feet, 16 May 1966 (R. A. Shippey); 1 ♂, 2 ♀, 12 June 1966 (F. & O.), AS-482; 2 ♂, 11 April 1967 (R. A. Shippey); 2 ♂, 23 April 1968 (F. & O.), AS-669 (Fig. 13). *Modoc Co.*: 2 mi. south of Alturas, 4,300 feet, 1 ♂, 10 June 1966 (F. & O.), AS-463; 1 ♀, 6 June 1967 (F. & O.), AS-593; 1 ♂, 3 mi. north of Eagleville, 4,640 feet, 10 July 1968 (F. & O.), AS-703; 1 ♀, north of Likely, 4,400 feet, 8 June 1966 (F. & O.), AS-453; 1 ♂, Willow Ranch, 4,700 feet, 9 June 1966 (F. & O.), AS-460. *Mono Co.*: 1 ♀, Mono Lake, 21 July 1911 (J. M. Aldrich coll., det. L. V. Knutson, USNM). *Shasta Co.*: 1 ♂, south of Redding, Mosquito Abatement District Headquarters, 480 feet, 24 May 1967 (F. & O.), AS-571. *Tulare Co.*: 1 ♂, Woodlake, in rotary trap, 24 May 1947 (no collector given, U. C. Berkeley). MONTANA: 1 ♀, Holotype, 3-Forks, (Three Forks, Gallatin Co.) 1 August 1918 (A. L. Melander, USNM). OREGON: *Lake Co.*: 1 ♀, 9 mi. south of Lakeview, 4,750 feet, 8 August 1968 (F. & O.), AS-748. *Lane Co.*: 1 ♀, west of Eugene, 400 feet, 8 August 1968 (F. & O.), AS-739. *Wasco Co.*: 1 ♂, 13 mi. north of Warm Springs, Hwy 26, 2,600 feet, 18 June 1969 (R. E. Orth), AS-790. WASHINGTON: *King Co.*: Seattle, 3 ♂ (no date, J. M. Aldrich coll., det. L. V. Knutson, USNM).

DEPOSITION OF NEALLOTYPE AND ADDITIONAL MATERIAL.—Neallotype and four specimens, United States National Museum; four specimens, California Academy of Sciences; seven specimens, Department of Entomology, University of California, Riverside.

Antichaeta vernalis Fisher and Orth, new species

Antichaeta robiginosa, Steyskal 1960, figs. 10–11 (not Melander 1918; misidentified).

Coloration and morphology as stated for *A. robiginosa* except as follows:

HOLOTYPE MALE.—Antenna, apical ⅔ of third segment at most lightly tinged with brown; arista dark brown, hairs black, short (not plumose). Tarsi, lightly infuscated. Wing, 5.0 mm. Postabdomen as in figures 8–11.

ALLOTYPE FEMALE.—Thorax, approximate upper ⅓ of meso- and pteropleura and most of propleuron testaceous, pruinose cinereous-blue below. Wing, 5.2 mm. Terminalia as in figure 12.

Holotype male, 2 MI. NORTH OF WILLITS, MENDOCINO COUNTY, CALIFORNIA, Hwy 101, 1,330 feet elevation. Latitude 39° 27′ North, Longi-

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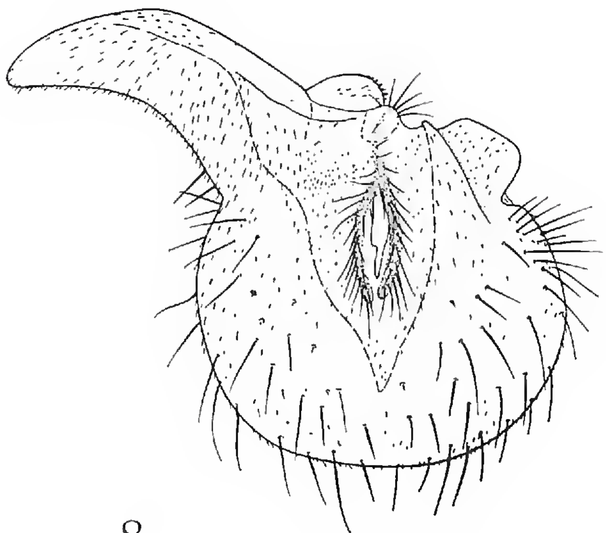
FIG. 8–12. *Antichaeta vernalis* Fisher and Orth, n. sp. Holotype. FIG. 8. Postabdomen, posterior view, inverted. FIG. 9. Postabdomen, dextal view. FIG. 10. Postabdomen, sinistral view. FIG. 11. Fifth sternum. FIG. 12. Allotype: terminal sterna.



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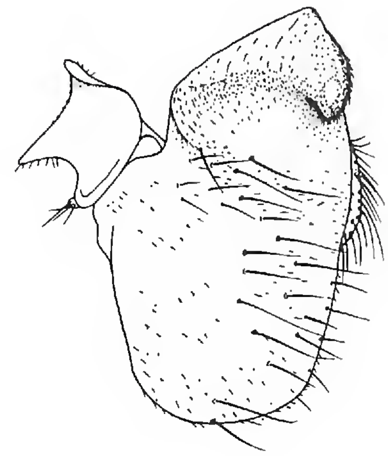

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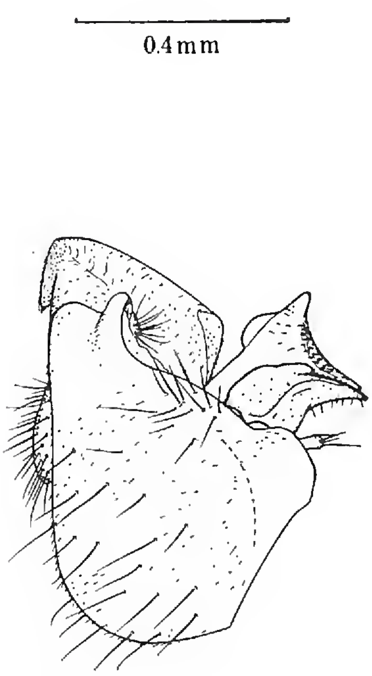

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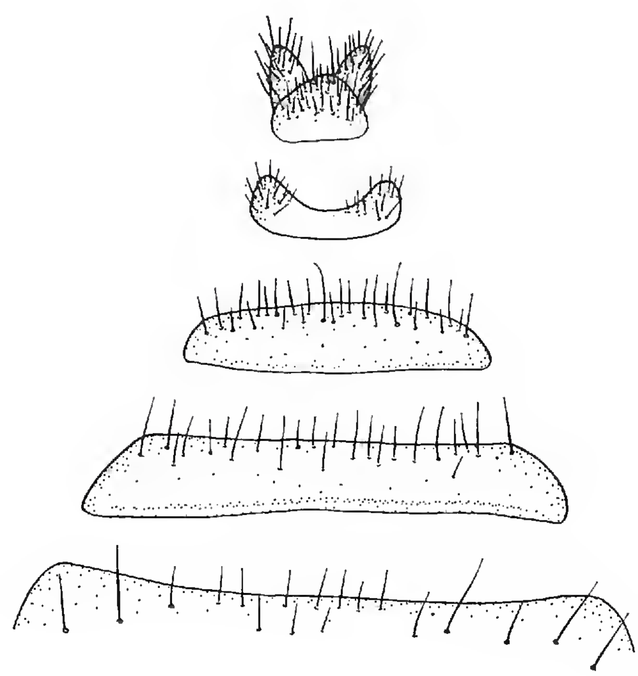

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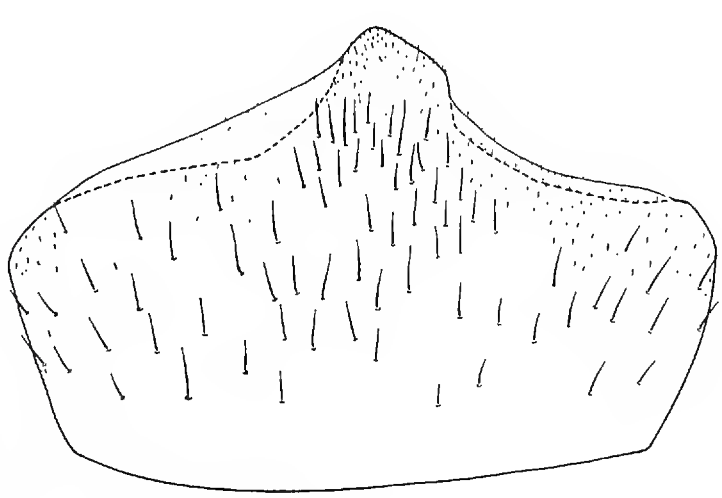

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tude 123° 21′ West, 23 April 1968 (T. W. Fisher and R. E. Orth), field accession number AS-669. Allotype female, same locality, 24 April 1968 (F. & O.), AS-671.

PARATOPOTYPES.—1 ♂, 1 May 1967 (R. A. Shippey, genitalia only—specimen mutilated beyond repair); 2 ♀, 11 April 1967 (R. A. Shippey); 1 ♀, 23 April 1968 (F. & O.), AS-670. PARATYPES.—CALIFORNIA: *Plumas Co.*: 1 ♂, 1 ♀, Rock Creek, Hwy 36 (40° 20′ N., 121° 06′ W.) 4,900 feet, 8 June 1966 (F. & O.), AS-451. OREGON: *Marion Co.*: 1 ♂, Roberts, 5 March 1940 (R. E. Rieder).

OTHER MATERIAL.—IDAHO: 1 ♀, Moscow Mt., 10 August 1924 (A. L. Melander). OREGON: *Marion Co.*: 1 ♀, Turner, 8 March 1942 (R. E. Rieder). [Rieder (Personal correspondence with T. W. Fisher, 18 November 1969) fixed his collection localities as Roberts, approximately 5 miles southwest of Salem on River Road, and Turner, approximately 10 miles southeast of Salem—both distances as measured from the center of the city.] WASHINGTON: 1 ♀, Mirror Lake, (Whatcom Co. ?), 26 June 1941, Bishopp, No. 29135, Lot No. 41-13667 (Yates and Knipling; J. M. Aldrich collection, det. L. V. Knutson, USNM).

VARIANT.—The male and female (wing lengths, 4.4 mm and 4.5 mm, respectively) from Rock Creek, Plumas Co., California, not only are smaller than the other paratypes, but their coloration is very similar to that of *A. robiginosa.* Short aristal hairs and terminalia appear to be identical to *A. vernalis.*

The name of the new species is derived from the latin *vernalis* (= of, or belonging to spring) and alludes to the season when this species was most often collected.

DEPOSITION OF TYPE MATERIAL.—Holotype and allotype, California Academy of Sciences, CAS No. 10208. The male paratype from Roberts, Oregon, was returned to Oregon State University.

FIELD OBSERVATIONS

The neallotype male of *A. robiginosa* was collected in the Modoc National Wildlife Refuge, two miles south of Alturas. The roadside ditches along Highway 395, which transects the refuge, were the usual collecting sites. This location is at the western fringe of the Great Basin biocoenose at approximately 4,350 feet elevation on the west side of the Warner Mountains. It is part of a broad, flat, marshy valley which is drained by the South Fork of the Pit River. In Modoc Co. 25 of the 44 species of Sciomyzidae known to occur in California were found. A total of 6 *A. robiginosa* occurred in 5 of 51 samples collected with a D-Vac suction collector and with aerial-sweep nets near Alturas during a four-year period. In these 51 samples, 5 *A. testacea* and 1 *A. borealis* were collected in 2 and 1 samples, respectively. *A. robiginosa* accounted

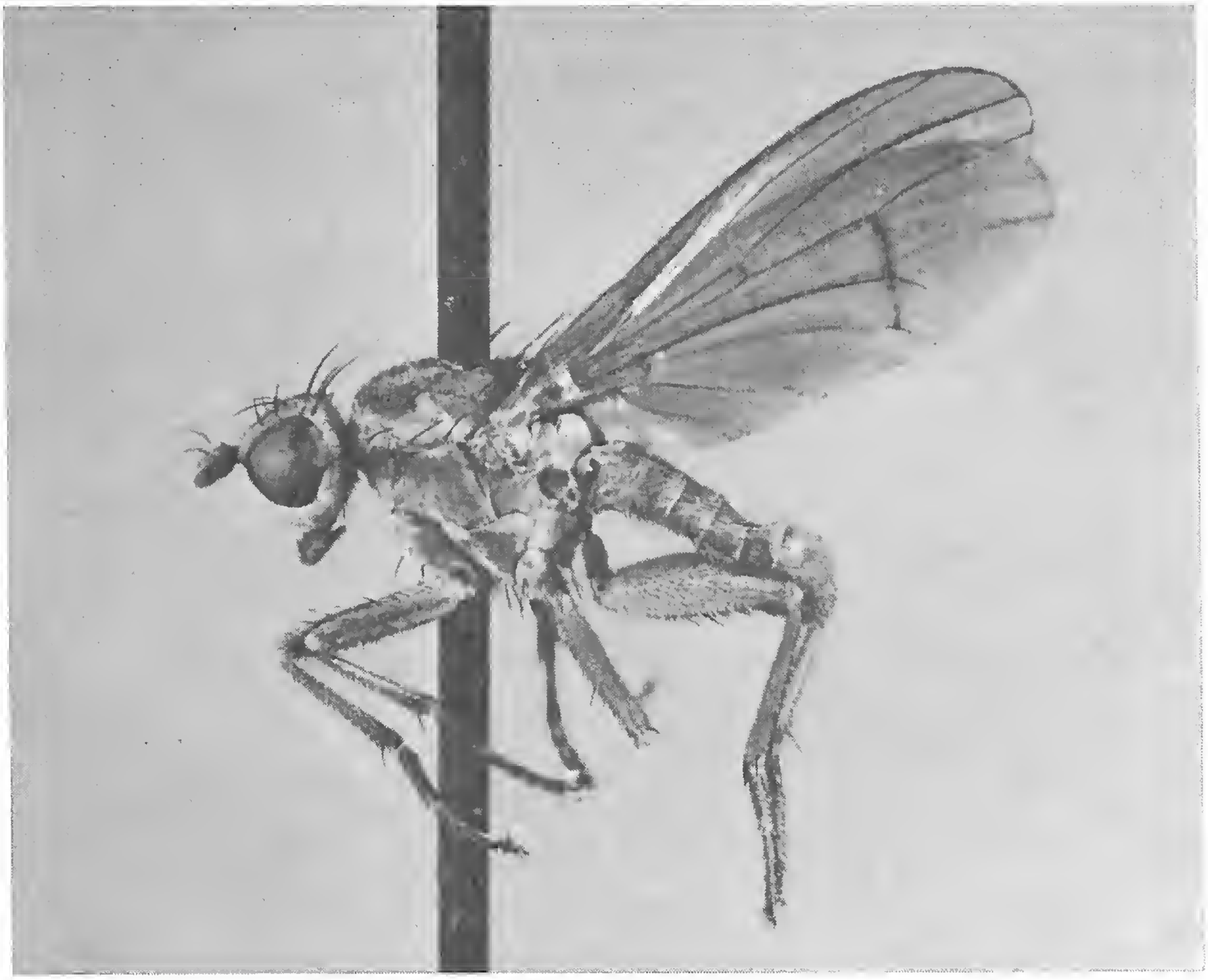

FIG. 13. *Antichaeta robiginosa* Melander, male. U.S.A., Calif., Mendocino Co., 2 mi. N/Willits, 1,330 feet elev., 23 April 1968 (TWF & REO), AS-669.

for two percent of the population of sciomyzid flies in samples in which it occurred.

Although an uncommon species itself, considering all areas collected, *A. robiginosa* occasionally occurs with other species of *Antichaeta. A. robiginosa* and *A. borealis* occurred together in a marshy meadow on the east side of the Warner Mountains, 3 miles north of Eagleville, 4,640 feet elevation (41° 20′ N., 120° 08′ W.). At Buckhorn Springs near Deep Springs Lake, Inyo Co., 5,000 feet elevation (37° 21′ N., 118° 00′ W.), *A. robiginosa* and *A. testacea* have been collected only on separate dates, indicating a possible difference in seasonal activity. In Mendocino Co. at the *A. vernalis* type locality, *A. robiginosa* and *A. vernalis* occur in the same marshy pasture along Highway 101 two miles north of Willits. In the Alturas area a curious distributional relationship of *A. robiginosa* and *A. testacea* was observed. *Antichaeta robiginosa* but not *A. testacea* was collected along Highway 395 between Alturas and Likely, 18 miles to the south, and *A. testacea* but not *A. robiginosa* was collected approximately 8 miles west of Alturas along

Highway 299. Close similarities of elevation, habitat, and snail fauna throughout this area apparently mask the critical factors which are responsible for the separation of these two species.

Although *A. robiginosa* presently is found mainly well above 1,000 feet elevation and above 40° North Latitude, its previous distribution probably covered a much broader geographic range, including much of the Sacramento and San Joaquin Valleys of California. This is indicated by the fact that a single male was collected near Redding, Shasta Co., 450 feet elevation (40° 39′ N., 122° 24′ W.), at the northern end of the Sacramento Valley, and that the first, and southernmost specimen of *A. robiginosa* we saw was a male collected at Woodlake, Tulare Co., California, 24-V-1947 (36° 26′ N., 119° 07′ W.). This locality, at 450 feet elevation, is near the western foothills of the Sierra Nevada Mountains well toward the southern end of the San Joaquin Valley. Several attempts were made to collect *A. robiginosa* in this area without success, but *A. testacea* was fairly common. *A. robiginosa* probably no longer occurs in the Woodlake area for one or more reasons. Drainage and reclamation projects associated with agricultural development of the valley, which has been continuous from approximately 1850 to the present, may have forced *A. robiginosa* toward the foothills into a more restricted habitat. There it had to compete with an established and presumedly superior ecological homologue, *A. testacea.* The species might also have been eliminated from the area by the mosquito control program which began in 1922 when the Delta Mosquito Abatement District (Tulare Co.) was formed. A specimen of *A. robiginosa* was taken in 1947 at which time chlorinated hydrocarbons were in vogue. In the 1950's these pesticides were replaced by organo-phosphates for mosquito control work. During the five-year period 1964 through 1968, an annual average of 1,266 pounds of liquid ethyl parathion and 6,883 pounds of liquid Baytex (pounds of actual toxicants) were applied to aquatic habitats in the 712 square miles comprising this single district. There are 60 such districts in California (Anon. 1965–69), and currently, attempts are being made to expand the use of biological or ecological methods of mosquito control in their programs. If this trend persists, perhaps in time certain species may reappear in the urban or suburban aquatic habitats.

The extent of this former habitat may be surmised from diaries of early expeditions and travelers which describe a vast marsh extending north and south from the Stockton area, requiring a trip of hundreds of miles to go around it. The "vast marsh" implies a habitat which probably included mud banks and hummocks, much of which was covered with thatches of dead vegetation under which hygrophilous snails could thrive—just as they do today in marshy habitats.

Although there is no laboratory data to confirm the biologies of *A. robiginosa* or *A. vernalis*, they are probably dependent on hygrophilous snails or their eggs, e.g., Succineidae, for oviposition sites and development of first-instar larvae which is the case with *A. testacea* (Fisher and Orth, 1964). Snails of the family Succineidae were present at all sites where *A. robiginosa* and/or *A. vernalis* were collected. These snails were especially abundant at Alturas, Willits, and Deep Springs.

Acknowledgments

The guidance and critique of L. V. Knutson, Systematic Entomology Laboratory, USDA, throughout the preparation of this paper is very much appreciated. Figures 1–12 were drawn by R. E. Orth; Figure 13, photo by E. B. White, UCR.

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A Redesciption of the Scorpion *Vejovis crassimanus* Pocock
(Scorpionida : Vejovidae)

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In 1898, R. I. Pocock described nine North American species of scorpions belonging to the genus *Vejovis* in a brief, but important, paper. One of these, *Vejovis crassimanus* Pocock, has caused considerable confusion even though it supposedly occurs in the Texas scorpion fauna. Examination of the cotypes used in the original description of this species revealed that Pocock apparently based his description on two specimens, one he thought to be a male, the other he thought to be a female. Study of these two specimens further revealed that they are both female specimens, but each represents a distinct and different species of *Vejovis*. To clarify this problem, the specimen which Pocock apparently believed to be the male, and upon which most of the description was based, is here redescribed and designated as the lectotype of *Vejovis crassimanus* Pocock. The second specimen appears to belong to the "eusthenura" group of *Vejovis* and appears to be closely related to *Vejovis coahuilae* Williams.

Thanks are gratefully acknowledged to D. J. Clark, of the Department of Zoology, British Museum of Natural History, for arranging the loan of the type specimens used in this study, and to C. A. Steketee for clerical assistance. This study was partially supported by the National Science Foundation through research grant GB 7679.

VEJOVIS CRASSIMANUS Pocock
(Figs. 1, 2)

DIAGNOSIS.—Large species of *Vejovis* belonging to the "punctipalpi" group. Coloration: more or less uniform yellow with faint underlying dusky markings on carapace; fingers reddish. Metasoma with inferior median keels smooth to crenulate on segment I, crenulate to serrate on II to IV; inferior lateral keels of segment I crenulate to serrate, serrate on II to V. Ventral surface of vesicle smooth, lustrous, with about five pairs long hairs. Pedipalps with movable finger shorter than carapace length, palm distinctly swollen, fingers unscalloped.

Very closely related to *Vejovis cazieri* Williams in structure from which it differs in the following characteristics: lacks pair of longitudinal stripes on the mesosomal dorsum; vesicle not as hirsute (with about five pairs of conspicuous hairs, not with about 30 pairs of conspicuous hairs) ; tarsomeres less hirsute; metasoma with inferior median keels not set with long conspicuous hairs (each segment with three pairs of hairs in *V. cazieri*) ; chela narrower than metasomal

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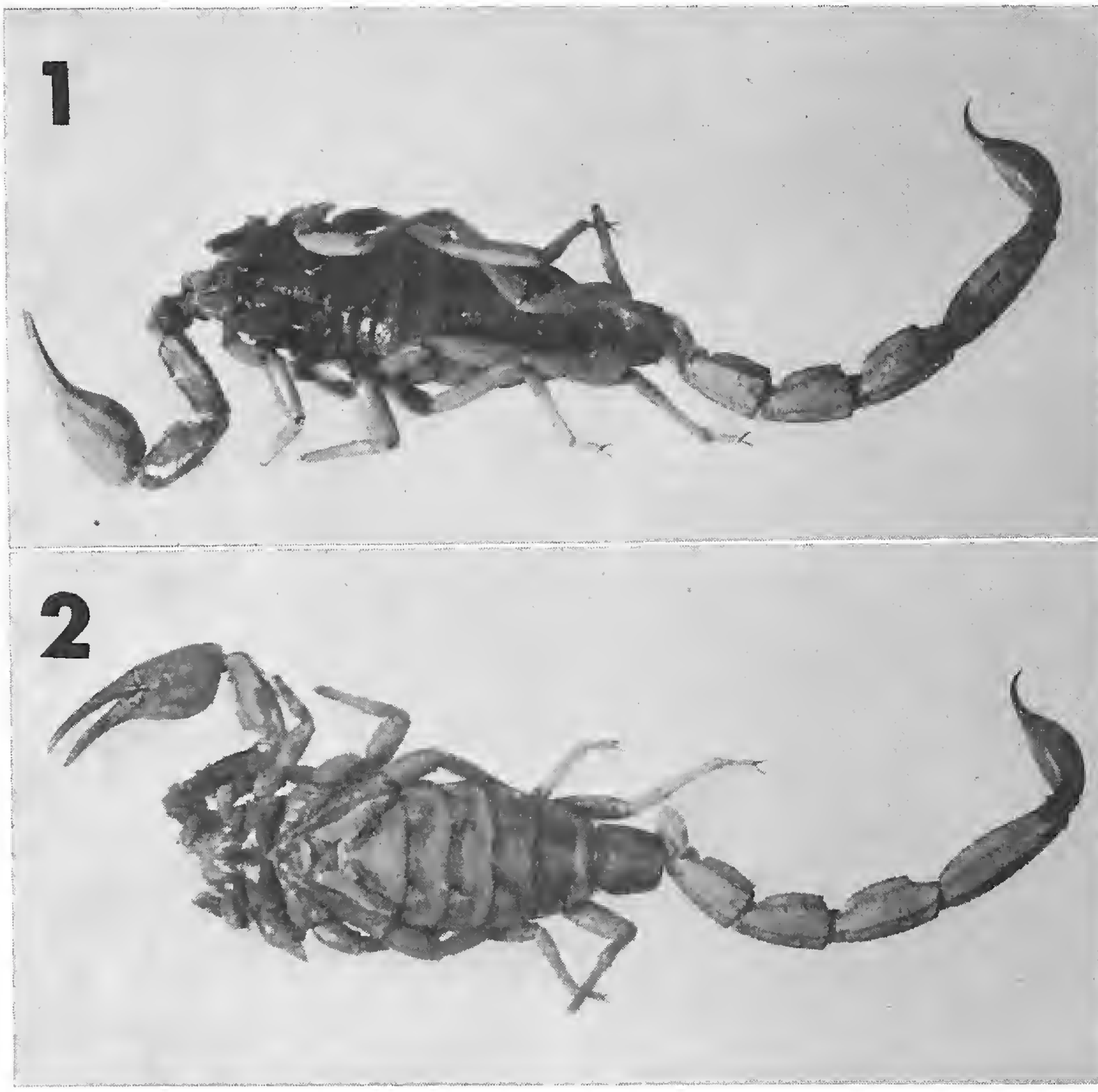

FIGS. 1 and 2. *Vejovis crassimanus* Pocock, lectotype female (S. C. Williams). FIG. 1. Dorsal view. FIG. 2. Ventral view.

segment I width. Also related to *Vejovis mexicanus* C. L. Koch and *Vejovis granulatus* Pocock, but *V. crassimanus* distinguished from *V. granulatus* by lack of distinct longitudinal stripes on mesosomal dorsum and by more swollen pedipalp palms. Distinguished from *V. mexicanus* by relatively shorter movable finger of pedipalp, which is distinctly shorter than carapace (not equal to, or longer than, carapace).

LECTOTYPE FEMALE.—*Coloration.*—Color pattern somewhat obscured by poor preservation. Uniform yellow with faint indication of underlying faint dusky markings on dorsum of carapace and mesosoma. Pedipalp fingers reddish.

Carapace.—Lateral eyes three per group; median eyes on raised ocular tubercule; carapace surface coarsely granular.

Mesosoma.—Tergites coarsely granular; two pairs of serrate lateral keels on last tergite. Sternites smooth and lustrous; one pair crenulate keels on last sternite. Stigma long oval.

Metasoma.—Dorsal and dorso-lateral keels serrate on segments I to IV, each keel ends posteriorly in very slightly enlarged tooth on segments I to III.

TABLE 1. Measurements (in millimeters) of *Vejovis crassimanus* Pocock, lectotype established by S. C. Williams.

	Lectotype (female)
Total length	55.0
Carapace, length	7.6 (approx.)
width (at median eyes)	6.0 (approx.)
Metasoma, length	26.6
segment I (length/width)	3.7/3.7
segment II (length/width)	4.3/3.6
segment III (length/width)	4.4/3.5
segment IV (length/width)	5.8/3.4
segment V (length/width)	8.4/3.2
Telson, length	7.8
Vesicle (length/width)	5.2/2.8
depth	2.6
Aculeus, length	2.6
Pedipalp	
Humerus (length/width)	5.5/2.0
Brachium (length/width)	6.0/2.4
Chela (length/width)	11.3/3.6
depth	3.8
movable finger, length	6.5
fixed finger, length	4.6
Pectines	
teeth (left/right)	15/15

Dorsolateral border of segment V irregularly crenulate. Inferior lateral keels of segment I crenulate to serrate, serrate on II to V. Inferior median keels smooth to crenulate on segment I, crenulate to serrate on II to IV, serrate on V. Inferior intercarinal spaces of segment V essentially smooth with a few scattered granules.

Telson.—Ventral surface smooth and lustrous; with about five pairs of long hairs almost approximating aculeus length.

Chelicerae.—Inferior surface of movable finger completely lacking denticles.

Pedipalps.—Palm of chela well swollen inwardly, keels well developed and smooth to granular. Fingers short. Internal margin of fingers not scalloped, internal borders essentially meet along entire length when chela closed.

Standard Measurements.—Table 1.

TYPE DATA.—*Vaejovis crassimanus* Pocock, 1898, (lectotype female, S. C. Williams), "San Diego, Texas, 1889, William Taylor." Type depository, British Museum of Natural History.

Lectotype in poor physical condition. Metasoma disarticulated between second and third segments, large piece of carapace loose, anterior border of carapace almost completely missing, one pedipalp missing, chelicerae in separate vial, walking legs with most tarsomeres missing. Base color appears darkened due to poor preservation.

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Pocock, R. I. 1898. The scorpions of the Genus *Vaejovis* contained in the collection of the British Museum. Ann. Mag. Natur. Hist., ser. 7, 1: 394–400.

A New Subgenus of *Andrena* Found in California and Oregon
(Hymenoptera : Apoidea)

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The three species included in *Nemandrena* were brought to the attention of the author by R. W. Cruden, University of Iowa, who found they are important pollinators of *Nemophila menziesii* H. & A. (Hydrophyllaceae) (Cruden, in press). Two of the bees were undescribed and the third was known only from the holotype. The bees form a rather unique natural grouping meriting subgeneric recognition and are of special interest because of the convergence in the form of their mouthparts with other *Andrena*, as described below.

One of the three species has the pronotum with humeral angles and ridges much as in the *Opandrena-Andrena s. str.-Belandrena* group of subgenera. The other two species lack even a trace of these angles and ridges and seem to be related to *Melandrena* (= *Gymnandrena*). The presence of this pronotal character in a species of a subgenus generally characterized by the lack of the humeral angle is known in several subgenera, i.e., *Diandrena, Hesperandrena, Callandrena.* It seems that the three species in question are most closely related to the *Tylandrena-Melandrena* group of subgenera.

The subgenus *Nemandrena* can be recognized readily in both sexes by the extremely narrow, pointed galeae, a character shared with *Belandrena* Ribble (1968a), *A.* (*Micrandrena*) *lamelliterga* Ribble (1968b), *Scoliandrena* and, perhaps, a few other *Andrena.* The *Nemandrena* galeae, however, are dulled by fine, regular tessellation, whereas the other forms with small galeae have shiny galeae which are at most very delicately shagreened. In addition, the labral process of the male of *Nemandrena* is uniquely horned, as described below, and the mesoscutum of the female is sculptured with extremely fine, longitudinal rugulae, also a unique *Andrena* character.

The short, narrow, pointed galea is presumably an adaptation to the chief nectar and pollen plants visited by these bees. The three species of *Nemandrena*, two species of *Belandrena* and *A.* (*Micrandrena*) *lamelliterga* all seem to be oligolectic on plants of the family Hydrophyllaceae, in particular species of *Nemophila* and *Phacelia*. The narrow galeae of these three groups of bees are then a functional convergence formed by an adaptation to the same or related plants, as the three groups of bees are not closely related to one another.

The *Scoliandrena*, also with narrow galeae although somewhat wider than in the other three groups, seem to be more closely related to the *Nemandrena*. At least these two subgenera both appear to have been derived from the *Tylandrena-Melandrena* stock and they resemble one another in the lack of tergal pale fasciae and in the long, spinelike, simple hairs of the front coxae. However, the small *Scoliandrena* galeae were produced as an adaptation to the narrow-tubed boraginaceous flowers of *Cryptantha* to which they are oligolectic. Also, the small *Scoliandrena* galeae differ markedly from those of *Nemandrena* by bearing numerous, short, hooked hairs, presumably used for pulling pollen from deep within the corolla tube of *Cryptantha*.

The subgeneric and specific descriptions given below follow the form and use of terms defined in papers bearing on a monographic revisional study of the Western Hemisphere species of the genus *Andrena* previously published by the author (1964, 1967, 1969).

Nemandrena LaBerge, new subgenus

TYPE SPECIES.—*Andrena torulosa* LaBerge.

Medium-sized bees; facial quadrangle distinctly broader than long; eyes with inner margins parallel; vertex above lateral ocellus equals one to one and one-half ocellar diameters; labial palpus normal; maxillary palpus longer than galea by last two palpal segments when extended; galea extremely narrow, short and acutely pointed; labral process triangular; clypeus relatively flat, with a low, rounded, subapical, shiny boss; malar area linear; genal area in profile one and one-half times as broad as eye or broader. Pronotum with or without humeral angle and dorsoventral ridge; propodeum with dorsal enclosure finely tessellate, rugulae, if present, extremely short and confined to extreme base. Tergal integument finely and obscurely punctate, surfaces reticularly shagreened or finely tessellate. Hind tibial spur normal. Pterostigma about as broad as from inner margin prestigma to anterior wing margin; with three submarginal cells; vein 1st m-cu meets second submarginal cell slightly before middle of cell. Vestiture variously colored; terga without trace of apical pale fasciae; sterna with single row of subapical, extremely long, plumose hairs but not forming a dense subapical fimbria.

FEMALE.—Facial fovea shallow, extending to below lower margins of antennal sockets, well-separated from compound eye especially in lower half, separated from compound eye especially in lower half, separated from lateral ocellus by at least one ocellar diameter; labrum below process with a strong, transverse, shiny sulcus ending at each apicolateral angle of labrum in a raised, acute process directed apically and slightly laterally, without cristae; subgenal coronet present, well developed. Mesoscutum between parapsidal lines to posterior margin with longitudinal, parallel, extremely fine rugulae and dense tessellation; middle basitarsus not broadened medially; tibial scopal hairs simple, rather short; trochanteral flocculus complete, well formed; propodeal corbicula complete anteriorly with abundant internal simple hairs. Pygidial plate without internal raised triangular area.

MALE.—Clypeus and parocular areas black; labral process with a strong apicomedial horn on surface almost as long as process; mandibles not decussate, femalelike; first flagellar segment at least twice as long as second. Mesoscutum with fine rugulae as in female but much less distinct and usually reduced to short rugulae on declivous posteromedian area. Sterna 2–5 without dense subapical fimbriae; sternum 6 not reflexed apically. Gonobase with ventral-median processes extremely thin and long.

Andrena (Nemandrena) torulosa LaBerge, new species

This small gray species can be told from the other two species of *Nemandrena* by the presence of a strongly developed humeral angle and dorsoventral ridge on the pronotum in both sexes. If this character were overlooked, *A. torulosa* would be extremely similar to *A. crudeni* whose description follows, but differs from *A. subnigripes* by the paler vestiture of the metasoma and legs. So similar are *A. torulosa* and *A. crudeni* that one wonders whether or not the complicated-looking, pronotal character difference could not be produced by a single Mendelian locus with a dominant gene producing one or the other condition. No intermediates have been found and there seems to be complete geographic separation between the two species. It is hoped that giving both forms specific status will keep the problem from becoming lost in the literature.

FEMALE.—*Measurements and ratios.*—N = 20; length, 9–11 mm; width, 3.0–3.5 mm; wing length, M = 3.65 ± 0.110 mm; FL/FW, M = 0.88 ± 0.003; FOVL/FOVW, M = 3.17 ± 0.050.

Integumental color.—Black except as follows: tips of mandibles rufescent; flagellar segments 3– or 4–10 dark brown below; wing membranes hyaline, veins dark reddish-brown; terga 2–4 with apical areas slightly hyaline; sterna 2–5 with apical areas hyaline; distitarsi slightly rufescent; tibial spurs testaceous.

Structure.—Antennal scape length equal to flagellar segments 1–3 plus three-fourths of segment 4; flagellar segment 1 as long as segments 2 plus 3 plus three-fourths of 4, segment 2 about equal in length to 3 and each shorter than 4, segments 2 and 3 about as long as broad or shorter, 4–10 longer than broad. Eyes each about four times as long as broad, inner margins parallel. Malar space linear, width of base of mandible equals about 5.5 times minimum length of malar space. Mandible short, in repose extending beyond middle of labrum by about one-fifth its length. Galea dull, tessellate, short, extremely narrow and pointed. Maxillary palpus extends beyond tip of galea by last two segments; segmental ratio about 1.0:1.0:1.0:0.8:0.5:0.7. Labial palpus with first segment slightly curved; segmental ratio about 1.0:0.7:0.5:0.6. Labral process triangular, depressed medially near apex and with a small median protuberance just basad of depression or with a distinct median longitudinal rugula with a small lateral concavity on either side near apex (holotype of first type) ; labrum apical to process with a strong transverse shiny sulcus. Clypeus relatively flat, with a distinct median subapical shiny boss, lateral to boss gibbous subapically, remainder with large, crowded punctures but extremely shallow and obscured by fine dense tessellation. Supraclypeal area sculptured like clypeus but punctures smaller. Genal area in profile as broad as one and one-half times eye width, surface dulled by minute, relatively sparse punctures and coarse reticular shagreening. Vertex short, above lateral ocellus equal to one ocellar diameter or slightly more, surface opaque, dulled by dense regular tessellation and small sparse punctures. Face above antennae with fine longitudinal rugae, interrugal spaces dulled by fine reticular shagreening. Facial fovea short, narrow, extends to just below lower margins antennal sockets, separated from lateral ocellus by one ocellar diameter or more, well separated from margin of compound eye.

Pronotum with well-formed humeral angle, triangular in lateral view, and dorsoventral ridge not crossed by an impressed oblique suture; surface tessellate, area behind dorsoventral ridge slightly roughened. Mesoscutum between parapsidal lines except in anterior third with extremely fine, close-set, longitudinal rugulae, with minute obscure punctures separated mostly by one to two puncture widths or more, surface opaque, dulled by fine regular tessellation. Scutellum similar but without rugulae or these short and evanescent. Metanotum dulled by close-set minute punctures and dense tessellation. Propodeum with dorsal enclosure smooth, tessellate, with a few extremely short rugulae at base; dorsolateral and posterior surfaces with distinct sparse punctures and surface coarsely tessellate; corbicular surface coarsely tessellate, punctures extremely sparse. Mesepisternum with fine shallow punctures obscured by fine dense tessellation. Pterostigma about as broad as from inner margin prestigma to anterior wing margin; vein 1st m-cu meets second submarginal cell at or before middle of cell.

Metasomal terga with apical areas indistinct, basal areas with small punctures separated mostly by one to two puncture widths, more crowded on terga 2 and 3 than on 1 and 4, apical area punctures sparse; punctures obscured by coarse, irregularly and finely reticulate shagreening. Pygidial plate V-shaped with rounded apex, without raised internal triangular area, with strongly curved rows of close-set coarse punctures (unless worn). Sterna 2–5 with narrow impunctate apical areas, basal areas with crowded punctures in apical halves, impunctate basally, surfaces moderately dulled by fine reticular shagreening.

Vestiture.—Generally cinereous but vertex and facial foveae with brown hairs, terga 5 and 6 brown medially, tarsi with outer surfaces at least partly brown, hind tibiae with scopal hairs below basitibial plates and along posterior border brown, and fore and middle tibiae with outer surfaces brown at least in part. Fore coxae (and to a lesser degree middle coxae) with long, stiff, simple hairs. Terga without apical pale fasciae; sterna 2–5 with short hairs in basal areas and subapical fringes of extremely long, plumose hairs. Propodeal corbicula with moderately long, plumose hairs anteriorly, with abundant internal long simple hairs; trochanteral flocculus complete; tibial scopal hairs simple, relatively short (but along posterior margin at least as long as median width of tibia).

MALE.—*Measurements and ratios.*—N = 16; length, 8–10 mm; width, 2–3 mm; wing length, M = 3.43 ± 0.196 mm; FL/FW, M = 0.81 ± 0.004; FS1/FS2, M = 2.33 ± 0.052.

Integumental color.—Black except as follows: mandibles with tips rufescent; flagellar segments 2– or 3–11 reddish-brown to dark brown below; wing membranes hyaline, colorless, veins dark reddish-brown; terga 2–5 with apical areas slightly translucent; sterna 2–5 with apical areas hyaline or rufescent; distitarsi rufescent; tibial spurs testaceous.

Structure.—Antennae moderately long, in repose reaching to metanotum; scape length equals first two and one-half flagellar segments or slightly more; flagellar segment 2 distinctly shorter than 3 and shorter than broad, segments 3–11 longer than broad. Eyes each about three and one-third times as long as broad, inner margins parallel. Malar space and galeae as in female. Mandible as in female but slightly longer. Maxillary palpus as in female but segmental ratio about 0.7:1.0:0.9:0.8:0.7:0.7. Labial palpus as in female but ratio about 1.0:0.5:0.6:0.5. Labral process triangular with a prominent median horn half as long as length of process rising from surface subapically; apical part of labrum not strongly sulcate as in female. Clypeus broad, relatively flat with a prominent median shiny elevated boss, surface elsewhere dulled by crowded, extremely shallow punctures and fine, dense tessellation. Supraclypeal area, genal area, vertex and face above antennae as in female except genal area slightly broader, face above antennae with rugae weak especially near ocelli and vertex somewhat taller.

Thoracic sculpturing as in female except mesoscutum with rugulae scarcely visible except in posterior declivity, much finer than in female and scutellum without evident rugulae. Wing venation as in female.

Tergal sculpturing as in female except basal area punctures sparser (separated mostly by two to four puncture widths) and apical areas of terga 2–5 shinier, shagreening finer. Sterna 2–5 as in female but punctures extremely sparse. Sternum 6 with a broad, very shallow, apical emargination, subapically with a median, slightly protuberant, triangular knob; medially impunctate and dull to moderately shiny.

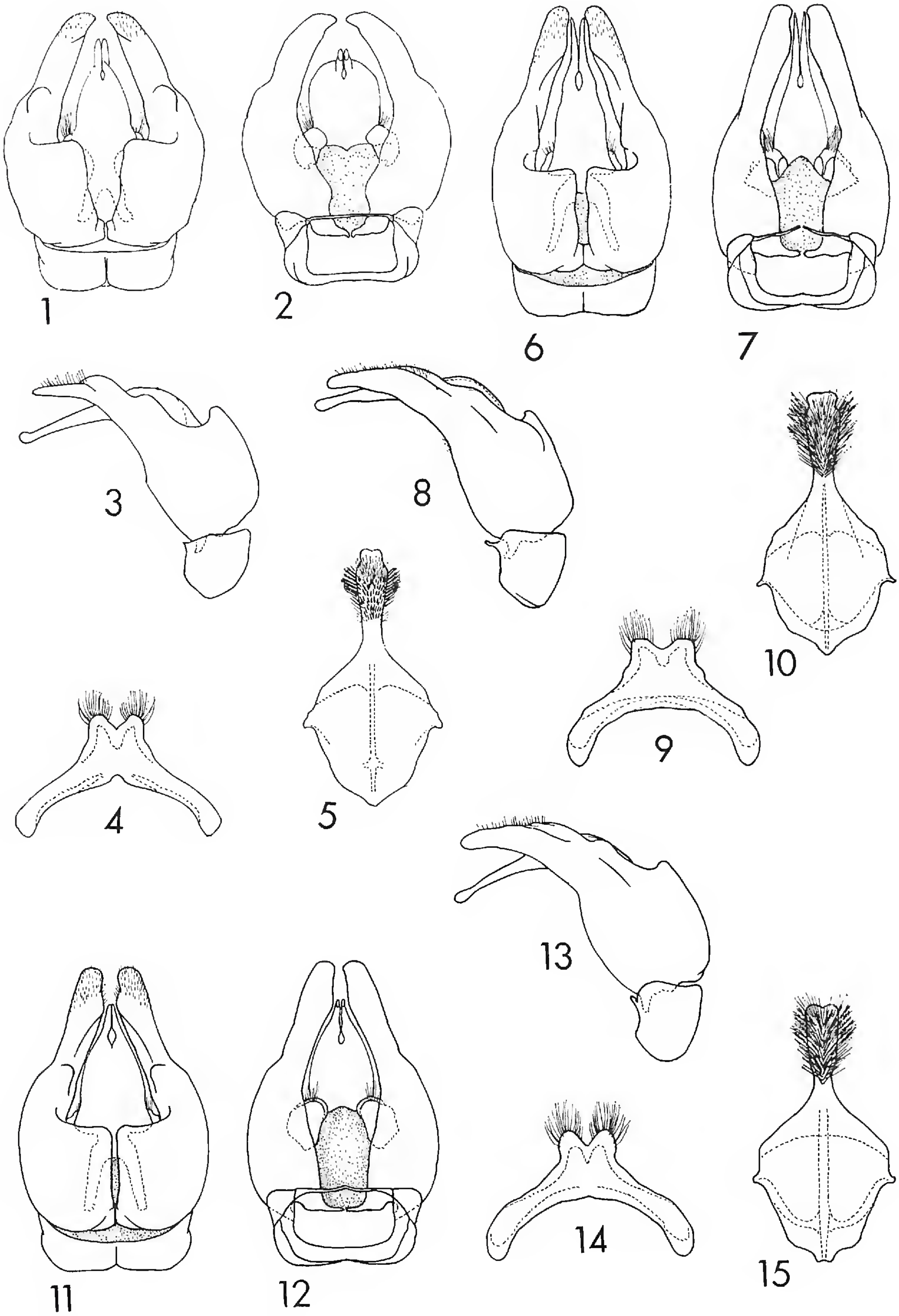
Terminalia as figured (Figs. 1–5), note the following: falcate apical processes of gonocoxites; shape of volsellae; sternum 8 with apical area with short stout pointed hairs medially.

Vestiture.—Generally white to cinereous; clypeus with thick beard; terga without pale apical fasciae; sterna 2–5 without distinct subapical fimbriae but with a single transverse row of subapical, extremely long, plumose hairs (longest laterally).

Holotype female, 2.1 MILES SOUTH OF THE OAKVILLE ROAD ON THE SILVERADO TRAIL, NAPA COUNTY, CALIFORNIA, on *Nemophila menziesii atomeria*, 19 February 1967, by R. W. Cruden. Allotype, 2 ♀ and 3 ♂ paratypes same data as type. Additional paratypes include 230 ♀ and 15 ♂ as listed below.

CALIFORNIA: *Humboldt Co.*: Kneeland (16.3 mi. S.): 1 ♀ on *N. m. atomeria*, 2 May 1965, R. W. Cruden. *Lake Co.*: Anderson Spring: 1 ♀, 30 March 1961, J. S. Buckett. Route 20 (2.1 mi. E. of Rte. 53): 2 ♀ on *N. m. menziesii*, 26 April 1965, R. W. Cruden. Route 175 (2 mi. S. of Rte. 29): 13 ♀ on *N. m. menziesii*, 30 April 1966, R. W. Cruden; 19 ♀ on *N. m. menziesii*, 7 May 1966, R. W. Cruden; 1 ♀ on *N. m. menziesii*, 5 May 1966, R. W. Cruden. Sawmill Flat, Bartlett Mt.: 2 ♀ on *N. m. atomeria*, 9 May 1965, R. W. Cruden. *Marin Co.*: Fort Baker: 1 ♀, 15 March 1925, C. L. Fox. Lake Lagunitas: 1 ♀, 30 March 1961, D. Q. Cavagnaro, Woodacre: 1 ♂, 17 March 1929, M. C. Van Duzee. *Mendocino Co.*: Mendocino Pass: 1 ♀, 19 April 1948, R. M. Bohart. Ryan Creek: 1 ♀, 17 April 1938, N. F. Hardman; 8 ♀, 12 April 1941, N. F. Hardman; 3 ♀, 13 April 1941, N. F. Hardman; 2 ♂ on *Arctostaphylos* sp., 26 March 1949, P. D. Hurd; 1 ♀ on *Nemophila* sp., 18 April 1954, R. Craig. *Napa Co.*: Chiles-Pope Valley Road (0.2 mi. N. of Rte. 128): 1 ♀ on *N. m. menziesii*, 27 March 1965, R. W. Cruden. Monticello (11 mi. S.): 8 ♀, 20 March, 2 ♀, 25 March 1930, L. M. Smith; 2 ♀, 29 March 1956, E. A. Kurtz. Pope Valley (3.3 mi. S.): 6 ♀ on *N. m. liniflora*, 16 April 1966, R. W. Cruden; 1 ♀ on *Platystemon californica*, 2 ♀ on *N. m. menziesii*, 8 ♀ on *N. m. liniflora*, 20 April 1966, R. W. Cruden; 1 ♀ on *Limnanthes douglasii*, 26 April 1966, R. W. Cruden; 1 ♀ on *P. californica*, 8 ♀ on *N. m. atomeria*, 16 April 1967, R. W. Cruden. Silverado Trail (2.7 mi. S. of Oakville Road): 5 ♀, 1 ♂ on *N. m. atomeria*, 24 March 1967, R. W. Cruden. *Sonoma Co.*: El Verano (1 mi. S.): 54 ♀, 7 ♂ on *Nemophila* sp., 9 March 1967, R. W. Thorp, B. J. Donovan and R. Adlakha; 37 ♀ on *L. douglasii*, 29 March 1967, R. W. Thorp and B. J. Donovan; 22 ♀ on *L. douglasii*, 3 April 1967, R. W. Thorp and B. J. Donovan. Lichau Road (2.8 mi. E. of Pressley Road): 1 ♀ on *N. m. menziesii*, 8 May 1965, R. W. Cruden. Triniti: 1 ♂, 26 March 1937. Triniti Road (2.1 mi. E. of Cavedale Road): 2 ♀, 12 April and 3 ♀ 24 April 1965, on *N. m. atomeria*, R. W. Cruden. A single female paratype was collected at Mark West Sprgs., California, on *Nemophila* sp., 23 April 1935, by E. P. Van Duzee, but the author has not been able to locate this site. OREGON: *Washington Co.*: Forest Grove: 1 ♀, 2 April, 1 ♂, 4 April and 2 ♀, 1 ♂, 6 April 1918, F. R. Cole; 1 ♂, 23 March and 1 ♀, 29 March 1919, L. P. Rockwood.

The holotype and allotype are preserved in the collection of the Illinois Natural History Survey. Paratypes are deposited in the collections of The University of California at Berkeley and at Davis, the California Academy of Sciences in San Francisco, Professor P. H. Timberlake at Riverside, California, Dr. R. W. Cruden, Iowa City, Iowa, Oregon State University at Corvallis, Utah State University at Logan, the University of Kansas at Lawrence and the United States National Museum in Washington, D. C.



FIGS. 1–15. Genital capsules (dorsal, ventral and lateral views) and sterna 7 and 8 of the following: *A. torulosa* (1–5), *A. crudeni* (6–10), and *A. subnigripes* (11–15).

Andrena (Nemandrena) crudeni LaBerge, new species

Andrena crudeni is almost indistinguishable from *A. torulosa* except for the fact that *A. crudeni* lacks completely the pronotal humeral angle and ridge in both sexes.

FEMALE.—*Measurements and ratios.*—N = 20; length, 9–12 mm; width, 2.5–4.0 mm; wing length, M = 3.61 ± 0.102 mm; FL/FW, M = 0.86 ± 0.003; FOVL/FOVW, M = 3.22 ± 0.072.

Integumental color.—As in *A. torulosa.*

Structure.—Structure and sculpture of head as in *A. torulosa* except as follows: maxillary palpus with segmental ratio about 1.0:1.0:0.7:0.7:0.6:0.4; labial palpus with ratio about 1.0:0.6:0.4:0.6. Thoracic and metasomal sculpture and structure as in *A. torulosa* except pronotum completely lacks humeral angle and dorsoventral ridge, laterally pronotum rather evenly and finely tessellate.

Vestiture.—As in *torulosa* but head with vertex and along inner margins compound eyes usually with abundant reddish-brown hairs.

MALE.—*Measurements and ratios.*—N = 9; length, 8–10 mm; width, 2.0–2.5 mm; wing length, M = 3.32 ± 0.229 mm; FL/FW, M = 0.80 ± 0.008; FS1/FS2, M = 2.37 ± 0.087.

Integumental color.—As in *A. torulosa.*

Structure.—Structure and sculpture of head as in *torulosa* except as follows: maxillary palpus with segmental ratio about 1.0:1.0:1.0:0.9:0.7:0.6; labial palpus with ratio about 1.0:0.5:0.4:0.4. Thoracic and metasomal structure and sculpturing as in *A. torulosa* except as follows: pronotum completely lacks humeral angle and dorsoventral ridge, surface finely and regularly tessellate; terminalia as figured (Figs. 6–10), note apical process gonocoxite longer, less falcate; sternum 7 broader at apex; shape of volsellae; sternum 8 lacking short stout hairs medially.

Vestiture.—As in *A. torulosa.*

Holotype female, 10 MILES NORTH OF CALIENTE, KERN COUNTY, CALIFORNIA, on *Nemophila menziesii menziesii*, 21 March 1965, by R. W. Cruden. Allotype, 2 ♀ and 2 ♂ paratypes same data as type. Additional paratypes include 125 ♀ and 6 ♂ from California, all collected by R. W. Cruden on *Nemophila menziesii menziesii* unless otherwise indicated.

Amador Co.: Jackson (0.5 mi. S. on Rte. 49): 1 ♀, 17 April 1966. *Calaveras Co.*: Angels Camp (1.9 mi. S. at Rte. 49): 3 ♀, 3 April 1965. Mokelumne River and Rte. 29: 1 ♀, 29 April 1967. Mokelumne River and Rte. 49: 4 ♀, 17 April 1966. *Fresno Co.*: Fresno (Shaw Avenue): 2 ♀, 2 ♂, 5 March 1957. Watts Valley (7 mi. W. of and near Watts Creek): 25 ♀, 3 ♂, March 1967, on *N. m. menziesii*, John Weiler. *Kern Co.*: Caliente (10 and 11 mi. N.): 22 ♀, 1 ♂, 6 April 1966. Glennville (3.8 mi. N.): 2 ♀, 14 April 1965, on *N. m. menziesii*, R. A. Schlising. Granite-Glennville Road (8.8 mi. N.E. of Woody-Granite Rd.): 2 ♀, 14 April 1965, on *N. m. menziesii*, R. A. Schlising. Lake Isabella (1 mi. W.): 1 ♀, 21 March 1969. Walker Basin (15.2 mi. N. of Caliente): 4 ♀, 6 April 1966. *Madera Co.*: Bass Lake Road (Rte. 432, 0.4 mi. S. of Rte. 222): 2 ♀, 15 May

1967. Coarsegold (3.1 mi. N.E. at Rte. 41): 12 ♀, 15 May 1967. *Monterey Co.*: Jolon (12.9 mi. S. on Jolon-Bradley Rd.): 1 ♀, 20 March 1965. Spring Road (1.7 mi. N.E. of Mission Rd.): 3 ♀, 19 March 1965. *Nevada Co.*: Route 49 (1.8 mi. N. of County line): 1 ♀, 24 April 1966. *San Benito Co.*: Lonoak Road (11.3 mi. E. of Rte. 101): 3 ♀, 19 March 1965. *San Luis Obispo Co.*: Palo Prieto Road (4.5 mi. S. of Rte. 466): 1 ♀, 26 March 1965. San Miguel (1.4 mi. E.): 2 ♀, 20 March 1965. *Tulare Co.*: Badger (2.9 mi. N.): 1 ♀, 15 April 1965, on *N. m. menziesii*, R. A. Schlising. *Tuolumne Co.*: Black Oak Road (3.5 mi. N. of Sonora-Tuolumne Rd.): 4 ♀, 13 May 1967, on *Nemophila maculata*, R. W. Cruden. Soulsbyville Road (0.5 mi. N. of Sonora-Tuolumne Rd.): 5 ♀, 13 May 1967, on *N. maculata*, R. W. Cruden. Standard Road (at Sonora-Tuolumne Rd.): 3 ♀, 13 May 1967, on *N. maculata*, R. W. Cruden. Thell-Ward Ferry: 20 ♀, 13 May 1967.

A single female in the P. H. Timberlake collection, Riverside, California, bears no collection data. The paratypes are distributed to the same collections as listed for *A. torulosa.* The holotype and allotype are in the collection of the Illinois Natural History Survey.

ANDRENA (NEMANDRENA) SUBNIGRIPES Viereck

Andrena (Andrena) subnigripes Viereck, 1916, Proc. Acad. Natur. Sci. Philadelphia, 68: 581.

Andrena (Cryptandrena) subnigripes: Lanham, 1949, Univ. Calif. Publ. Entomol., 8: 223.

This small, brightly colored species is closely related to *A. crudeni.* Like *A. crudeni,* it differs from *A. torulosa* by lacking the pronotal humeral angle and ridge. The female of *A. subnigripes* differs from that of *A. crudeni* by having the metasomal and leg hairs black and the thoracic hairs fulvous to fox-red. The male of *A. subnigripes* differs from that of *A. crudeni* by having black hairs on the last few metasomal segments and having dark ochraceous thoracic hair. Viereck's (1916) original description of the *A. subnigripes* female is excellent.

FEMALE.—*Measurements and ratios.*—N = 20; length, 10–12 mm; width, 3.0–3.5 mm; wing length, M = 3.74 ± 0.099 mm; FL/FW, M = 0.84 ± 0.003; FOVL/FOVW, M = 3.09 ± 0.050.

Integumental color.—As in *A. torulosa* but terga not at all translucent apically and tibial spurs dark reddish-brown.

Structure.—Head structure and sculpturing as in *A. torulosa* except as follows: maxillary palpus with segmental ratio about 1.0:1.0:0.9:0.7:0.6:0.7; labial palpus with ratio about 1.0:0.5:0.5:0.4. Thoracic and metasomal structure and sculpturing as in *A. torulosa* except pronotum completely lacks humeral angle and dorsoventral ridge, surface dull, finely and regularly tessellate and terga 1–4 with apical areas slightly shinier.

Vestiture.—Head hairs dark ochraceous to fulvous with dark brown hairs usually present on vertex and on all specimens along inner margins of eyes, on lower parts of genal area, on mandibles and labrum, in facial fovea and a few dark brown hairs mixed with the paler hairs on clypeus especially apically. Thorax fulvous to bright fox-red above, fulvous on sides and a few dark brown hairs ventrally. Metasomal hairs black or blackish-brown except tergum 1 basally and tergum 2 at extreme base at sides; first two sterna with hairs often pale. Leg hairs black to dark brown except hind trochanteral flocculus ochraceous and usually some femoral hairs pale; fore coxae with long spinelike hairs dark brown. Hair form and pollen collecting hairs as in *A. torulosa.*

MALE.—*Measurements and ratios.*—N = 4; length, 9–10 mm; width, about 2.5 mm; wing length, 3.35–3.50 mm; FL/FW, 0.78–0.79; FS1/FS2, 2.00–2.50.

Integumental color.—As in *A. torulosa.*

Structure.—Head structure and sculpturing as in *torulosa* except as follows: maxillary palpus with segmental ratio about 0.9:1.0:0.9:0.9:0.6:0.7; labial palpal ratio about 1.0:0.6:0.4:0.6. Thoracic and metasomal structure and sculpturing as in *torulosa* except as follows: pronotum completely lacks humeral angle and dorsoventral ridge, surface finely and regularly tessellate; terga 1–5 with apical areas shiny, shagreening extremely delicate; terminalia as figured (Figs. 11–15), note gonocoxites with apical processes less falcate; note shape of volsellae; sternum 8 with apical area with median hairs stout but not short as in *torulosa.*

Vestiture.—Head and thoracic hairs ochraceous to pale fulvous. Metasomal hairs ochraceous except last three or four terga and sterna with dark reddish-brown hairs. Leg hair ochraceous except as follows: inner surfaces tarsi dark brown (hind) to reddish-brown (fore and middle); hind tibia with outer surface with some brown hairs along posterior margin and surrounding basitibial plate; middle tibia with outer surface with brown hairs at least apically.

TYPE MATERIAL.—The holotype female of *A. subnigripes* from Southern California is in the collection of the Philadelphia Academy of Natural Sciences (No. 4018).

DISTRIBUTION.—This species is known from only a few localities in California and the data is given below in full.

Fresno Co.: Shaw Avenue east of Fresno. 37 ♀, 4 ♂, on *Nemophila menziesii menziesii,* 5 March 1967, R. W. Cruden. *Tulare Co.*: Strathmore. 1 ♀, 1 April 1933, P. H. Timberlake.

ACKNOWLEDGMENTS

I wish to thank Dr. R. W. Cruden for the generous loan of his many specimens collected during his studies of the plant genus *Nemophila* and also for allowing me to distribute paratypes of these unusual new bees to several museums. I wish also to thank Mr. John K. Bouseman (Urbana, Illinois), and Mrs. Ellen Larson (Chadron, Nebraska) for their skill in aiding in preparing the drawings for this paper. I am grateful to the National Science Foundation (Grant GB 7374) for continued support of a revision of the genus *Andrena.*

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A New Species of *Phaeogenes*

(Hymenoptera : Ichneumonidae)

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A new species of *Phaeogenes*, tribe Alomyini of the subfamily Ichneumoninae (Hymenoptera : Ichneumonidae), was discovered during a study of the parasitoids of the artichoke plume moth, *Platyptilia carduidactyla* (Riley) (Lepidoptera : Pterophoridae) (Lange, 1950). As the new species, *Phaeogenes cynarae,* doesn't conform well to the existing key for the Alomyini (Townes, *et al.*, 1965), Dr. Henry Townes was kind enough to confirm the species as being in the genus *Phaeogenes sensu lato,* as compared to *Phaeogenes* in the strict sense.[1] This paper presents the description of *Phaeogenes cynarae* for the benefit of future workers in the ecology of the species and its host.

[1] Personal communication, 9 December 1969.

The Pan-Pacific Entomologist 47: 57–62. January 1971

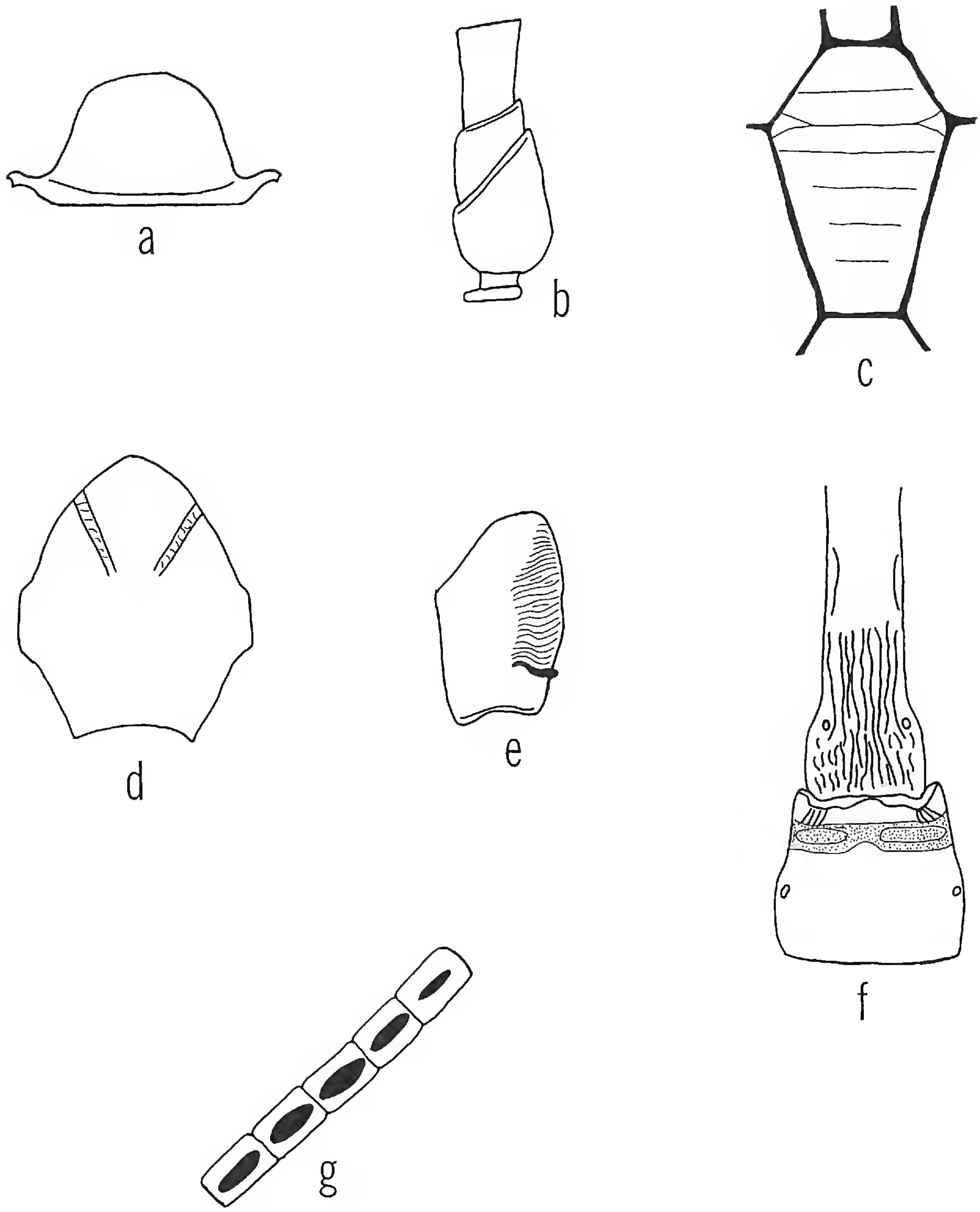

FIG. 1. *Phaeogenes cynarae* Bragg, Holotype: a. Clypeus; b. Right basal antennal segments; c. Areola; d. Dorsal view of mesoscutum showing notauli; e. Right hind coxa showing carina and secondary carinae; f. Postpetiole and second abdominal tergite showing sculpture; g. Tyloids of male (Allotype) antenna, flagellar segments 8–12.

Phaeogenes cynarae Bragg, new species

FEMALE HOLOTYPE.—*Morphological Characters.*—Gena only slightly impressed before the hypostomal carina; clypeus prominent with sparse setation, bell-shaped and apically thickened (Fig. 1a); basal segments of antenna quadrate, 1.5 ×

longer than wide (Fig. 1b); areola longer than wide, truncate (Fig. 1c); notauli weakly impressed (Fig. 1d); transverse carina of hind coxa strongly raised with parallel secondary carinae (Fig. 1e); postpetiole sculptured with longitudinal striae (Fig. 1f); second abdominal tergite thyridia prominent with gastrocoeli impressed, and striae anterior to the thyridia (Fig. 1f). Length 9 mm.

Coloration.—Head and thorax black; antenna red-brown, darkened near the apex; coxae and legs red; abdomen red-brown; postpetiole red-brown.

MALE ALLOTYPE.—*Morphological Characters.*—Like female except lacking carina on hind coxa; flagellar segments 8–12 with the tyloids occupying the length of the segments, long-oval in shape (Fig. 1g). Length 12 mm.

Coloration.—Frons, clypeus, and mouthparts lemon yellow; scape yellow anteriorly; coxae and trochanters yellow; alary sclerites yellow; head and thorax black; legs red; postpetiole black; abdomen red.

VARIATION IN PARATYPE SERIES.—Coloration is the only variable noted. The females vary as follows: head and thorax black to light brown; the antenna may have flagellar segments 8–10 white; abdomen red to brown, with segments 6–7 rarely darkened; postpetiole black to red. The males may have the frons, clypeus, and mouthparts individually yellow or not; the alary sclerites yellow or not; the coxae and trochanters yellow or not; and the abdominal segments 6–7 rarely black. The range of length in females is 5–10 mm, and 5–12 mm in males.

Holotype female, PROGENY OF A FEMALE COLLECTED IN SALINAS, MONTEREY COUNTY, CALIFORNIA, 24 June 1969, D. E. Bragg. Allotype, progeny of same female as holotype.

PARATYPES (67 ♀, 78 ♂).—CALIFORNIA: *Mono Co.*: Hilton Creek, ♂, 4 September 1956, R. M. Bohart (UCD). *Monterey Co.*: Arroyo Seco Camp, ♂, 5 June 1958, R. M. Bohart (UCD); Castroville, 2 ♀, 29 June 1937, W. H. Lange (USNM), ♀, 8 July 1969, D. E. Bragg; Salinas, 2 ♀, ♂, 8 November 1968, 2 ♀, 13 March, ♀, 22 April, 44 ♀, 52 ♂, 24 June (progeny of collected female, siblings to holotype and allotype), ♀, ♂, 15 July, 2 ♀, 4 ♂, 12 August 1969, ♂, 2 March 1970, D. E. Bragg. *Nevada Co.*: Sagehen Creek, ♂, 23 August 1968, D. S. Horning (UCD); Scott's Flat, ♀, 10 July 1968, ♀, 10 July 1969, D. E. Bragg. *Plumas Co.*: Antelope Valley, 2 ♂, 2 August 1969, D. E. Bragg. *San Luis Obispo Co.*: Arroyo Grande, ♂, 7 May 1930, ? (UCB), ♀, ?, R. Van den Bosch H-13-1 (USNM). *San Mateo Co.*: Halfmoon Bay, ♀, 3 ♂, October, 3 ♀, November 1936, ♂, 5 April 1937, W. H. Lange (USNM); Pescadero, ♂, 25 October 1937, W. H. Lange (USNM). CONNECTICUT: *New Haven Co.*: New Haven, ♂, 15 April ?, Mary Urban (USNM). MICHIGAN: *Monroe Co.*: Monroe, ♂, 27 June 1931, L. G. Jones (USNM). NEBRASKA: Seward, 2 ♀, 13 July 1955, C. Brandhorst (USNM). OREGON: *Benton Co.*: Corvallis, ♀, 6 April 1928, H. A. Scullen (USNM); *Douglas Co.*: Diamond Lake, ♂, 23 July 1966, P. Rude (UCB). WASHINGTON: *Pierce Co.*: Paradise Valley, Mt. Ranier, ♂, 4 September 1932, J. F. Clarke (USNM).

OTHER MATERIAL SEEN.—CALIFORNIA: *Mendocino Co.*: Hopland Field Station, ♂, 13 July 1956, P. D. Hurd (UCB). *Monterey Co.*: Salinas, ♂, 22 April, 3 ♂, 24 June 1969, D. E. Bragg. INDIANA: York, ♂, 5 April 1931, L. G. Jones (USNM).

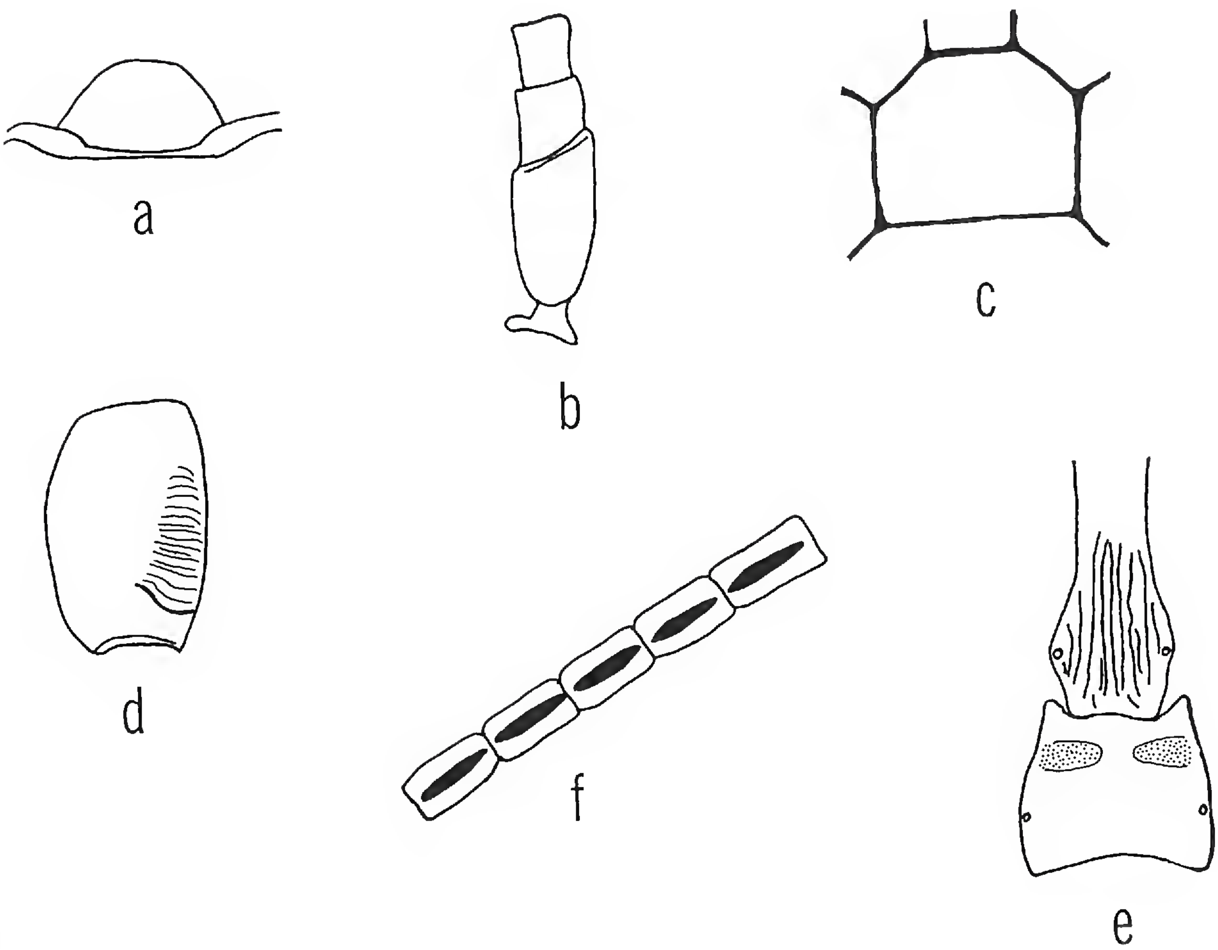

FIG. 2. *Phaeogenes ischiomelanus* Wesmael: a. Clypeus; b. Right basal antennal segments; c. Areola; d. Right hind coxa showing carina and secondary carinae; e. Postpetiole and second abdominal tergite showing sculpture; f. Tyloids of male antenna, flagellar segments 6–10.

DEPOSITION OF TYPE MATERIAL.—Holotype, allotype, all specimens noted as "(UCD)" above, plus twenty other paratypes, to the Museum, Department of Entomology, University of California, Davis. All specimens noted as "(UCB)" above plus twenty other paratypes, to the California Insect Survey Collection, Department of Entomology, University of California, Berkeley. All specimens noted as "(USNM)" above plus ten other paratypes to the U. S. National Museum. Twenty paratypes to the American Entomological Institute, Ann Arbor, Michigan, and sixty-five paratypes retained by the D. E. Bragg private collection, currently located in Davis, California.

DISTRIBUTION.—*Phaeogenes cynarae* is a transition zone species associated with its host on plants of the genera *Cirsium* Miller and *Cynara* Linnaeus. Distribution seems to be limited more by favorable physical factors, especially available water and shelters, than by host abundance. Distribution is throughout the continental United States.

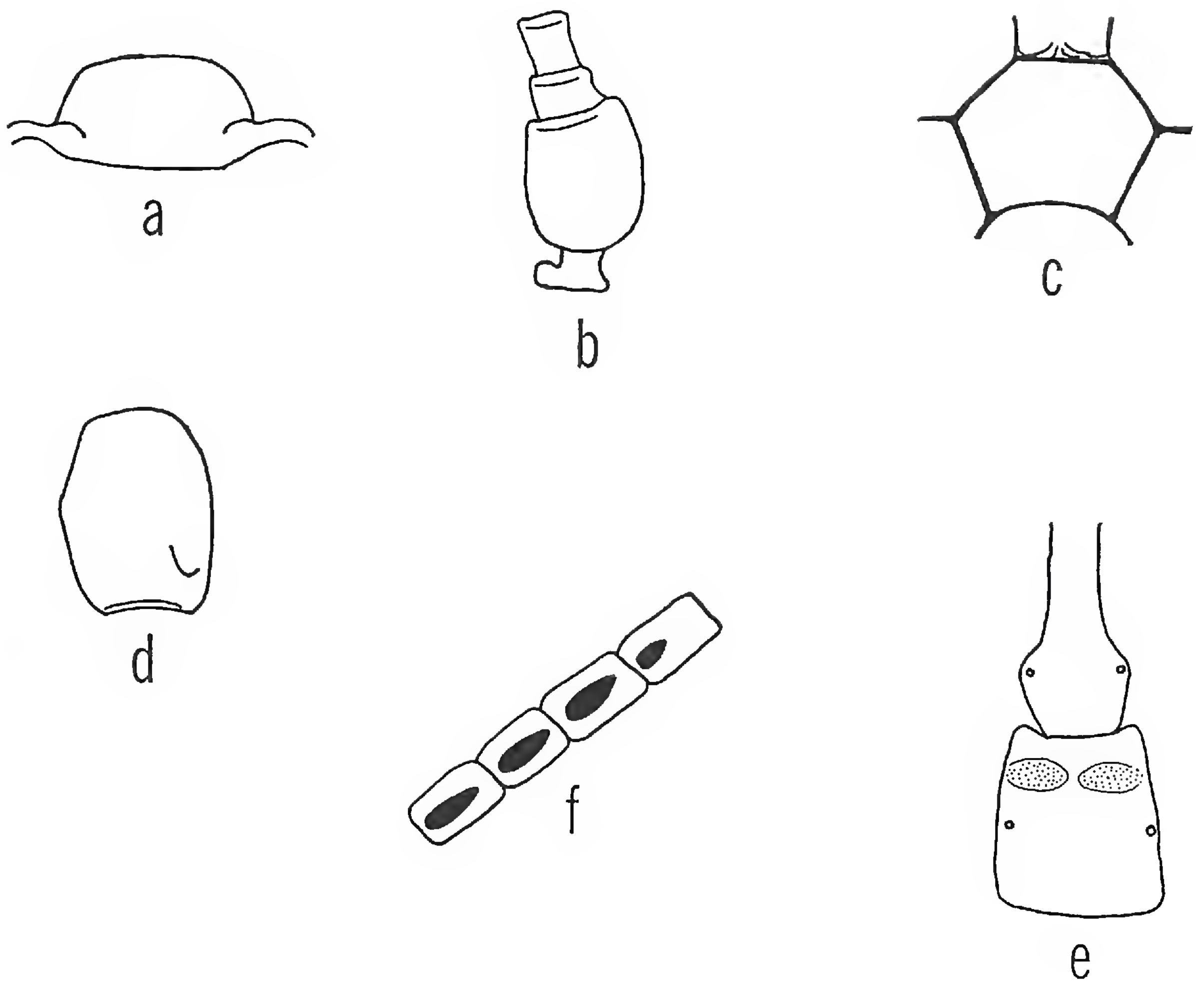

FIG. 3. *Phaeogenes fuscicornus* Wesmael: a. Clypeus; b. Right basal antennal segments; c. Areola; d. Right hind coxa showing carina; e. Postpetiole and second abdominal tergite; f. Tyloids of male antenna, flagellar segments 7–10.

DISCUSSION

Phaeogenes cynarae is closely related to *Ph. ischiomelanus* Wesmael in Perkins' (1959) *Ph. fuscicornus* Wesmael group, on the basis of morphological characters.[2] *Phaeogenes cynarae* is the only known nearctic species in the *fuscicornus* group, and differs from *Ph. ischiomelanus* and *Ph. fuscicornus* in several ways. Since the palearctic species are described in Perkins' (1959) work, only distinguishing characters not treated by Perkins will be discussed here. *Phaeogenes ischiomelanus* has the clypeus (Fig. 2a) less dome-shaped and less apically thickened; the basal antennal segments are more elongate (Fig. 2b); the areola is short and squared with thinner carinae (Fig. 2c); the carina of the hind coxa, while possessing parallel secondary carinae, is less pronounced (Fig. 2d); the postpetiole is less strongly sculptured, and the second abdominal tergite has smaller thyridia (Fig. 2e); and the tyloids

[2] Personal communication, 2 February 1970, Dr. R. Carlson.

of the male antenna are on flagellar segments 6–10 and are more slender (Fig. 2f) than those of *Ph. cynarae. Phaeogenes fuscicornus* has a broader, more shallow clypeus with no apical thickening (Fig. 3a); the basal segments of the antenna are more squat (Fig. 3b); the areola is hexagonal and as wide as long (Fig. 3c); the carina of the hind coxa is prominent, but without secondary carinae (Fig. 3d); the postpetiole is smooth (Fig. 3e); and the tyloids of the male antenna are on flagellar segments 7–10 and are shorter and wider (Fig. 3f) than those of *Ph. cynarae.* By the judicial use of Perkins' key and the figures shown in this paper, investigators should be able to determine specimens of *Ph. cynarae.*

Phaeogenes cynarae is a pupal parasitoid of *Platyptilia carduidactyla*, which species is its only known host. Females insert one egg into a fourth instar host larva, and the adult wasp emerges from the pupa 15–30 days later. Biological data, including specific details of behavior and ecology are still being obtained and will be published along with data for other parasitoids of *P. carduidactyla* at a later date.

Acknowledgments

Gratitude must be expressed to Dr. Henry Townes, Dr. Leopoldo Caltagirone, and Dr. Robert Carlson for advice on the preparation of this paper. Dr. Robert Carlson of the USNM, Dr. Leopoldo Caltagirone of UCB, and Mr. R. O. Schuster of USD were kind enough to provide the aforementioned paratypes and other specimens including those of the palearctic species.

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New Species, New Synonymies and New Records of Bark-Beetles from Arizona and California

(Coleoptera : Scolytidae)

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Continuing studies on the bark-beetle fauna of California have revealed three new species and five new cases of synonymy. Also included herein is a description of a new species of the genus *Pityotrichus* Wood and a note on a species previously unrecorded from the United States. Besides *Pityotrichus*, the new species and most of the synonyms represent species in the genus *Pityophthorus* Blackman.

Pityophthorus brucki Bright, new species

FEMALE.—1.8 mm long, 2.5 times longer than wide; body reddish-brown, vestiture yellowish.

Frons flattened from eye to eye, slightly concave in center; surface shining, punctures moderate in size; vestiture short and sparse in central portion, with fringe of very long, yellowish setae, longest reaching from vertex to epistomal margin, sometimes covering entire frons. Antennal club 1.3 times longer than wide, widest through third segment; segments one and two combined definitely shorter than segments three and four combined; first segment notably narrower than others; all segments strongly arcuate.

Pronotum slightly wider than long, widest behind summit; sides rather broadly rounded, faintly constricted in front of middle; anterior margin rather narrowly rounded, bearing two prominent asperities; asperities of anterior slope erect, rather sharp, arranged in broken concentric rows; posterior portion shining, punctures rather close, separated by a distance equal to their diameters; impunctate median line broad, very faintly elevated.

Elytra about as wide as pronotum, 1.8 times longer than wide; sides parallel on basal three-fourths, broadly rounded at apex; striae punctured in regular rows, only the first impressed; strial punctures faint, shallow, a little larger in first striae; interspaces wider than striae, dull, with a row of very faint punctures on first, third, fifth and alternate interspaces; vestiture of very fine strial setae and slightly longer interstrial setae. Declivity convex, not sulcate; suture and first striae impressed below general elytral surface; lateral margins rounded, devoid of granules; strial punctures not visible, indicated only by rows of very fine setae.

MALE.—Similar in size and proportions to female. Frons flattened nearly to eyes, divided by a distinctly elevated, longitudinal carina in center, area on each side of carina roughened by large, shallow punctures; vestiture sparse.

Pronotum similar to female except asperities more strongly elevated and sharper.

Elytra similar to female except strial punctures larger and deeper. Declivity similar to female except suture more deeply impressed.

THE PAN-PACIFIC ENTOMOLOGIST 47: 63–70. January 1971

TYPE MATERIAL.—*Holotype female*, MT. HAWKINS, SAN BERNARDINO COUNTY, CALIFORNIA, 23 June 1940, *Pinus lambertiana*, C. R. Bruck collection, J. N. Knull collection. Allotype male, and 10 paratypes with same data. Two paratypes, Idyllwild, Riverside Co., California, 24 October 1941, *Pinus lambertiana*, D. DeLeon collector. The holotype, allotype and four paratypes are in the Ohio State University collection, Columbus, Ohio. Additional paratypes are in the Canadian National Collection, Ottawa, Ontario and the California Insect Survey, Berkeley.

REMARKS.—*P. brucki* ranges in size from 1.5 to 1.8 mm, and averages 1.6 mm. In one of the males the frontal carina extends to the epistomal margin but in three others it does not. The characters of the female frons and the declivity of both sexes display little notable variation.

This species illustrates some of the difficulties with Blackman's (1928) groups. Based on antennal characters, this species clearly belongs to group I but it lacks the elevated ninth elytral interspace which is supposed to be characteristic of that group. Since I believe the antennal character is more fundamental, this species is placed in group I. It appears to show some relationship with *P. scalptor* Blackman but the relationship is remote.

Pityophthorus sierrensis Bright, new species

FEMALE.—2.6 mm long, 2.9 times longer than wide; body black, antennae reddish-brown, vestiture yellowish.

Frons finely, densely punctured and pubescent on a semicircular area, this area not reaching eyes on sides and extends dorsally above upper level of eyes, setae rather dense, the longest ones about as long as antennal funicle; surface between eye and pubescent portion smooth with a few faint, shallow punctures; surface above pubescent portion more densely punctured, punctures larger than on side, more closely placed and deeper. Antennal club 1.3 times longer than wide, widest through second segment; first segment nearly straight, second rather weakly arcuate.

Pronotum 1.1 times longer than wide, widest behind summit; sides broadly arcuate, faintly constricted in front of middle; anterior margin broadly rounded, bearing numerous asperities; asperities of anterior slope rather low, numerous, arranged in no definite order; posterior portion minutely reticulate, rather dull, punctures close, deep; transverse impression behind summit evident; impunctate median line broad, faintly elevated.

Elytra as wide as pronotum, 1.8 times longer than wide; sides parallel on basal three-fourths, broadly rounded at apex; striae punctured in regular rows, first definitely impressed; strial punctures small, separated by a distance equal to little more than their diameters; interspaces wider than striae, minutely reticulate, bearing row of fine punctures on first, third, fifth and alternate interspaces, these about same size as strial punctures but much sparser; vestiture consisting of very fine strial setae and somewhat longer interstrial setae. Declivity sloping; first interspace elevated and granulate; second interspace sulcate and distinctly widened; third interspace elevated as high as first, granulate; punctures in first striae obsolete, smaller than on disk in striae two and three; ninth interspace faintly elevated on lateral portions; vestiture on declivity a little longer than on disk.

MALE.—Similar in size and proportions to female. Frons faintly impressed above epistomal margin; longitudinal carina distinct, not tooth-like, elevated from epistomal margin to above upper level of eyes; area on each side of carina strongly punctured, punctures large, deep and close; vestiture sparse except along epistomal margin, consisting of short setae, somewhat longer in impressed area above epistomal margin.

Pronotum similar to female except asperities more erect and sharper.

Elytra similar to female. Declivity similar to female except second interspace not as deeply sulcate and granules in first and third interspace a little larger.

TYPE MATERIAL.—*Holotype female*, 1 MILE SOUTH OF ONION VALLEY, INYO COUNTY, CALIFORNIA (Robinson Lake, about 10,000 ft.), 4 September 1968, D. E. Bright, *Pinus Balfouriana*. No. 10777 in the Canadian National Collection. Allotype male, same date as holotype. Paratypes: 13, same data as holotype; 48, same locality and date as holotype, *Pinus flexilis*. The holotype, allotype and most of the paratypes are in the Canadian National Collection, Ottawa, Ontario. Additional paratypes are in the California Insect Survey, Berkeley.

REMARKS.—Specimens in the type series range in size from 2.4 to 2.7 mm. The frontal carina in some males is more strongly elevated, especially in the lower part, and may be shorter than in other specimens. Usually the punctures of the first striae in the declivity are evident and in some specimens may be as distinct as the punctures of the second and third striae. The height and number of granules on the declivital interspaces also varies between specimens.

Pityophthorus inyoensis Bright, new species

FEMALE.—2.05 mm long, 2.85 times longer than wide; body dark reddish-brown except pronotum reddish, antennae and legs light brown; vestiture yellowish.

Frons finely punctured and pubescent on a semicircular area, this area with a concave circular area in center and slightly protuberant above epistoma, setae moderately abundant, longer and incurved around margin, longest setae slightly longer than antennal funicle; surface above pubescent portion more strongly punctured, punctures larger than in center and more strongly impressed. Antennal club large, 1.2 times longer than wide, widest through second segment; first segment weakly arcuate, others more strongly so.

Pronotum 1.1 times wider than long, widest at middle; sides broadly arcuate, faintly constricted in front of middle; anterior margin broadly rounded bearing about six asperities, the median two longest; asperities of anterior slope erect, sharp, arranged in no definite order; posterior portion shining, densely punctured, punctures closer than a distance equal to their diameters, moderately deep;

transverse impression not evident; impunctate median line broad, faintly elevated; vestiture abundant.

Elytra as wide as pronotum, 1.7 times longer than wide; sides parallel on basal three-fourths, broadly rounded at apex; striae punctured in nearly regular rows, only the first impressed; strial punctures moderate, separated by a distance about equal to their diameters; interspaces wider than striae, minutely reticulate, with row of punctures on first, third, fifth, and other interspaces punctured near declivity except fourth which is impunctate; vestiture consisting of short strial setae and longer interstrial setae. Declivity convex; second interspace barely, if at all, widened and sulcate; strial punctures slightly reduced in size but distinct to apex; suture and first striae depressed slightly; lateral elevations rounded, not elevated higher than suture; first and third interspace very faintly granulate; vestiture as on elytral disk.

MALE.—Similar in size and proportions to female. Frons flattened on a semicircular area similar to female, with a distinct tooth-like carina on lower portion just above epistoma; surface impressed above carina; area on each side of carina finely punctured, more strongly so at margins of flattened area; vestiture sparse.

Pronotum similar to female except asperities a little higher and sharper.

Elytra similar to female. Declivity similar to female except second interspace very slightly wider and less deeply sulcate.

TYPE MATERIAL.—*Holotype female*, 1 MILE SOUTH OF ONION VALLEY, INYO COUNTY, CALIFORNIA (Robinson Lake, about 10,000 ft.), 4 September 1968, D. E. Bright, *Pinus Balfouriana.* No. 10964 in the Canadian National Collection. Allotype male, same data as holotype. Paratypes: 19, same data as holotype; 27, Onion Valley, Inyo Co., California, 4 September 1968, D. E. Bright, *Pinus Balfouriana.* The holotype, allotype and most of the paratypes are in the Canadian National Collection, Ottawa, Ontario. Additional paratypes are in the California Insect Survey, Berkeley.

DISCUSSION.—Specimens in the type series range in size from 2.0 to 2.4 mm. The carina on the frons of males varies in height and length but it is always distinctly elevated and toothlike. The amount of pubescence on the female frons also varies. The second declivital interspace on many specimens is not wider than it is on the disk while in others it is slightly wider.

This species is related to *P. artifex* Blackman and *P. venustus* Blackman but is distinguished by a shorter, higher male frontal carina, by the somewhat less densely pubescent female frons and by the much shallower second declivital interspace.

DENDROCRANULUS CALIFORNICUS (Hopkins)

Xylocleptes californicus Hopkins, 1915, U. S. Dep. Agr. Rep., 99: 44.
Dendrocranulus californicus, Wood, 1961, Coleopt. Bull., 15: 41.

Xylocleptes venturina Hopkins, 1915, U. S. Dep. Agr. Rep., 99: 44 (new synonymy).
Dendrocranulus venturina, Wood, 1961, Coleopt. Bull., 15: 41.

Types and paratypes of both of Hopkins' species have been compared to one another and to several series from various parts of California. No meaningful, consistent differences were noted. This species is somewhat variable in the depth of the concavity on the male frons and in the features of the elytral declivity. In most series examined, examples with various degrees of development of these features could be found. Distribution and host plant are the same, therefore only one species can be recognized.

Pityophthorus monophyllae Blackman

Pityophthorus monophyllae Blackman, 1928, Bull. N. Y. State Coll. Forest., 1 (3–b), Tech. Publ., 25: 47.
Pityophthorus socius Blackman, 1928, Bull. N. Y. State Coll. Forest., 1 (3–b), Tech Publ., 25: 48 (new synonymy).
Pityophthorus piceus Bright, 1966, Pan-Pac. Entomol., 42(4) : 297, (new synonymy).

The holotypes of *P. monophyllae* and *P. socius* and paratypes of *P. piceus* were compared to each other. The frons of the holotype of *P. socius* is less densely pubescent than that of *P. monophyllae*, but the type series of both species shows a complete range of variation. In other features, the two holotypes are identical. In addition, no differences could be detected when comparing numerous specimens of *P. monophyllae* and *P. piceus*. Both *P. socius* and *P. piceus* must be considered synonyms of *P. monophyllae*.

Pityophthorus opimus Blackman

Pityophthorus opimus Blackman, 1928, Bull. N. Y. State Coll. Forest., 1 (3–b), Tech. Publ., 25: 80.
Pityophthorus aristatae Bright, 1964, Pan-Pac. Entomol., 40(3) : 166 (new synonymy).

Four paratypes of *P. opimus* from Colorado were compared to paratypes of *P. aristatae* from California and found to represent the same species. The variations seen are considered to be within the normal range for the species. This is the first record of this species by this name from California.

Pityophthorus tuberculatus Eichhoff

Pityophthorus tuberculatus Eichhoff, 1878, Mem. Soc. Roy. Sci. Liege, 2nd Series, 8: 498.
Pityophthorus rugicollis Swaine, 1925, Can. Entomol., 57: 193; Blackman, 1928, Bull. N. Y. State Coll. Forest., 1 (3–b), Tech. Publ., 25: 92.

Pityophthorus novellus Blackman, 1928, Bull. N. Y. State Coll. Forest., 1 (3–b), Tech. Publ., 25: 96 (new synonymy).

Pityophthorus novellus was described from three callow, completely distorted specimens taken from *Pinus sabinianae* near Tehachapi, California. Two of those specimens (allotype and paratype) have been examined. The allotype is a male and displays enough features to enable one to recognize it as *P. tuberculatus.* The one paratype is a female and, although distorted, shows the characteristic frontal features of the female *P. tuberculatus. Pityophthorus tuberculatus* is a common species in California with several records from *Pinus sabinianae.* Since no essential differences were noted and since distribution and host plant are similar, only one species can be recognized.

PITYOPHTHORUS CRISTATUS Wood

Pityophthorus cristatus Wood, 1964, Great Basin Natur., 24(2): 68.

This species was described from specimens collected at Perote, Vera Cruz, Mexico (holotype), Tulancingo, Hidalgo, Mexico and Las Vigas, Vera Cruz, Mexico. Subsequently it was recorded from El Salto, Durango, Mexico (Thomas, 1966). I recently collected this species from two localities in Arizona: Santa Rita Mountains, Santa Clara Co. and Miller Canyon, Huachuca Mountains, Cochise Co. The species is known from *Pinus ayacahuite, P. engelmanni* and *P. leiophylla.* These represent the first records of this species from the United States.

Genus PITYOTRICHUS Wood

Pityophilus Blackman, 1928, Bull. N. Y. State Coll. Forest., (1–b), Tech. Publ., 25: 147 (preoccupied).
Pityotrichus Wood, 1962, Great Basin Natur., 22 (1–3): 76.

TYPE SPECIES.—*Pityophilus barbatus* Blackman, monotypic.

Members of this genus resemble species in *Pityophthorus* in general body shape but may be recognized by the enlarged pregular area of the head, which bears a beard-like fringe of long hair-like setae on the female, by the evenly rounded, weakly sulcate elytral declivity and by the antennal club, which is definitely longer than wide, with the first two sutures chitinized.

KEY TO THE SPECIES OF PITYOTRICHUS

1. Interstrial setae almost as long as the width of an interspace; body 1.6–1.8 mm long; frons of male flattened, obscurely punctured, not carinate, bearing a few longer setae on periphery of flat area; in *Pinus edulis* .... *barbatus* (Blackman)

Interstrial setae very short, much shorter than width of an interspace; body 1.8–2.1 mm long; frons of male flattened, distinctly carinate, carina elevated, surface distinctly punctured on each side; in *Pinus flexilis* and *P. strobiformis* .... *hesperius* Bright, n. sp.

Pityotrichus hesperius Bright, new species

FEMALE.—1.9 mm long, 2.7 times longer than wide; body reddish-brown, vestiture yellowish.

Frons flattened on rather large area, slightly concave in center; surface shining, punctures very closely placed, distinctly impressed; vestiture sparse, consisting of short, fine, scattered, hair-like setae with a few, longer setae intermixed, especially around upper level of concavity. Pregular area greatly enlarged, bearing a semi-circular fringe of long, curved setae, these long enough to nearly cover mouthparts. Antennal club 1.25 times longer than wide, widest through third segment; segments one and two slightly arcuate, chitinized at lateral margins.

Pronotum as long as wide, widest just behind middle; sides broadly rounded, distinctly constricted in front of middle; anterior margin broadly rounded, bearing six, erect asperities; asperities on anterior slope erect, sharp, arranged in broken concentric rows; posterior portion shining, punctures rather large, distinctly impressed, close; median line broad, impunctate, faintly elevated; vestiture on posterior punctate portion consisting of fine, hair-like setae, one arising from each puncture.

Elytra 1.6 times longer than wide; sides parallel on basal two-thirds, broadly rounded at apex; striae punctured in regular rows, punctures fine, moderately impressed, each puncture bearing a small, erect, hair-like seta, these setae usually but little longer than a distance equal to the diameter of a puncture; interspaces minutely rugose, opaque, distinctly wider than striae, bearing a row of scattered punctures on first, third, fifth and alternate interspaces, each puncture bearing a longer, hair-like seta, these setae much shorter than a distance equal to the width of an interspace. Declivity evenly convex; suture weakly elevated, finely granulate; second interspace widened, slightly impressed; third and remaining interspaces as on disk; strial punctures very faint.

MALE.—Similar in size and proportions to female. Frons flattened, divided by a definite longitudinal carina in center, area on each side of carina distinctly punctured; vestiture sparse. Pregular area enlarged, only sparsely pubescent.

Pronotum and elytra similar to female except more coarsely sculptured.

TYPE MATERIAL.—*Holotype female,* PINALENO MTNS., GRAHAM COUNTY, ARIZONA, 15 July 1968, D. E. Bright, *Pinus strobiformis.* No. 11445 in the Canadian National Collection. Allotype male, same data as holotype. Paratypes: 28, same data as holotype; 5, Sandia Peak, Bernalillo Co., New Mexico, 9 July 1968, D. E. Bright; *Pinus flexilis.* The type material is in the Canadian National Collection, Ottawa, Ontario.

REMARKS.—Specimens in the type series range in size from 1.8 to 2.1 mm. The female frons is sometimes completely flat with no concave center portion. The punctures of the striae on the declivity are usually more evident than those in the holotype. The carina on the frons of the male varies in height and length but is always distinctly visible.

Literature Cited

BLACKMAN, M. W. 1928. The genus *Pityophthorus* Eichh. in North America. Bull. N. Y. State Coll. Forest., 1 (3–b), Tech. Pub., 25, 212 pp.

THOMAS, J. B. 1966. Some Scolytidae from the Sierra Madre Occidental in Mexico. Can. Entomol., 98(8): 871–875.

ZOOLOGICAL NOMENCLATURE: Announcement A. (n.s.) 86

Required six-month's notice is given on the possible use of plenary powers by the International Commission on Zoological Nomenclature in connection with the following names listed by case number:

(see *Bull. Zool. Nomencl.* 26, pt. 6, 7 April 1970):

1791, Suppression of *Papilio aglaja* Linnaeus, 1758 (Insecta, Lepidoptera).

1889, Suppression of *Culex albirostris* Macquart, 1851 (Insecta, Diptera).

1892, Emendation to SPHAERIDAE of SPHAERIIDAE Erichson, 1845 (Insecta, Coleoptera).

1897, Type-species for *Trepsichrois* Hübner, 1816 (Insecta, Lepidoptera).

1898, Type-species for *Monroa* Warren, 1904, and *Hetererannis* Warren, 1904 (Insecta, Lepidoptera).

1899, Suppression of *Hymenitis* [Illiger], 1807 (Insecta, Lepidoptera).

(see *Bull. Zool. Nomencl.* 27, pt. 2, 10 August 1970):

1904, Type-species for *Phidippus* C. L. Koch, 1846; Suppression of *Salticus variegatus* Lucas, 1833 (Aranaea).

1916, Neotype for *Hyocephalus aprugnus* Bergroth, 1906 (Insecta, Hemiptera).

1917, Type-species for *Mimecomutilla* Ashmead, 1903 (Insecta, Hymenoptera).

1918, Suppression of *Zealandobates* Hammer, 1967 (Acari).

1919, Suppression of *Clavicera* Latreille, 1802 (Insecta, Hymenoptera).

1921, Neotype for *Saperda inornata* Say, 1824 (Insecta, Coleoptera).

Comments should be sent in duplicate, citing case number, to the Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London S.W. 7, England. Those received early enough will be published in the *Bulletin of Zoological Nomenclature.* —MARGARET DOYLE.

PACIFIC COAST ENTOMOLOGICAL SOCIETY

R. W. Thorp	F. L. Blanc	M. S. Wasbauer	P. H. Arnaud, Jr.
President	*President-elect*	*Secretary*	*Treasurer*

Proceedings

Three Hundred and Thirty-Second Meeting

The 332nd meeting was held Friday, 20 February 1970, at 7:45 p.m. in the Morrison Auditorium of the California Academy of Sciences, Golden Gate Park, San Francisco, with President Thorp presiding.

Members present (43): R. P. Allen, F. G. Andrews, C. Armin, M. Bentzien, R. Blair, F. L. Blanc, I. Boussy, T. Briggs, R. M. Brown, G. Buckingham, P. Cammer, W. Chase, J. A. Chemsak, R. V. Cottam, H. V. Daly, F. Ennik, M. R. Gardner, W. G. Goodman, J. Guggolz, K. S. Hagen, T. P. Heck, M. E. Irwin, W. H. Lange, R. L. Langston, K. Lorenzen, Kathleen Meehan, A. R. Moldenke, P. A. Opler, Judy Perlstein, J. A. Powell, D. C. Rentz, D. W. Ribble, R. Schoeppner, H. I. Scudder, O. Shields, C. N. Slobodchikoff, R. G. Stecker, L. Stotlemyre, R. W. Thorp, M. S. and Joanne S. Wasbauer, R. H. Whitsel, R. F. Wilkey.

Visitors present (37): J. W. Banne, Mary F. Benson, Nancy Blair, Nancy Brownfield, G. J. Guiliani, Linda Campbell, P. Chase, Barbara and Diane Daly, W. and Patricia Dana, A. Garren, Kathy Green, C. and Etta Hansen, R. and Valerie Hatch, Patricia Haverstock, T. G. Hentey, K. S. Heston, S. E. Heston, Wendy Jacobs, Ellen Lange, Carol La Point, M. Marquis, Allison Moldenke, G. Nichols, Sandra Ortega, Kathy Rentz, E. Rogers, Jr., S. Sims, Susan B. Slightam, J. A. Smith, P. Y. So, B. Stainbrook, H. Stainbrook, V. Stanett, Phyllis Stecker, Joyce Thorp, R. Wehrman, R. White.

The minutes of the meeting held 19 December 1969 were summarized.

The following names were proposed for membership: Carl Johansen, Fred G. Andrews, Robert L. Mangin, Edvins Kaulens.

President Thorp asked for introductions from the floor. Mr. Leech introduced P. Y. So from Hong Kong, interested in coccinellids and biological control of tropical insects. Mr. R. F. Wilkey introduced three outstanding students in the entomology program of the 4-H in Sacramento, Alan Garren, Bill Stainbrook and Hal Stainbrook.

President Thorp announced that the next meeting would be held at Morrison Auditorium on April 17. Three speakers are to be featured. The following meeting will be the annual picnic and field day and will be held on Saturday, May 16.

Mr. D. C. Rentz showed six slides of the Farallone Islands and the habitat of a crane fly which lives in the masses of mat-like algae on the rocks near shore.

Dr. Edwards announced the publication of a new book on the biology and external morphology of bees with a synopsis of the genera of northwestern America, by W. P. Stephen, G. E. Bohart and P. Torchio. The illustrated key is excellent and very easy to use. This was published by the University of Oregon Press at about $1.98.

Dr. Powell announced the appearance of the long-awaited *Diptera of Western North America* by F. C. Cole. It is a UC Press release at about $25.00.

The principal speaker of the evening was DR. J. GORDON EDWARDS, San Jose State College. His illustrated talk was entitled, "In Search of Insects in Beautiful Costa Rica."

Coffee and other refreshments were served at a social hour in the entomology rooms following the meeting.—M. S. WASBAUER, *Secretary.*

THREE HUNDRED AND THIRTY-THIRD MEETING

The 333rd meeting was held at 7:45 p.m. on Friday, 17 April 1970, in the Morrison Auditorium of the California Academy of Sciences, Golden Gate Park, San Francisco. President Thorp presided.

Members present (29): R. P. Allen, P. H. Arnaud, Jr., W. E. Azevedo, M. M. Bentzien, R. G. Blair, F. L. Blanc, D. L. Briggs, T. S. Briggs, R. M. Brown, R. J. Bushnell, P. Cammer, D. C. Carlson, J. F. Emmel, F. Ennik, J. R. Gabel, T. P. Heck, E. L. Kessel, H. B. Leech, K. Lorenzen, D. C. Rentz, D. Ribble, R. E. Stecker, R. W. Thorp, M. S. Wasbauer, S. C. Williams.

Visitors present (25): L. Allen, A. D. Bacon, Nancy Blair, J. Chapman, Rita Dechene, Alexandria Ennik, Mr. and Mrs. K. Falsaulle, Mrs. J. Guggolz, H. E. Hallett, Jr., Meredith Halliburton, R. Halliburton, J. T. Hjelle, Katharine D. Jenkins, Lupe Nava, S. Nava, A. Nonomura, J. Nonomura, Adell Reid, Taly Slay, S. Sims, R. C. Smith, Christie Stecketee, Debbie Sursner, Joyce Thorp.

The minutes of the meeting held 20 February were summarized.

The following new nembers were elected: Aldro Dean Bacon, John T. Hjelle, Susan Slightam.

Mr. R. P. Allen announced a shift of policy in advertising in the *Pan-Pacific Entomologist.* There will be more smaller ads in the future and less larger ads, with an emphasis on local firms producing collecting equipment, photographic equipment and personal ads for specimens, exchanges, etc. The rate for personal ads will continue at $1.50 per line. He stated that the Society badly needs advertising of this kind.

President Thorp announced that, due to increasing costs of publication of the *Pan-Pacific Entomologist,* the Executive Board of the Society voted to increase dues and subscription rates. Annual dues for regular members will be $7.50, those for student members will be $5.00. Members in each category will receive the journal. Subscriptions to the journal for non-members will be $10.00 per year. These new rates go into effect with volume 47, Number 1, January 1971.

Mr. Leech announced two new publications. The first is Tuxen's *Taxonomists' Glossary of the Genitalia of Insects,* second edition, which is larger than the first. The first had 284 pages and the second 359. The authors of the various chapters have brought their sections up-to-date or have completely rewritten them. In some cases, sections have new authors. For example, the Hymenoptera chapter is authored by Dr. E. L. Smith of Chico State College. In the first edition, this chapter was done by C. D. Michener. The other publication is *A Field Guide to the Insects of America North of Mexico* by Borror and White. It is one of the Peterson Field Guide Series and is excellent. There are over 400 pages with 16 color plates and 1300 other illustrations covering 579 families of insects. The price is $5.95.

President Thorp called for notes and exhibits. The following notes were presented:

A Larval Nematode Parasitic on an Anyphaenid Spider.—On 29 August 1969, a spider of the family Anyphaenidae was found on a rock along the Van Duzen River, eight miles south of Highway 36, on Van Duzen Road, Trinity County, California.

The spider did not react to prodding, except to move slightly. About one hour after having been placed in a plastic box, it was noticed that the spider had died and that four green nematodes had emerged from the abdomen. The nematodes were moving in an agitated manner, one of them having climbed to the top of the box. At this time, they were placed in 70% isopropyl alcohol.

The nematodes have not yet been identified, the problem being that they are larval forms without the important sexual characteristics required for identification. Sexual maturity is very likely attained in a final host such as a bird, small mammal, or invertebrate predator which has eaten the spider.—JOHN T. HJELLE, *San Francisco State College.*

Note on Holes made by Tarantulas (Theraphosidae and Dipluridae).—During the past month and a half, fourteen tarantula holes have been excavated and measurements taken while in search of theraphosid tarantulas. When digging up a spider, the following procedure has been carried out:

1. The diameter of the mouth of the hole is measured before digging begins.
2. An ordinary flexible electrical wire with markings in centimeters is then inserted into the hole until it meets with positive resistance.
3. The total depth is then read from the graduations on the wire.
4. When the direction of the hole changes, the reading is recorded and the angle from the horizontal is measured with a protractor.
5. The excavating is continued until the bottom of the hole is reached or a tarantula "pops" out of the hole.

During the digging, care is taken to avoid dislodging the wire since it acts as a guide to the direction of the hole. However, sometimes I am not always successful and the wire gets pulled out or dislodged.

On the fourteen spider holes excavated, the following data have been accumulated. (All measurements in centimeters): Diameter: 1.0 to 3.0; Average 1.8; Vertical: 10.0 to 40.0; Average 20.5; Angular: 10.0 to 30.0; Average 19.6; Total Length: 15 to 60; Average 33.4; Angle of Turn: 40° to 80°; Average 62.5°. Specific data are as follows:

Hole #	Diameter	Vertical	"Horizontal" (Angular)	Total Length	Angle from Horizontal
1	1.5	30	—	30	—
2	1.0	31	19	50	80° E
3	2.5	15	30	45	70°
4	1.5	—	—	20	—
5	1.5	40	20	60	—
6	2.5	25	—	25	—

Hole #	Diameter	Vertical	"Horizontal" (Angular)	Total Length	Angle from Horizontal
7	3.0	—	25	25	40° (from surf.)
8	2.0	15	15	30	60°
9	2.0	15	15	15	—
10	1.7	10	30	40	60° SW
11	2.0	—	—	35	—
12	1.5	10	15	25	60° S
13	—	30	13	43	60°
14	—	15	10	25	70°
Laboratory					
#2	2.0	6	9	15	30°
6	1.7	3	5	8	90°

It is assumed that the holes dug under "laboratory" conditions are smaller because of the somewhat confined quarters and limitation of the battery jars used as containers.—J. RUSSEL GABEL, *San Francisco State College.*

Larva and pupa of *Adela septentrionella* Walsingham.—Kodachrome slides of various stages of this diurnal moth were exhibited. Females oviposit into unopened buds of *Holodiscus discolor* (Rosaceae), in May in the San Francisco Bay area. The host is a deciduous shrub, without much foliage near the ground, so that it is probable that the younger case-bearing larval stages live on the ground, but they have not been discovered. About a dozen full-grown larvae were recovered from litter beneath *Holodiscus* near Fairfax, Marin County, on 13 March 1970. The cases were flat, elongate, oval and slightly figure 8 shaped in outline, about 2.3–2.7 × 7.2–7.4 mm, and were covered with bits of frass and debris. Larvae apparently had completed feeding by this date and pupation occurred soon thereafter. The first adult emerged at the end of March, probably well ahead of sibs in the field, as *Holodiscus* buds were still in an early stage there on 17 April. The bizarre pupa features antennae which considerably exceed the body length, extending free from the wing case tips to wrap around the caudal area of the abdomen (about three times in the male), in the manner of many Trichoptera.—J. A. POWELL, *University of California, Berkeley.*

Dasypodinae (Insecta: Hymenoptera) versus Dasypodinae (Mammalia: Edentata).—While browsing through the drawers of Hymenoptera at the California Academy of Sciences, San Francisco, I was struck by the name Dasypodinae in the bee family Melittidae. A mammalogy course at the San Francisco State College had taught me that Dasypodinae is the name of a subfamily of edentate armadillos (Edentata: Dasypodidae). Reference to Simpson's 1945 *Principles of Classification and a Classification of Mammals* (Bull. Amer. Mus. Nat. Hist., vol. 85) verified this.

Dr. E. I. Schlinger thought that an emendation, rather than a complete name change, might be desirable, based on the fact that the bee genus *Dasypoda* is the name from which the subfamily name was formed, whereas in the armadillos the subfamily name dasypodinae was based on the generic name *Dasypus*. The correct names should be Dasypinae for the armadillos and Dasypodinae for the bees. I plan to write a more extensive paper and petition the International Congress on Zoological Nomenclature for the emendation of the subfamily Dasypodinae (Edentata : Dasypodidae) to Dasypinae. Since there is no homonymy at the family level, there appears to be no need to change the family name from Dasypodidae to Dasypidae. I am indebted to Drs. R. C. Miller and P. H. Arnaud, Jr., of the California Academy of Sciences, and P. D. Hurd, Jr. and E. I. Schlinger of the University of California, Berkeley, for advice.—THOMAS P. HECK, *Department of Biology, Queens College, Flushing, New York, N.Y. 11367.*

The principal speakers of the evening and their topics were as follows: DR. NORMAN E. GARY, University of California, Davis—"Mating Behavior of the Honey Bee"; MR. MICHAEL BENTZIEN, University of California, Berkeley—"Biology of Diguetid Spiders"; MR. FRANKLIN ENNIK, Bureau of Vector Control, California Department of Public Health, Berkeley—"Loxosceles Spiders of California."

A social hour was held in the entomology rooms following the meeting.—M. S. WASBAUER, *Secretary.*

THREE HUNDRED AND THIRTY-FOURTH MEETING

The 334th meeting was the annual picnic and field day. It was held on Saturday, 16 May 1970, at Angel Island State Park.

There were 28 members and guests present: Mr. and Mrs. F. L. Blanc, Mr. and Mrs. Richard Brown and children, Mr. and Mrs. Franklin Ennik and children, Mr. and Mrs. Russel Gabel, Mr. and Mrs. Ron Stecker and children, Dr. and Mrs. Robbin Thorp and children, Dr. and Mrs. Wm. Tilden and children.

Members and guests met at the picnic area near park headquarters for lunch at 1:30 p.m.

Collecting is not allowed in State parks so major activities were hiking and exploring the island.—M. S. WASBAUER, *Secretary.*

THREE HUNDRED AND THIRTY-FIFTH MEETING

The 335th meeting was held at 7:45 p.m. on Friday, 16 October 1970, in the Morrison Auditorium of the California Academy of Sciences, Golden Gate Park, San Francisco. President Thorp presided.

Members present (32): R. P. Allen, J. A. Anderson, F. G. Andrews, P. H. Arnaud, Jr., F. L. Blanc, I. Boussy, G. Brady, D. L. Briggs, T. Briggs, R. M. Brown, W. L. Chase, J. G. Edwards, W. E. Ferguson, M. R. Gardner, Lauren Green, E. Grissell, J. F. Gustafson, K. S. Hagen, J. Hjelle, E. A. Kane, H. B. Leech, R. Lem, R. Main, E. S. Ross, R. E. Stecker, V. Stombler, R. Tassan, R. W. Thorp, M. S. Wasbauer, S. C. Williams.

Visitors present (25): S. Anderson, Madeline M. Arnaud, Kathy Beeby, G. R. Cox, Alice and Jane Edwards, D. Emenegger, Stephenie Ferguson, K. Florens, Donna and Steve Gary, D. Guiliani, Jean Keer, Mr. and Mrs. M. Marquis, Alice E. Munroe, F. R. Nelson, W. A. Nelson, C. B. Philip, Iris Savage, Taly Slay, Joyce Thorp, Marilyn Trochman, K. R. Wald, A. R. Walter, D. Wasbauer.

The minutes of the meetings held 17 April and 16 May were summarized.

The following new members were elected: R. C. Brusca, David duBois, Alexander R. Dutton, Mrs. Douglas Munroe (family membership), Cornelius B. Philip.

President Thorp noted the untimely death of **Prof. J. W. MacSwain** of the University of California at Berkeley, a long time member of the society. The membership joined President Thorp in observing a minute of silence to honor the memory of Prof. MacSwain.

Dr. J. F. Gustafson, Chairman of the Salt Marsh Study Committee made a plea for publication of results of ecological studies on the salt marshes of California.

The principal speaker of the evening was Dr. Kenneth S. Hagen, University of California, Berkeley. His illustrated talk was entitled "Recent advances in Biological Control."

A social hour was held in the entomology rooms following the meeting.—M. S. Wasbauer, *Secretary.*

Three Hundred and Thirty-Sixth Meeting

The 336th meeting was held at 7:45 p.m. on Friday, 13 November 1970, in the Morrison Auditorium of the California Academy of Sciences, Golden Gate Park, San Francisco. President Thorp presided.

Members present (37): R. P. Allen, J. R. Anderson, F. G. Andrews, L. C. Armin, W. E. Azevedo, F. L. Blanc, R. M. Bohart, I. Boussy, G. Brady, T. Briggs, R. M. Brown, R. Bushnell, W. L. Chase, A. R. Dutton, J. G. Edwards, F. Ennik, W. E. Ferguson, M. R. Gardner, J. R. Gabel, Lauren Green, J. Guggolz, J. F. Gustafson, K. S. Hagen, J. T. Hjelle, E. A. Kane, H. B. Leech, R. Lem, W. D. Murray, W. H. Nutting, E. S. Ross, R. Schoeppner, C. W. Slobodchikoff, R. E. Stecker, R. W. Thorp, M. S. Wasbauer, R. H. Whitsel, S. C. Williams.

Visitors present (47): Lisa Anderson, S. Anderson, Margaret Bohart, Melissa Boussy, D. Chandler, J. Chapman, Pat Chase, J. Cronin, M. E. Cronin, Janie Edwards, Mr. and Mrs. D. Emenegger, J. Ennik, Stephenie Ferguson, Toni Gabel, Julia Garcia, R. Gardner, Nancy Gardner, Donna Gary, Linda Goodall, T. Hammer, Martha Hjelle, Janet Holman, D. Jolly, Patty Jones, A. Jung, L. Kane, Jo Anne Kerr, D. Lem, Helen Lepley, Mr. and Mrs. M. Marquis, M. Maloney, Sandy Miller, Mr. and Mrs. K. W. Miller, Judy Oppenheim, Elizabeth Register, Taly Slay, A. Smith, J. R. Smith, D. Stead, Joyce Thorp, W. L. Vaundell, Charlene Williams, R. Wong, Maxine Zack.

The minutes of the meeting held 16 October were summarized.

President Thorp announced his appointment of the temporary committees for the year: Auditing committee—Mr. H. Vannoy Davis, Chairman; Mr. T. S. Briggs and Dr. C. D. MacNeill. Nominating committee—Dr. W. E. Ferguson, Chairman; Dr. J. F. Gustafson and Dr. K. S. Hagen.

The following note was presented:

Developmental Anomalies in the scorpion *Centruroides sculpturatus* (Scorpionida: Buthidae).—Two adult specimens of *Centruroides sculpturatus* Ewing which show developmental anomalies were recently collected in the Salt River Valley of Arizona by Lorin Honetschlager. One specimen was essentially normal with the exception of the telson which was represented as two completely separate telsons. Each telson was fully formed and of equivalent size to that of a normal adult telson for this species. Each telson was also fully functional and capable of independent operation. The terminal metasomal segment (segment V) also showed some abnormal development in that it was wider than normal and the inferior median keel was not separate and unpaired, but was in a distinctly paired condition. Between these paired inferior median keels there was an additional inferior median keel (not normally present) which bifurcated posteriorly.

The other specimen showing abnormal development was normal except for having two fully formed and separate metasomas and telsons. Each metasoma-telson replicate was essentially normal in size and basic structure, and each was fully functional. The terminal mesosomal segment showed a slight abnormal development in that it was slightly wider than normal and had a distinctly developed inferior median keel (not normally present). The dorsal median keel of this segment was abnormal in that it extended to the posterior margin of the tergum, ending in a distinct bifurcation (this keel is usually short, simple and unbifurcated).

Developmental anomalies of these kinds have only been reported in four other species from two families of scorpions. In the Buthidae it was reported in *Buthacus leptochelys, Androctonus crassicauda,* and *Centruroides infamatus.* In the Chactidae it has been reported in *Euscorpius carpathicus.* The record of *Buthacus leptochelys* was unusual in that the bifurcation and complete body replication began at the fourth mesosomal segment. The anomalies of the other reported species were much like the specimen of *Centruroides sculpturatus* reported here with the completely replicated metasoma and telson. Such developmental anomalies are probably attributed to an abnormal midsagittal division of the posterior embryonic germ band. It is interesting to note that this kind of anomaly has never been found to occur in the anterior region of the body or with the other appendages.—STANLEY C. WILLIAMS, *Department of Biology, San Francisco State College.*

The principal speaker of the evening was DR. E. S. ROSS, California Academy of Sciences. His illustrated talk was entitled "Entomological highlights of a trip to Africa and around the World."

A social hour was held in the entomology rooms following the meeting.—M. S. WASBAUER, *Secretary.*

THREE HUNDRED AND THIRTY-SEVENTH MEETING

The 337th meeting was held Friday, 18 December 1970, at 7:45 p.m. in the Morrison Auditorium of the California Academy of Sciences, Golden Gate Park, San Francisco, with President Thorp presiding.

Members present (29): R. P. Allen, F. G. Andrews, G. S. Benham, Jr., F. L. Blanc, I. Boussy, R. M. Brown, S. L. Clement, V. Davis, A. R. Dutton, F. Ennik, W. E. Ferguson, E. Grissell, J. Guggolz, T. E. Hewton, Jr., J. T. Hjelle, R. L. Langston, H. B. Leech, C. B. Philip, E. S. Ross, E. I. Schlinger, R. O. Schuster, R. E. Stecker, V. Stombler, R. W. Thorp, J. W. Tilden, M. S. Wasbauer, Joanne Wasbauer, R. F. Wilkey, S. C. Williams.

Visitors present (11): Judith Benham, Irene Brauer, Karen S. Corwin, Stephenie Ferguson, Netta Leong, P. Rauch, M. Santos, J. A. Smith, Joyce Thorp, R. L. Wong, Virginia Woo.

The minutes of the meeting held 13 November were summarized.

One new member was elected: Karen S. Corwin.

President Thorp called for the annual reports of the standing committees. R. E. Stecker, chairman of the Program committee, announced the dates for the 1971 programs: 19 February, 16 April, 15 May, 15 October, 19 November, 17 December. The annual picnic will be 15 May, and Mr. Stecker called for those who have suggestions on an area for the picnic to contact him.

Hugh B. Leech, chairman of the Historical committee, announced that the society received some valuable material for the archives during the year. These included from Wayne Gagné, the original illustrations for *The Miridae of the Galapagos Islands* by Gagné and Carvallo; from Cornelius B. Philip, a large amount of material from his files at Hamilton, Montana including some valuable signatures on letters dealing principally with Diptera and public health matters; from R. L. Doutt, a longhand manuscript of the late T. D. A. Cockerell; from David Rentz, the manuscript and plates of his *Revisionary studies of the Nearctic Decticinae* published in the memoirs series. Considerable help was forthcoming this year from Miss Helen Davis, a retired school teacher. Miss Davis very generously donated a good many hours of her time in putting the E. C. Van Dyke correspondence in order in files. She also went through some of the early files of the society and arranged them.

Mr. Leech then summarized the financial statement for the year in the treasurer's absence.

H. Vannoy Davis, chairman of the Auditing committee presented a summary of the Auditing committee's review of the Society's financial condition.

President Thorp announced his appointments to the Publication committee through 1973: Don Linsdale, Oakland Museum and Evert I. Schlinger, University of California, Berkeley. Fred Andrews, Bureau of Entomology, Sacramento, was appointed to fill the remaining year of the term of R. F. Wilkey.

William E. Ferguson, chairman of the Nominating committee, presented the slate of nominees for offices in the Society during 1971: President, F. L. Blanc; President-elect, D. G. Denning; Secretary, M. S. Wasbauer; Treasurer, P. H. Arnaud. There were no nominations from the floor. The slate of candidates was unanimously elected to office for 1971.

The incoming president, F. L. Blanc, called for notes and exhibits. The following notes were presented:

Clarifications in the Nomenclature of Some North American Scorpionida. —In 1836 C. L. Koch described a new genus and species of North American scorpion based on a specimen he called *Vaejovis mexicanus* (Koch, C. L. 1836. Die Arachniden. Nuremberg, vol. 3: 51). Later, in 1876, T. Thorell emended the spelling of *Vaejovis* to "*Vejovis*" based on the belief that "*Vejovis*" would be a more correct spelling (Thorell, T. 1876. Ann. Mag. Nat. Hist. 4th. ser., 17 (97): 5, 10). In studying Koch's manuscript, it is now clear that he definitely intended to use the spelling "*Vaejovis*" as this generic name is spelled this way uniformly in the text, index, and on the figure. Therefore, Thorell's emendation must be considered as an unjustified emendation according to Articles 32 and 33 of the International Code of Zoological Nomenclature. As such, Thorell's "*Vejovis*" must be considered as a junior objective synonym of Koch's *Vaejovis*. Because *Vaejovis* is the nominal genus of its family, this family name should be spelled Vaejovidae, and not Vejovidae.

In the same paragraph that Thorell unjustifiably emended *Vaejovis* he also changed the spelling of *Brotheas* to *Broteas* (Scorpionida: Chactidae) for similar reasons. This should also be considered an unjustified emendation and the spelling *Brotheas* should, therefore, be retained.—STANLEY C. WILLIAMS, *San Francisco State College.*

Birth Behavior in the South African Scorpion *Hadogenes*.—During January of 1970, Karl S. Switak, of the California Academy of Sciences staff collected a series of scorpions of undetermined species, but belonging to the genus *Hadogenes* and family Scorpionidae. These specimens were excavated from burrows two feet deep in Kruger National Park, South Africa. One large female specimen was given to me early in January soon after its arrival in San Francisco. On 13 January she began giving birth. The entire birth process took place over a time interval of 10 days. On the first day only two young were born, and six was the maximum number of young born during any one 24 hour period. During the birth process the female never stilted above the substrate, but held the ventral part of the body close to (but not touching) the ground. The young emerged from the genital aperture in a somewhat precocious condition in that they were not covered by a membrane and were capable of considerable locomotor activity. As the young emerged, they grabbed hold of the ventral surface of the mother's body, walked upside down to the lateral region of the venter, then quickly ascended to the mother's back. On the back of the mother they assumed a random spatial orientation, similar to that of *Centruroides* in the Buthidae. The young remained on the mother's back as first instar larvae for a minimum of 37 days (13 January to 19 February), with some individuals remaining in this stage somewhat longer (possibly up to 50 days). The first instar larvae were capable of considerable locomotion, but usually remained motionless and were on the mother's back at all times. Two individuals in the last first instar larval stage were removed from the mother's back and placed on the substrate next to the mother. These crawled on the substrate rather quickly and soon encountered the quiescent mother, at which time they promptly ascended her back and took their place with the remainder of the litter. The first instar larvae began molting on 19 February, but the last individual in the fisrt instar did not molt until 5 March. Three of the second instars left the mother's back four days after the first molt; others remained longer. The birth behavior of several species of North American scorpions has been studied and described (Williams, S. C. 1969. Proc. Calif. Acad. Sci. ser. 4, 37(1): 1–24). It is, therefore, possible to make some comparisons with the birth process in some of the American forms. There was a striking similarity between the birth behavior of this African species and the American forms which have been studied. The following are some of the more important similarities: the young are born alive; the first instar is represented as a larval form which lacks pretarsal claws, and full development of the telson, and is soft and whitish; the first instar larval stage ascends to the mother's back without touching the ground and remains on the mother's back in a physically inactive state throughout this stadium; the first molt produces the second instar nymph stage which appears like a miniature adult, with pretarsal claws, and a fully developed telson; the young leave the mother's back as second instar nymphs; the first instars do not feed; the mother showed no attempt to eat the young of either the first or second instar stage.

Birth in this South African species of scorpion differed from the birth process in North American scorpions in the following significant ways: the young were not covered by a membrane or chorion at time of parturition; the young were not caught in a cradle formed by the first two pairs of walking legs of the mother; the first stadium was conspicuously long (37 to 51 days compared to 7 to 14 days); the birth process occurred gradually over a period of 10 days (not in less than 24 hours); the mother did not stilt above the substrate during parturition; the litter did not accomplish the first molt in synchrony in that individuals molted over a time period of 13 days (not within 12 to 48 hours); second instar nymphs began leaving the mother's back in four days (not in about two weeks).—STANLEY C. WILLIAMS, *San Francisco State College.*

Notes on the cerambycid beetle *Ulochaetes leoninus* LeConte.—Larvae of the cerambycid beetle *Ulochaetes leoninus* Leconte were found in large numbers in a felled tree of *Pinus ponderosa* Douglas on March 28, 1970. At that time sections of the log and pieces of the bark were collected. This material was brought to San Jose and placed in rearing cages kept at room temperature. The locality of the tree was 19 miles east of Red Bluff at a point one mile SW from the confluence of North and South Antelope Creeks, Tehama County, California.

The tree, which measured 75cm d.bh., had been growing in an isolated group of several Ponderosa pines along Antelope Creek at an elevation of 1320 feet. Although the known hosts of *Ulochaetes* include *Pinus ponderosa, P. Jeffreyi, Pseudotsuga Menziesii,* and *Abies concolor* (Essig, 1926; Craighead, 1923), the nearest continuous stand of any of these trees is about 5 air miles away. This would indicate that the beetle probably traveled a long distance to attack the log.

The time the tree was cut is not definitely known, but on the basis of previous trips to the area, I estimate it had been felled about two years earlier. The trunk of the tree was still moist from winter rains at the time the collections were made.

Extensive mining by the larvae was evident in the sapwood of the trunk. Some mining was evident in the heartwood but was much less extensive. The larval galleries were packed tightly with light-colored, moist, finely divided frass. The galleries meander through the wood, intersecting galleries of other larvae, but generally proceeded in the direction of the grain of the wood. There were some larval excavations in the bark, which was about 4cm thick. These were filled with reddish frass and invariably led to pupal chambers.

Full grown larvae were found in pupal chambers both in the bark and in the sapwood. Those chambers found in the bark were located 2mm to 8mm from the inner surface of the bark. Pupal chamber shape varied considerably, but most chambers were elongate, the ends rounded, and the sides subparallel. They varied in size from 3cm to 6cm long, from 1½cm to 2½cm wide, and were from 1cm to 1½cm deep. The chambers, which are situated lengthwise with the grain of the bark, are sealed from the larval galleries with a frass plug.

At the time of collection some prepupal larvae were placed on a layer of tissue in vials which were plugged with moist cotton. These were later stored at room temperature in the dark. One larva pupated on March 30, 1970 and transformed to the callow adult on April 16, 1970. Normal pigmentation developed during several following days.

Emergence of adults from pieces of bark and sections of log occurred between April 16, 1970 and June 6, 1970. Peak emergence occurred during the last week in April and the first week in May, in San Jose. A total of 28 adults emerged; 8 males and 20 females.

These beetles exhibit a remarkable likeness to bumblebees. They are slow fliers with heavy bodies. When at rest if a beetle is disturbed it raises the short elytra, curves the abdomen upward, holds the hind wings at right angles to the body and beats them rapidly without becoming airborne. This display and the buzzing noise which accompanies it may be effective in frightening away predators that have had unpleasant experiences with bumblebees.—DAVID L. WILSON, *San Jose State College.*

The principal speaker of the evening was DR. R. W. THORP, University of California, Davis, the outgoing President of the Society. His presidential address was entitled "Bumble Bees and their Ways."

Coffee and other refreshments were available during a social hour in the entomology rooms following the meeting.—M. S. WASBAUER, *Secretary.*

SCIENTIFIC NOTE

A technique for the study of insect-borne pollen.—Fuchsin glycerine jelly provides a method of transforming insect or stigma-borne pollen into a semipermanent mount *in the field.* All that is required is a container of jelly, a needle, microscope slides, cover slips and a spirit lamp and the preparations can be made very conveniently and very rapidly. For example, often the best method of identifying insect-borne pollen is to make a set of reference mounts while actually in the habitat under study.

The basic material for this technique is fuchsin glycerine jelly. The usual method of preparation is a modification of that described by Kisser (1935, Z. wiss. Mikr., 51: 38–40). The ingredients are: distilled water 175 cc., glycerine 150 cc., gelatin 50 gm., crystalline phenol 5 gm., and crystalline basic fuchsin stain. The gelatin is added to the distilled water in a large beaker and heated until dissolved. The glycerine and phenol are then added and the whole mixture gently warmed and stirred. Add basic fuchsin crystals to obtain the strength of color desired; I find that the color of claret stains most pollen grains very clearly. Too dark a color may obscure morphological detail and too light a color may not highlight such detail sufficiently. The decision on the strength of color *does* depend upon the type pollen of grains likely to be encountered. For example, Compositae pollen frequently absorbs very much stain, hence a standard (claret) or a weaker color is often desirable. The contents of the beaker, which now resemble gore, must be filtered through glass wool into containers and left to set. Remember the need to prevent contamination: containers should be completely clean and then sealed once the jelly is in place. Sterile plastic petri dishes are perhaps the most useful containers.

Basic fuchsin is not the only stain that can be added, it just happens to be a good general stain. Others may be added provided that they are soluble. Ruthenium red has been used to stain the intine of pollen grains and fast green has also been tried as a general stain.

A small cube of jelly is placed beside the pollen sample on a clean slide which is then warmed very gently over a spirit lamp until the jelly melts. In the interests of a pure sample use a flamed needle to dissect the jelly from its container. Do not overheat the preparation or the mountant will denature and become unmanageable. Inversion of the slide over a glass cover slip makes a thin, bubble-free, semipermanent mount. The stain is absorbed very rapidly so that by the time the preparation is placed on the microscope stage the grains are clearly colored. The time taken to absorb stain can be useful in distinguishing between difficult pollen species.

The beauty of this technique is that parts of insects (and sometimes whole insects) and parts of flowers, especially intact stigmas, can be mounted with the pollen *in situ.* Insect integuments and floral tissue normally do not absorb the stain hence pollen grains are instantly conspicuous in the preparation. I have mounted whole styles direct from fresh flowers and whole flies taken in mid-visit to a flower.

To remove pollen from an insect a small needle spearing a blob of jelly can be applied to the integument. The jelly is then transferred to a slide with the pollen adhering to it. Slight warming of the blob can help to trap all the pollen. In this way individual groups of grains can be precisely identified and analysed. —A. J. BEATTIE, *Stanford University, Stanford, California 94305.*

BOOK REVIEWS

INVERTEBRATA PACIFICA, Vol. I, pp. 1–197, 1903–1907. Edited by C. F. Baker. Reprinted 1969 by E. W. Classey Ltd., Hampton, Middlesex, England. Available from Entomological Reprint Specialists, P. O. Box 207, East Lansing, Michigan 48823. $10.80.

Invertebrata Pacifica was a rather short-lived serial publication which was initiated by Charles Fuller Baker in 1903, the year of his arrival at Pomona College. On accepting a position with the Estacion Agronomica Santiago de las Vegas, Cuba, in 1904, Baker continued his editorship but abandoned the publication when he returned to Pomona College in 1908. He was an enthusiastic and tireless collector of insects and this trait is evident in the content of the publication which is based mostly on material collected by Baker in California, Nevada, Mexico, Guatemala and Nicaragua. It contains descriptions of approximately 245 new species and 7 new genera by C. F. Baker, A. P. Morse, D. W. Coquillett, J. J. Kieffer, Peter Cameron, J. A. G. Rehn, Nathan Banks and J. C. Crawford.

The reprint edition of this difficult to obtain series was produced by photo-offset and thus preserves the original format and pagination. The paper is of good quality and the workmanship in the book cloth binding is fair.—MARIUS S. WASBAUER, *California Department of Agriculture, Sacramento.*

THE KODIAK ISLAND REFUGIUM, ITS GEOLOGY, FLORA, FAUNA AND HISTORY. Thor N. V. Karlstrom and George E. Ball, Editors. The Ryerson Press, Toronto, for the Boreal Institute, University of Alberta, Edmonton. xiv + 262 pp., 28 figs., 21 tables, 1 pl. 1969. $10.00.

This is a stimulating multidiscipline study of the significance of the biota of a refugium, a nonglaciated area which presumably acted as a refuge while the surrounding areas were ice or snow covered for long periods. Chapter 7 is of particular interest to entomologists.

There is a Foreword by J. J. Bond, a Preface by Ball and Karlstrom; the book proper is divided into five Parts. Part I, an Introduction by Karlstrom, and Chapter 1, The biological importance of Pleistocene refugia, by Carl H. Lindroth. Part II gives the Regional setting and geology of the Kodiak Island Refugium, by Karlstrom. Part III comprises the Botanical investigations of the same area, with four chapters by as many authors. Part IV is largely entomological: Chapter 7, An annotated list of invertebrates of the Kodiak Island Refugium (Lindroth and Ball). Chapter 8, The species of the subgenus *Cryobius* of the Kodiak Archipelago (Ball). Chapter 9, An analysis of the carabid beetle fauna of the Refugium (Lindroth). Chapter 10, The fishes of the Kodiak Island Refugium (J. D. McPhail). Chapter 11, Origin of the terrestrial mammalian fauna of the Kodiak Archipelago (R. L. Rausch). Part V: Concluding remarks concerning the importance of the Kodiak Island Refugium for the survival of the biota (Lindroth).—HUGH B. LEECH, *California Academy of Sciences, San Francisco.*

RECENT LITERATURE

The following publications have been issued by the University of California Press:

The Flies of Western North America. By Frank R. Cole with the collaboration of Evert I. Schlinger, University of California Press, Berkeley and Los Angeles. 693 pages, illus. 1969. $25.00.

University Publications in Entomology:

Biology and Taxonomy of Bark Beetle Species in the Genus *Pseudohylesinus* Swaine (Coleoptera : Scolytidae). By Donald E. Bright, Jr., Univ. Calif. Publ. Entomol., 54: 1–46, 4 plates. 1969. $2.00.

Taxonomy and Biology of the Lacewing Genus *Meleoma* (Neuroptera : Chrysopidae). By Catherine A. Tauber. Univ. Calif. Publ. Entomol., 58: 1–94, illus. 1969. $3.50.

A Taxonomic Revision of the Weevil Genus *Dorytomus* in North America (Coleoptera : Curculionidae). By Charles W. O'Brien. Univ. Calif. Publ. Entomol., 68: 1–80, illus. 1970. $3.00.

Bulletin of the California Insect Survey:

The Cephid Stem Borers of California (Hymenoptera : Cephidae). By Woodrow W. Middlekauff. Bull. Calif. Insect Surv., 11: 1–19, illus. 1969. $1.00.

For further information write: Publicity Department, University of California Press, 2223 Fulton Street, Berkeley, California 94720.—Ed.

BOOK NOTICE

The Lepidoptera of New York and Neighboring States. Primitive forms, Microlepidoptera, Pyraloids, Bombyces. By William T. M. Forbes. Reprinted by Entomological Reprint Specialists, East Lansing, Michigan. 729 pages, illus. 1969. $17.50.

This edition is an unabridged facsimile reprint of the work originally published in 1923 as Cornell University, Agricultural Experiment Station, Memoir 68.—Ed.

NEW JOURNAL

Scheduled for April publication is the new *International Journal of Insect Morphology and Embryology* with Dr. A. P. Gupta, Department of Entomology and Economic Zoology, Rutgers University, New Brunswick, New Jersey 08903, as its editor-in-chief. The journal will be published quarterly by the Pergamon Press (New York, Oxford, Paris).

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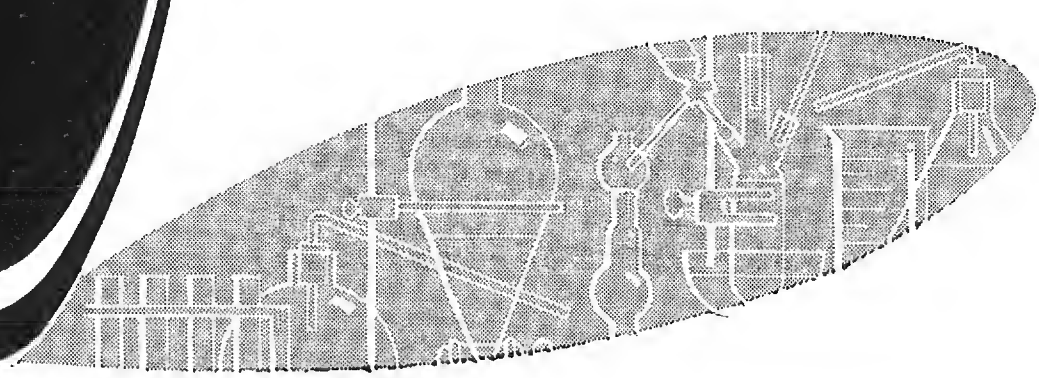

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Essig, E. O. 1926. A butterfly migration. Pan-Pac. Entomol., 2: 211–212.

1958. Insects and mites of western North America. Rev. ed. The Macmillan Co., New York. 1050 pp.

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The Pan-Pacific Entomologist

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Contributions to the Biology and Taxonomy of the *Paraleptophlebia* of Oregon[1]

(Ephemeroptera : Leptophlebiidae)

D. M. Lehmkuhl[2] and N. H. Anderson

Entomology Department, Oregon State University
Corvallis, Oregon 97331

This paper reports on the biology and taxonomy of western Oregon mayflies. The data are based primarily on monthly collections from Oak Creek, Benton County, in the foothills of the Coast Range, and bimonthly collections from the Metolius River, Jefferson County, on the east side of the Cascade Range. Details of the sampling areas and methods are given in Lehmkuhl and Anderson (1970).

Allen and Edmunds (1956) reported 10 species of *Paraleptophlebia* from Oregon. Three of these, *P. falcula* Traver (type locality, Corvallis, Oregon), *P. rufivenosa* (Eaton) and *P. vaciva* (Eaton) (type locality of both, Mt. Hood, Oregon) are apparently quite rare as Allen and Edmunds (op. cit.) did not see Oregon specimens. Males of 5 species were identified from the study area by using Traver's (1935) key—*P. bicornuta* (McDunnough), *P. debilis* (Walker), *P. gregalis* (Eaton), *P. sculleni* Traver, and *P. temporalis* (McDunnough). However, Day (1954) suggested that *P. sculleni* may be a synonym of *P. gregalis* and we have been unable to distinguish the nymphs or females of these species (see below). The other species recorded from Oregon by Allen and Edmunds were *P. heteronea* (McDunnough) and *P. memorialis* (Eaton) (as *P. pallipes* Hagen). The latter occurs in Idaho and California (Day, 1956) but we did not collect it during the present study. *P. heteronea* was one of the common mayflies in Berry Creek, Benton County, in Kraft's (1963) study. Female specimens labelled *P. heteronea* collected by Kraft from Berry Creek were examined by one of us (DML) and were found to be indistinguishable from female *P. temporalis* of the present study.

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[1] Technical Paper No. 2881, Oregon Agricultural Experiment Station. From a thesis by D. M. Lehmkuhl submitted in partial fulfillment by the requirements of the Ph.D. degree. This research was supported by National Science Foundation grants GB-3643 and GB-7958 to N. H. Anderson.

[2] Present address: Department of Biology, University of Saskatchewan, Saskatoon, Canada.

Most *Paraleptophlebia* species are univoltine and pass the winter in the egg stage; the habitat of nymphs ranges from moderately swift riffles to muddy substrates covered with leaf drift (Gordon, 1933). The biology of *P. debilis* in a northern stream is discussed by Clifford (1969). Koss (1968) investigated the fine structure of the eggs of several *Paraleptophlebia* species, including *P. debilis*. Chapman and Demory (1963) found that the nymphs of *Paraleptophlebia* fed mainly on detritus. The nymphs came to the top of stones at night and the proportion of algae in their diet increased at night. Gut contents also reflected changes in food availability at different seasons.

Keys to the western species of *Paraleptophlebia* males are given by Day (1956) for California, and Jensen (1966) for Idaho. Jensen provided a key to the mature nymphs, and Day tabulated potential taxonomic characters for the California nymphs. In the present paper we provide keys to the adult females and mature nymphs of *P. gregalis*, *P. temporalis*, *P. debilis*, and *P. bicornuta*.

Key to Females of Paraleptophlebia Lestage of Oregon

1. Notch in terminal abdominal sternite wide at opening, depth of notch about equal to width of opening (Fig. 1); with or without conspicuous sclerotized markings on sternite VIII (Fig. 2 & 3) 2

   Notch in terminal abdominal sternite a narrow V-shaped, depth of notch 1½ to 2 times the width of the opening; no conspicuous sclerotized markings on sternite VIII; sternite VII produced posteriorly to cover part of segment VIII so that in ventral view segment VII about twice as long as VIII; body usually rusty red and wings slightly tinged with yellow .... *temporalis* (McDunnough)

2. Markings on sternite VIII indistinct or absent; fork of Rs in hind wing bisected by a well developed 3rd vein, fork encloses 2 or 3 pairs of crossveins .... *bicornuta* (McDunnough)

   Markings on sternite VIII as in Fig. 2 or 3; fork of Rs in hind wing either lacking or, if present, with usually none and never more than one pair of crossveins 3

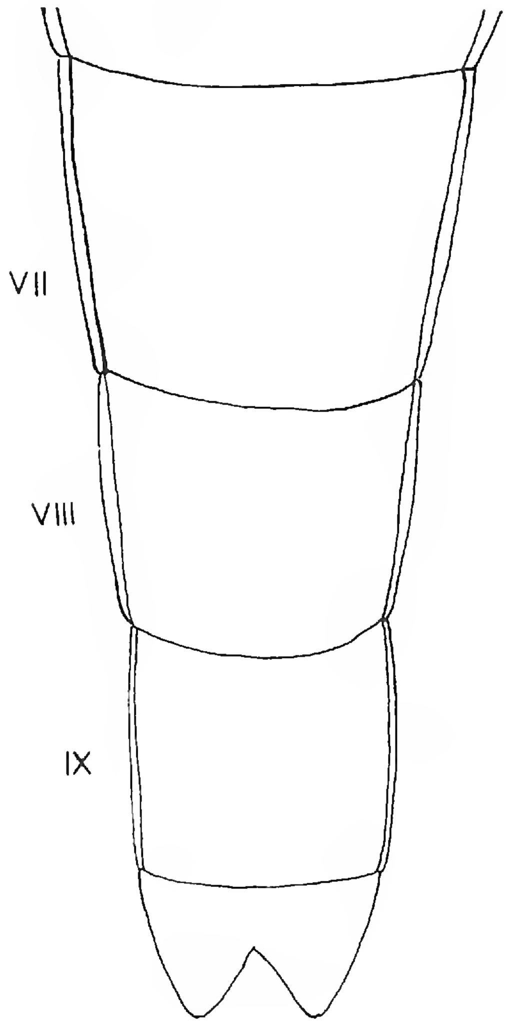
3. Sclerotized markings on segment VIII a narrow dark ridge continuing at least ½ the length of the segment and diverging at both ends (Fig. 3); fork of Rs usually present .... *gregalis* (Eaton)

   Sclerotized markings on segment VIII widely divergent at the anterior end and forming a ridge less than ½ the length of the segment (Fig. 2); fork of Rs represented only by detached arms, base of fork indistinct .... *debilis* (Walker)

Key to Nymphs of Paraleptophlebia Lestage of Oregon

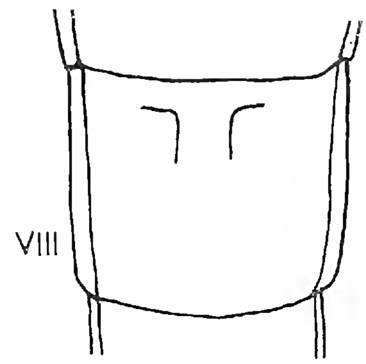
1. Mandibles with large tusks projecting forward and visible from above .... *bicornuta* (McDunnough)

   Mandibles without large tusks 2



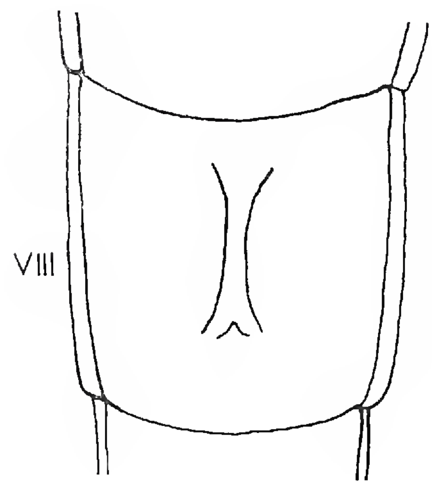
1

P. BICORNUTA



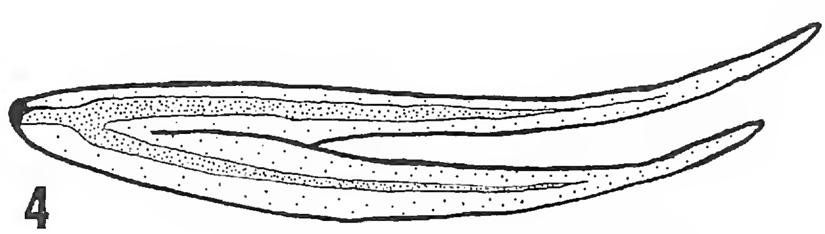
2

P. DEBILIS



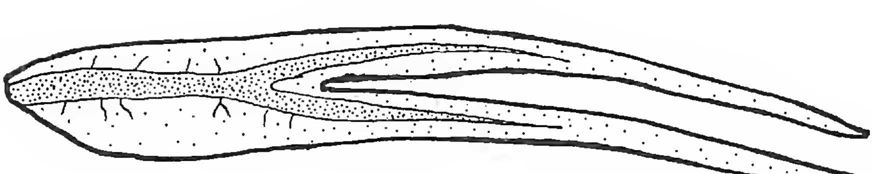
3

P. GREGALIS



4

P. DEBILIS



5

P. TEMPORALIS

FIGS. 1–3. Abdominal sterna of *Paraleptophlebia* females: FIG. 1) *P. bicornuta*; FIG. 2) *P. debilis*; FIG. 3) *P. gregalis*. FIGS. 4–5. Gills of *Paraleptophlebia* nymphs: FIG. 4) *P. debilis*; FIG. 5) *P. temporalis*.

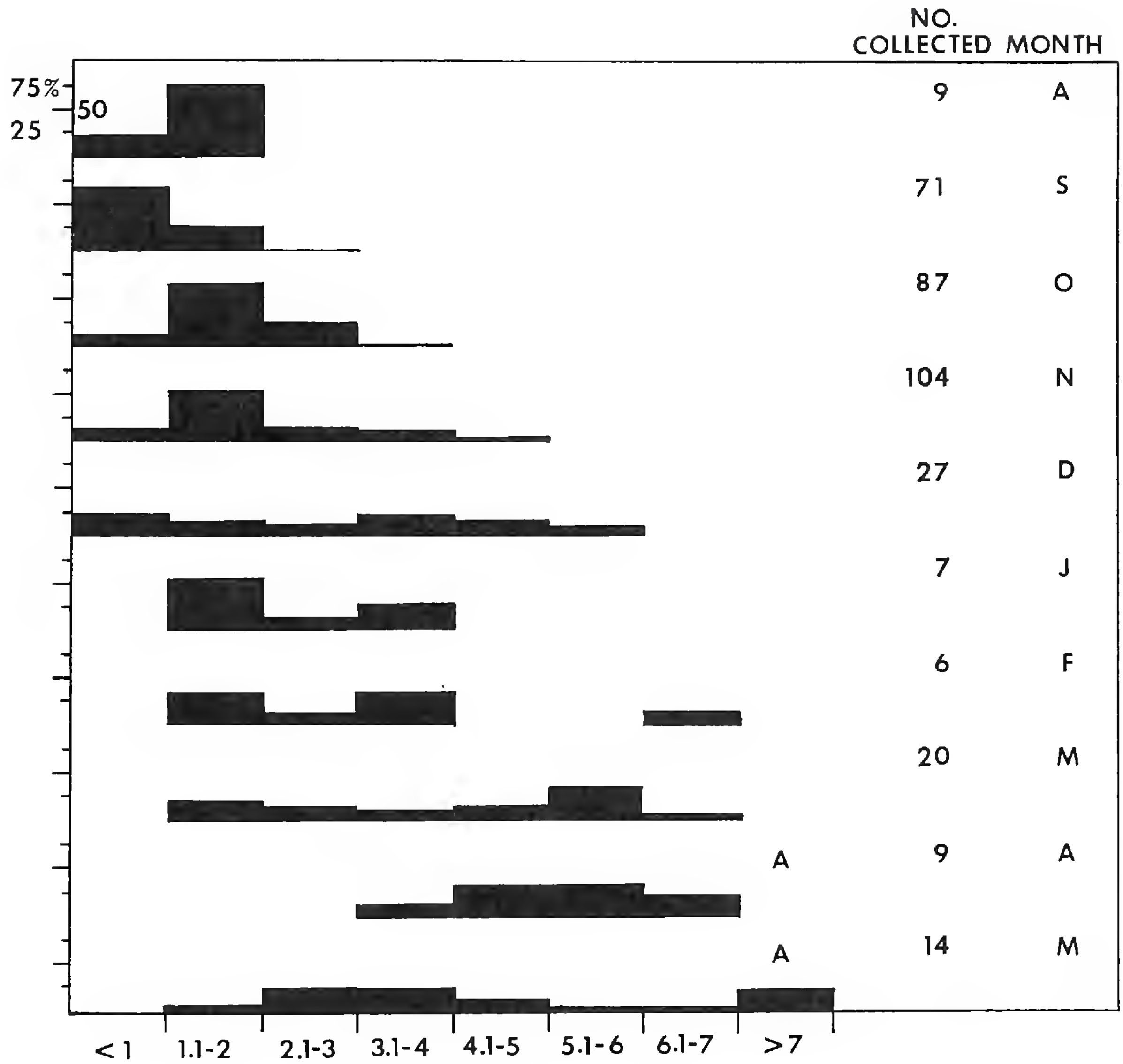


FIG. 6. Size class distribution of *Paraleptophlebia temporalis* nymphs in monthly benthos samples, Oak Creek, Benton Co., Oregon. A = adults collected. Nymphs absent in June and July.

2. Tracheae of gills forked in middle (Fig. 5), dark markings or bands lacking on legs .... *temporalis* (McDunnough)
   Tracheae of gills forked at base (Fig. 4) 3
3. Denticles of tarsal claws minute, scarcely if at all visible at 60 × magnification; femur, tibia and tarsus without definite dark bands .... *gregalis* (Eaton)
   Denticles of tarsal claws larger, usually visible at 30 ×; femur, tibia and tarsus each with a dark band .... *debilis* (Walker)

PARALEPTOPHLEBIA GREGALIS (Eaton)

Leptophlebia gregalis Eaton, 1884. Trans. Linnean Soc. London, Sec. Ser.-Zool., 2: 98.

Paraleptophlebia sculleni Traver, 1934. J. Elisha Mitchell Sci. Soc., 50: 189. NEW SYNONYMY.

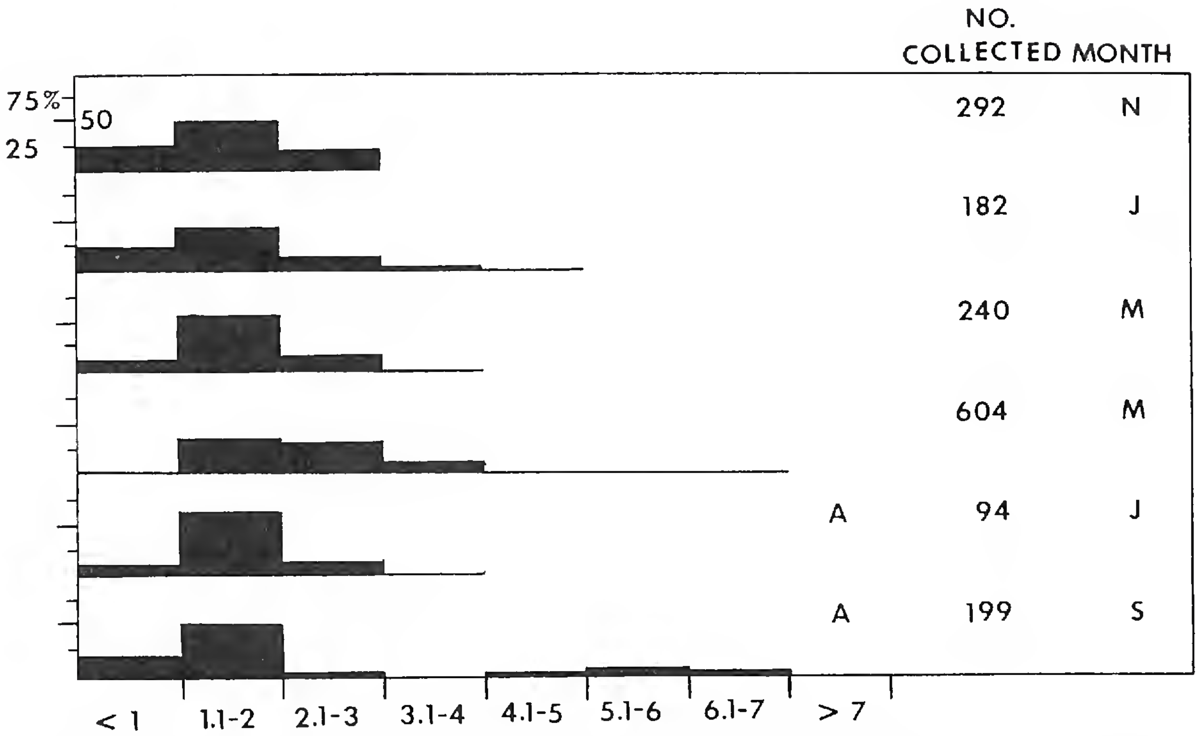


FIG. 7. Size class distribution of *Paraleptophlebia temporalis* nymphs in benthos samples, Metolius River, Jefferson Co., Oregon. A = adults collected.

The type locality of *P. gregalis* is Mt. Hood, Oregon; subsequently Traver described *P. sculleni* from a single male collected at Corvallis, Oregon. On the basis of her 1935 key and verification table, it is distinguishable from *P. gregalis* on color (middle abdominal segments predominantly white in *sculleni*, and brown in *gregalis*) and *sculleni* is slightly smaller. Day (1954) suggested, because of marked similarity of the genitalia, that "*P. sculleni* may . . . prove to be a synonym of *P. gregalis*."

One of us (DML) has collected extensively from the type locality of *P. sculleni*. Both color variants of males were obtained but no difference could be found in genitalic structures. In addition, deliberate searches were made and rearings carried out but distinguishable females or nymphs were not found. Thus we believe that only one polymorphic species is involved and the name *P. gregalis* has priority for the species.

The life cycle of *P. gregalis* is similar to that of *P. temporalis*.

PARALEPTOPHLEBIA TEMPORALIS (McDunnough)

P. temporalis had a univoltine cycle in Oak Creek (Fig. 6). Nymphs were absent in June and July, but the new generation had reached 2 mm in length by August. There was a large increase in the population during September and October, and more than 70% of the annual total nymphs were collected between September and November. Nymphs increased

TABLE 1. Distribution of age classes of *Paraleptophlebia temporalis* in Oak Creek.

		% per biotope		
Age Class*	Total for year	Still Backwater	Glide	Riffle
I	81	5	10	85
II	198	15	8	77
III	42	57	31	12
IV	32	67	28	5
V	5	40	60	0

* I—newly hatched, gills thread-like; II—gills more developed, wing buds absent; III—wing buds evident; IV—mesothoracic wing pads completely cover metathoracic wing pads; V—wing pads black.

gradually in size during the winter, and adults emerged from April to June.

The life cycle is not as clear in the Metolius River (Fig. 7) which is spring fed and has a fairly constant temperature all year. Nymphs of the smallest size class occurred in all collections, so apparently the eggs hatched throughout the year. Adults emerged from June to September, which was somewhat later than at Oak Creek.

In Oak Creek, *P. temporalis* occurred as small nymphs in the riffle areas from August to November. From November to March it was absent from areas of rapid current and was most abundant in slow waters. There was an apparent shift in biotope preference, with eggs hatching in the riffle but the nymphs moving to slower waters as they matured. There is a negative correlation between size and preferred current velocity (Table 1). The species occurred in both gravel areas and plant beds in the Metolius River but was most abundant in the

TABLE 2. Distribution of age classes of *Paraleptophlebia temporalis* in the Metolius River.

		% per biotope		
Age Class*	Total for year	Mid-*Ranunculus*	Edge-*Ranunculus*	Gravel
I	37	11	51	38
II	674	27	45	28
III	227	64	27	9
IV	175	88	11	1
V	20	90	10	0

* See Table 1.

TABLE 3. Distribution of age classes of *Paraleptophlebia debilis* in Oak Creek.

		% per biotope			
Age Class*	Total for year	Still Backwater	Glide	Edge-Riffle	Mid-Riffle
I	84	13	20	64	3
II	424	35	28	36	1
III	293	30	26	43	1
IV	297	11	29	60	0
V	22	27	32	41	0

* See Table 1.

plant beds. As is apparent in Table 2, the small nymphs were common on gravel substrates where the current was fast, but a lack of large individuals in the gravel suggests a movement to the plant beds prior to emergence.

PARALEPTOPHLEBIA DEBILIS (Walker)

This species occurred in both Oak Creek and the Metolius River, but in the latter it inhabited only muddy side pools and was not taken in the routine benthos samples. In Oak Creek, the nymphs were scarce or absent in winter, and young nymphs were first collected in the March samples (Fig. 8). In comparison with *P. temporalis*, this is a later emerging species. Adults, or nymphs with dark wing pads, were taken from June to November. The life cycle is univoltine with long periods of hatching and emergence and with most adults occurring in the autumn. The eggs apparently have a resting period of several months during the winter.

Jensen (1966) reported that prior to emergence nymphs often migrate into the still water of marginal pools. This is a similar observation to that noted for *P. temporalis* above. As indicated in Table 3, except for a high proportion of small nymphs in the edge of riffle biotope, *P. debilis* nymphs in Oak Creek were spread through the biotopes sampled, but within these biotopes the nymphs were always in the areas of slowest current velocity.

MATING AND OVIPOSITION.—The following observations were made at Helmick State Park, Luckiamute River, Polk Co., Oregon, on 24–27 July 1966. Mating swarms appeared suddenly as the sun dropped behind the trees in the late afternoon. Only individual males or small groups of males were seen while the sun still shone on the water.

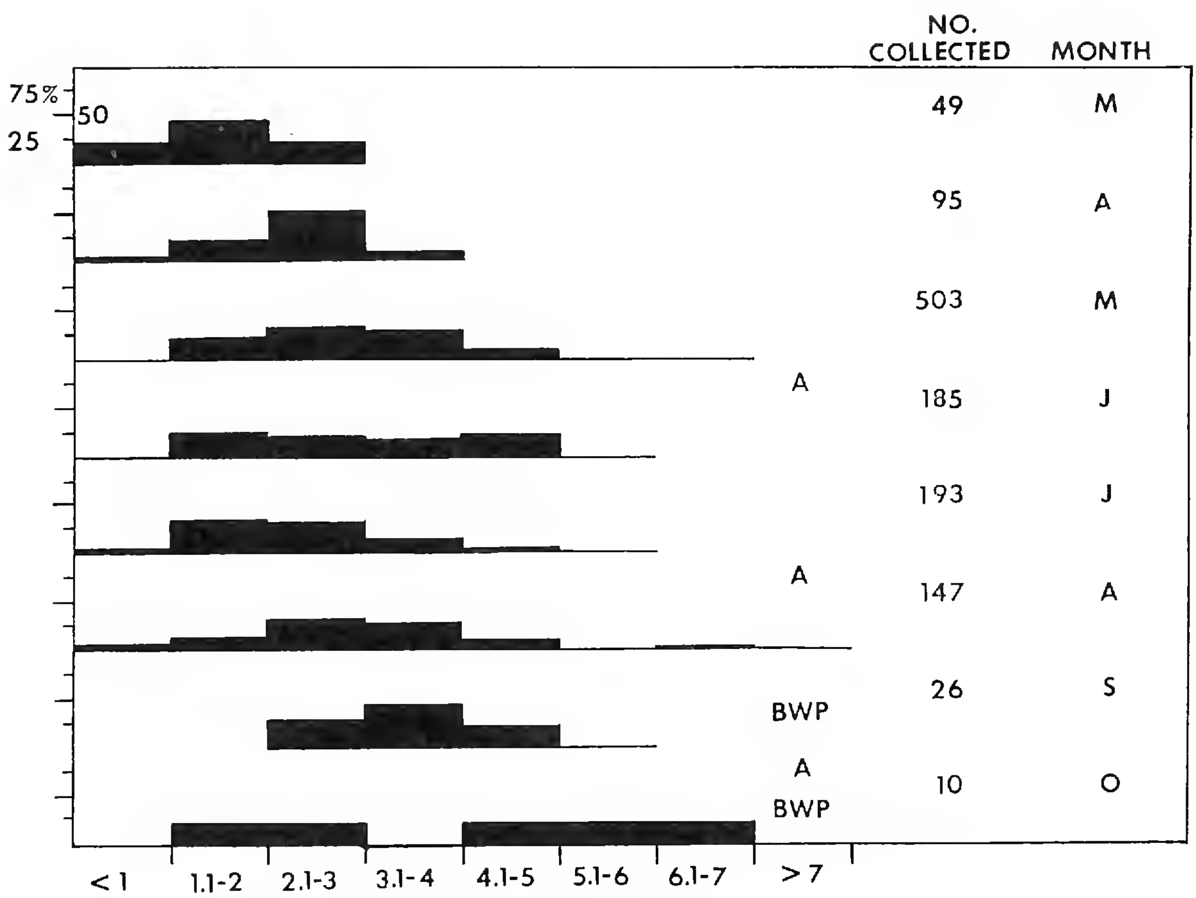


FIG. 8. Size class distribution of *Paraleptophlebia debilis* nymphs in monthly benthos samples, Oak Creek, Benton Co., Oregon. A = adults collected. BWP = mature nymphs with black wing pads. Nymphs absent November–February.

Within 3–4 minutes after the sun ceased shining on the surface, groups of 30–40 males appeared and swarmed 2–4 feet above the water, about 2–10 feet from shore. The dance was performed by the male repeatedly fluttering rapidly upward 4–5 feet above the water, then the wings and cerci were spread, the forelegs were stretched far forward, and they floated down until they were about 2 feet above the surface. Occasionally they fell into the water and usually could not free themselves.

Females appeared about 30 minutes after the males began to swarm. When a female entered a swarm she was immediately grasped by a male. The pair lost altitude and copulation was completed in the time it took them to fall 3 feet. The pair then separated and the female immediately began skipping across the surface of the water depositing eggs. She dropped to the surface of the water, dipped the tip of her abdomen, flew about 2 feet into the air, and dropped again. Three dips were enough to deposit all eggs. The time from the first contact between male and female until the last of the eggs were laid was only a few seconds. After oviposition the females flew to the bushes along the edge of the stream.

Twenty-two males were captured from a mating swarm and kept in a net to determine the length of adult life. These were captured at about 8 p.m. and by 9 p.m. the next day all but one were dead. Thus it appears that males do not live to swarm more than one day.

Paraleptophlebia bicornuta (McDunnough)

Although nymphs of several species of *Paraleptophlebia* have large tusks on the mandibles, *P. bicornuta* is the only species with tusks in western Oregon. Nymphs were often collected with *P. debilis* under silty stones in slow moving streams and rivers, and were occasionally collected in Oak Creek. The life cycle of *P. bicornuta* is similar to that of *P. debilis*, with adults emerging in summer and fall.

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Two New Species of *Ptecticus* with a Key to Species Occurring in America North of Mexico[1]

(Diptera : Stratiomyidae)

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In revising the Stratiomyidae of Mexico it was necessary to compare specimens of *Ptecticus sackenii* Williston from localities in Mexico with specimens from various localities in the United States. While making these comparisons I found two species from Arizona which possess a dark frons as does *P. sackenii* but differ in several other characters, notably male genitalia. These species, *P. melanothorax* and *P. nigritarsis*, are described for the first time and bring the total number of species of *Ptecticus* occurring in America north of Mexico to four. A key is provided to distinguish between the species and a lectotype is designated for *P. sackenii* Williston.

SYSTEMATIC TREATMENT

James (1935) first reviewed the genus *Ptecticus* as part of a larger work on the Geosarginae (= Sarginae) and followed a similar procedure in a later review (James, 1941). Notes on biology and a description of the larva of *P. trivittatus* (Say) was provided by McFadden (1967).

DIAGNOSIS.—The genus includes those species of Sarginae that have the second antennal segment extending deeply on the inner side into the third. The vertex is broader than the front and the eyes of both sexes are dichoptic but more so in the female than in the male. The lower squamae are simple and lack the strap-like lobe of *Chrysochroma* (of authors, not Williston). The American species formerly referred to *Chrysochroma* are not congeneric and a new name has been proposed for them in another paper (McFadden, 1970).

KEY TO THE SPECIES OF PTECTICUS IN AMERICA NORTH OF MEXICO

1. Frons shining black 2
   Frons yellow .... *trivittatus* (Say)
2. Mesonotum, scutellum and postscutellum orange-yellow 3

[1] Scientific Paper 3451, College of Agriculture, Washington State University. Work was conducted under projects 9043 and 1939. The author is indebted to the National Science Foundation, Grant GB-7384 for partial financial support of this project.

Mesonotum, scutellum and postscutellum dark metallic purple .... *melanothorax* McFadden, n. sp.

3. Posterior legs with apical four tarsomeres white; first abdominal tergum entirely yellow .... *sackenii* Williston

Posterior legs with at least apical tarsomere black; first abdominal tergum with a dark metallic mark .... *nigritarsis* McFadden, n. sp.

PTECTICUS TRIVITTATUS (Say)
(Figs. 1, 4)

Sargus trivittatus Say, 1829, p. 159, Indiana; type presumed lost.

DIAGNOSIS.—An entirely pale species that can be separated from each of the other three species that occur in America north of Mexico by the yellow frons and by the distinct male genitalia (Fig. 4).

DISTRIBUTION.—Insufficient collecting data still prevent accurate definition of the range of this species but probably it extends from the Rocky Mountains to the Atlantic coast and from Florida northward to the southern tier of Ontario counties in Canada (Fig. 1).

DISCUSSION.—*Ptecticus trivittatus* is the most commonly collected form that occurs in this area and during the hot summer months adults can often be seen frequenting garbage or other decomposing organic matter. Additional information on the biology of *P. trivittatus* and illustrations of the mature larvae are given in an earlier publication (McFadden, 1967).

PTECTICUS SACKENII Williston
(Figs. 2, 3)

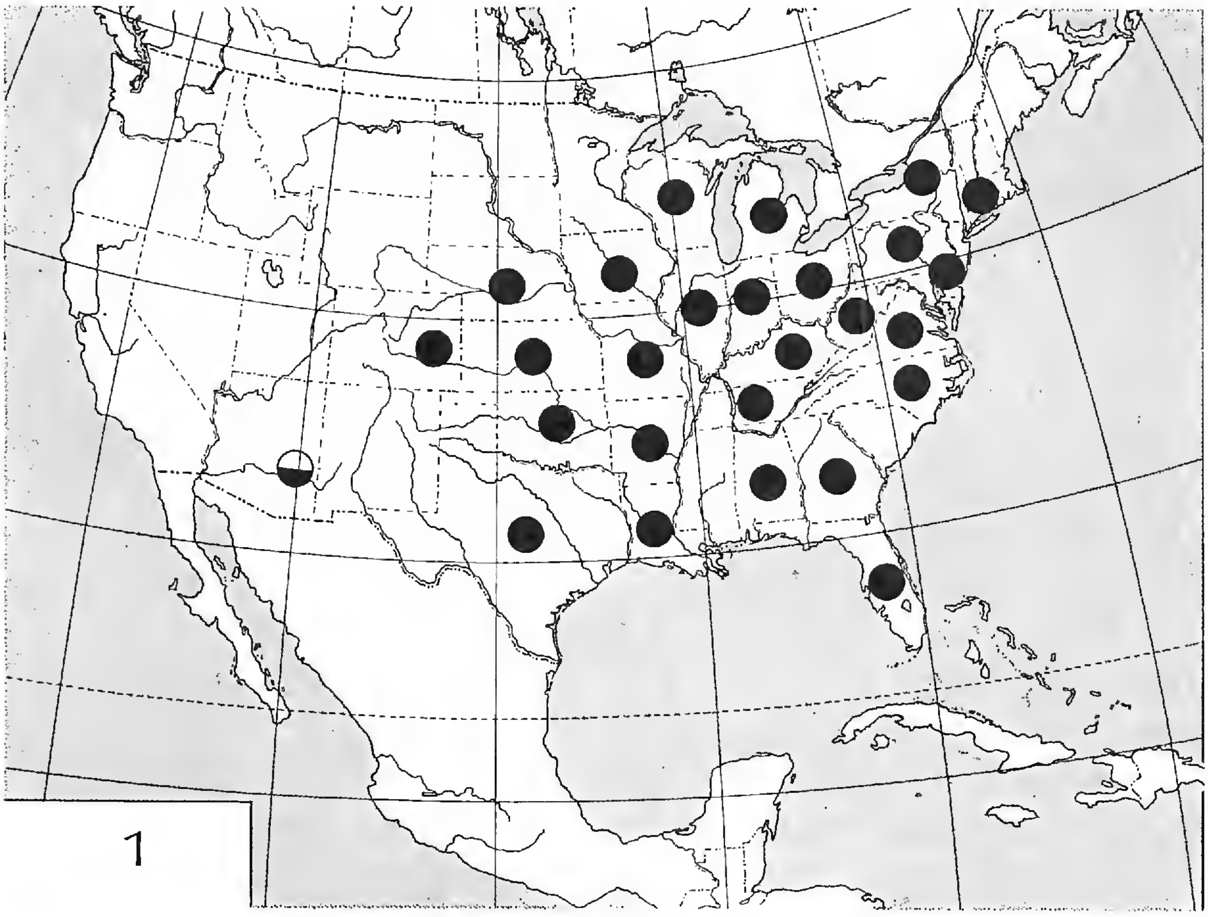
Ptecticus sackenii Williston, 1885, p. 124. Originally described from 4 specimens, 1 male and 3 females, all designated as cotypes by Williston. By present designation: LECTOTYPE: ♂ syntype, Shark River, New Jersey. PARALECTOTYPES: 1 ♀, New York; 1 ♀, Florida, Ft. George, August 1882.

All lectotype material is deposited in the Snow Entomological Museum, University of Kansas, Lawrence.

DIAGNOSIS.—Male genitalia, especially the cerci (Fig. 3), and the white apical four tarsomeres on the posterior legs will distinguish this species from the other two species that have the black frons.

DISTRIBUTION.—From Arizona east to the Atlantic coast, northward to Kansas west of the Mississippi River and as far north as southern Ontario east of the Mississippi (Fig. 2). The range also extends deeply into Mexico.

DISCUSSION.—The range occupied by *P. sackenii* is similar to that of *P. trivittatus* and, in fact, the two species are almost wholly sym-



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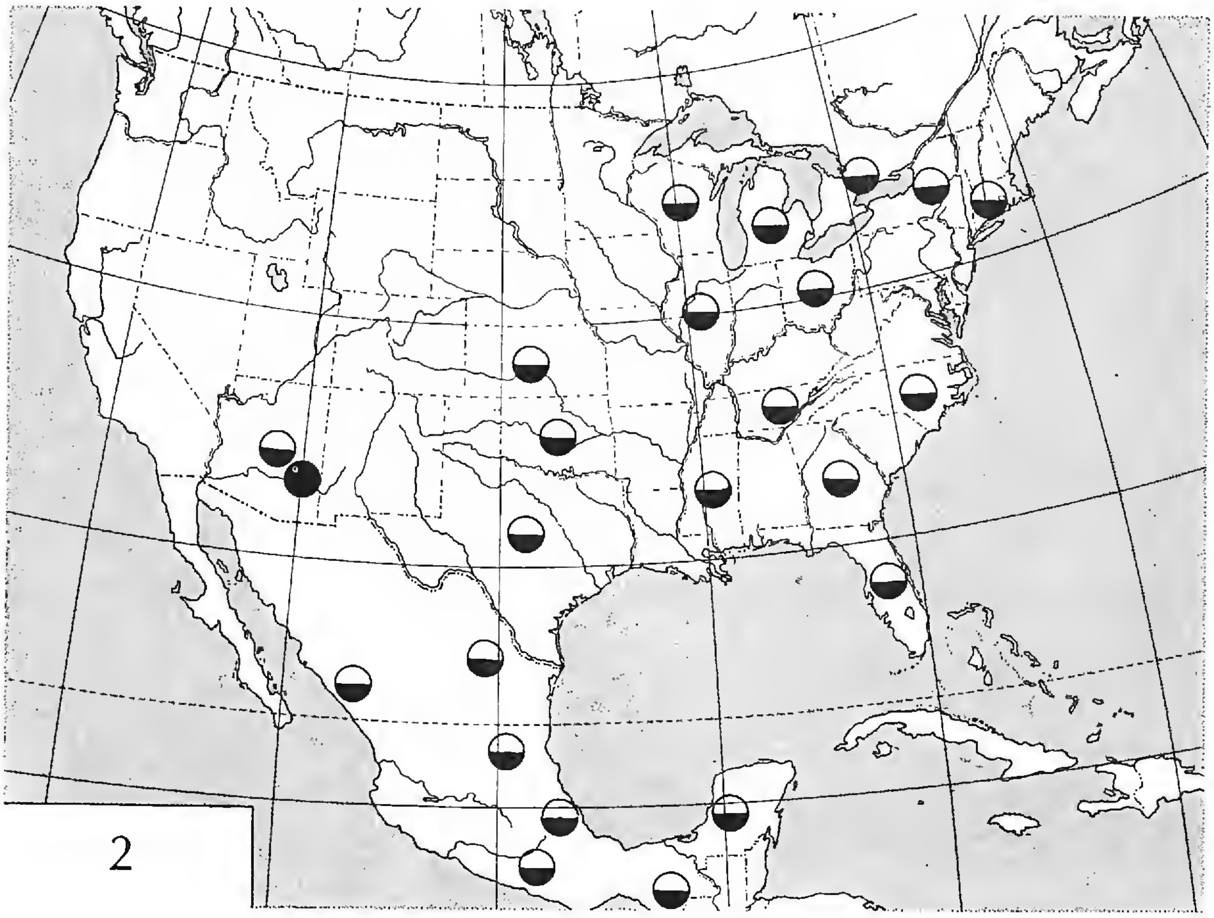

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patric. While *P. trivittatus* is commonly collected throughout its range, however, specimens of *P. sackenii* are rather rare and the species is poorly represented in most collections.

Ptecticus melanothorax McFadden, new species
(Figs. 1, 5)

TYPE MATERIAL.—*Holotype male*, S.W.R.S., 5 MI. W. PORTAL, COCHISE COUNTY, ARIZONA, 28 August 1963, Evans, 5,400 ft. Allotype, same data as type. Type and allotype deposited in American Museum of Natural History. One male and one female paratopotype, same data as type, deposited in Washington State University Collection.

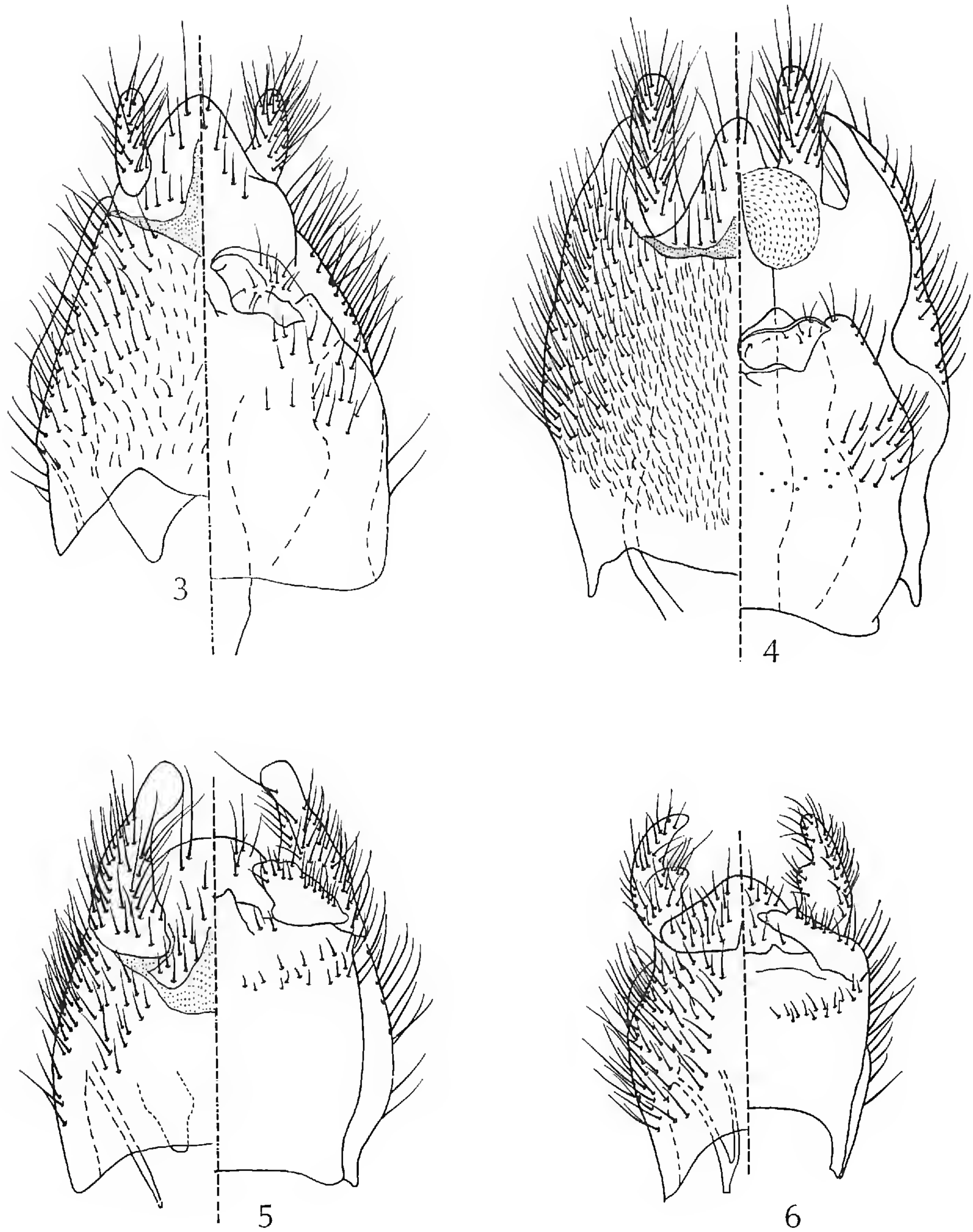
DIAGNOSIS.—Differing from other species of *Ptecticus* by having the mesonotum, scutellum and postscutellum dark metallic blue-black.

HOLOTYPE MALE.—Length 10 mm. Ocellar triangle and frons above tubercle black; tubercle, face and proboscis yellow; pile of frons brownish-yellow, that of vertex pale; pile of face and lower occipital orbit pale; antennae yellow, arista brownish yellow basally, darker at apex; pile of first and second antennal segments pale, except for a small posterolateral group of strong black hairs at distal margin of each segment as viewed from below. Thorax metallic blue-black over most of dorsal surface, becoming progressively lighter toward lateral line where it is yellow; humeri and a broad line along notopleural suture, white; postalar callosities reddish yellow; scutellum and postscutellum entirely dark metallic except an indistinct pale area on latter directly beneath apex of scutellum; pile of thorax pale, short and semi-appressed without overlap; pleura and pectus yellow. Wings subhyaline, stigma yellow. Halteres yellow. Legs yellow except for following black areas: tarsi of anterior legs, basitarsi and apical tarsomeres of posterior legs. Abdomen metallic blue-black with yellow areas as follows: a small spot at posterolateral margin of first tergum; second tergum with posterior transverse band, width less than half the length of that segment; a similar band on third tergum about equal to half the length of that segment; fourth tergum with dark area reduced to an indistinct mark near anterior margin, but separated from it by a narrow band of yellow; fifth tergum with a similar mark, but area further reduced; venter of abdomen yellow, except for first ventrite which appears somewhat darker. Male genitalia as in Fig. 5.

ALLOTYPE FEMALE.—Length 10 mm. Similar to male except for the following characters and usual sexual differences: arista black basally; scutellum with a narrow but distinct pale apical margin; posterior tibiae dark brown; posterolateral yellow spot on first abdominal tergum also present on anterolateral corner of second abdominal tergum; width of transverse yellow band on second abdominal tergum about half as long as segment; remaining abdominal terga

←

FIG. 1. Distribution of *P. sackenii* (half-filled circles) and *P. nigritarsis* (filled circles) in North America. FIG. 2. Distribution of *P. trivittatus* (filled circles) and *P. melanothorax* (half-filled circles) in America north of Mexico.



FIGS. 3–6. Male genitalia of *Ptecticus*. (Right half = ventral view; left half dorsal view). FIG. 3. *P. sackenii*. FIG. 4. *P. trivittatus*. FIG. 5. *P. melanothorax*. FIG. 6. *P. nigritarsis*.

entirely reddish yellow or brown; first abdominal ventrite darker than in male. Cerci metallic blue-black with pale pile.

VARIATION FROM TYPE.—Male paratopotype with first two tarsomeres yellow on anterior legs and apical two tarsomeres brownish on middle pair; posterior tibiae notably darker than femora in both specimens; abdominal markings variable in male. Dark metallic areas on fourth and fifth terga reduced to small indefinite linear markings on male paratopotype. Female paratopotype as follows: black of anterior tarsomeres extended to midpoint of tibiae, especially prominent on inner surface of tibiae; abdominal markings similar in both specimens except for three small indefinite dark metallic spots on anterior half of third tergum, two spots located near anterolateral margin, third about midway between outer two.

Ptecticus nigritarsis McFadden, new species

(Figs. 2, 6)

TYPE MATERIAL.—*Holotype male*, S.W.R.S., 5 MI. W. PORTAL, COCHISE COUNTY, ARIZONA, 28 August 1963, Evans, 5,400 ft. Allotype, same data as type. Type and allotype deposited in American Museum of Natural History. One male and one female paratopotype, same data as type, deposited in Washington State University Collection. A female paratype from New Mexico (Post Office Cyn., Hidalgo Co., 12 August 1967, E. I. Schlinger) in the University of California at Riverside Collection.

DIAGNOSIS.—Similar to *P. sackenii* but easily distinguished by the color of the apical four tarsomeres on the posterior legs.

HOLOTYPE MALE.—Length, 7 mm. Ocellar triangle and frons above frontal tubercle shining black; tubercle, face and proboscis yellow; pile of head pale; antennae yellow; arista yellow basally, dark brown apically; pile of first and second antennal segments yellow except for a few black hairs along distal margin on outer surface of second segment. Thorax brownish yellow with erect pale pile; pleurae and pectus yellow. Wings subhyaline, stigma only slightly yellow. Halteres yellow. Legs yellow except for following black areas: apical two tarsomeres of anterior and middle legs, basitarsi, apex of fourth and all of fifth tarsomeres of posterior legs. Abdomen yellow, metallic blue-black areas as follows: most of dorsal surface of first tergum but not at lateral margins, lighter at posterior margin; second, third and fourth terga with dark area restricted to anterior half except for second tergum which may have a median posterior elongation; fifth tergum with dark area more extensive, occupying about four fifths of dorsum. Venter of abdomen entirely yellow. Pile of abdomen short, the color matching ground color. Genital capsule yellow, genitalia as in Fig. 6.

ALLOTYPE FEMALE.—Length, 9 mm. Similar to male except for the following characters and usual sexual differences: black hairs on second antennal segment absent; most of second and all remaining tarsomeres black on anterior legs; apical three tarsomeres of middle legs black and basitarsi and apical portion of fourth tarsomere black on posterior legs. Abdomen yellow with following dark areas: first tergum with a rectangular mark about four-fifths length of that segment, posterior margin yellow; second, third and fourth terga with a pair of anterior spots; fifth tergum with a median transverse band; venter of abdomen entirely yellow; color of abdominal pile corresponding to ground color; basicercus yellow, disticercus brown.

VARIATION FROM TYPE.—Restricted to color characters of legs and abdomen. Male paratopotype with all tarsomeres except basitarsi, black, or at least dark brown, on anterior and middle legs; posterior basitarsi not as dark as type but still contrasting with white second and third tarsomeres; dark areas of abdominal terga similar to type but somewhat more extensive. No significant variation noted in female paratopotype, but female paratype with black of posterior legs restricted to basitarsi and fifth tarsomere.

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Appendix

Since this paper was written, two male specimens representing a third new species from Arizona have been found. The new species has a yellow frons and will come out to *P. trivittatus* in my key to species. It can be distinguished from *P. trivittatus*, however, by the greatly elongated, pincer-like cerci on the male genitalia.

A complete description of this new species will be included in a forthcoming paper on the *Ptecticus figlinus* complex which is currently in preparation.

BOOK REVIEW

Directory of Coleoptera Collections of North America (Canada Through Panama). Written, compiled and edited by Ross H. Arnett, Jr., and G. Allan Samuelson, assisted by Gerard E. Flory, Edward C. Mignot, C. Dietrich Schaaf, Eric H. Smith. Department of Entomology, Center for the Study of Coleoptera, Purdue University, Lafayette, Indiana 47907. viii + 123 pp. 1969. $3.95.

The authors had an eye on the future in preparing this book. The data are arranged for a punch card coding and retrieval system, and are actually on IBM cards at the Center for the Study of Coleoptera. After chapters on the directory and on the storage and retrieval of information from insect specimens, the listings are by countries, and by political divisions of the countries. There is a list of abbreviations of collection names (pp. 106–114), an index of scientific names (115–116), and an index to personnel (117–122).—Hugh B. Leech, *California Academy of Sciences, San Francisco.*

Behavior of *Leptalia macilenta* (Mannerheim), with a Description of the Pupa
(Coleoptera: Cerambycidae)

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During April 1970, field work in connection with the Field Entomology course of the University of California, Berkeley, resulted in the discovery of larval colonies of *Leptalia macilenta* (Mannerheim) at two localities in the central Coast Range of California. Observations were made on larval and pupation habits in the field and on adult behavior in the laboratory. At both sites larvae fed under bark of old *Umbellularia californica* (H. & A.) Nutt. (Lauraceae) logs, although conditions of the wood and habitat differed in several particulars between the two.

The first site is Lily Gulch, an east-running tributary of Alpine Lake, Marin County, where there is a permanent pond at about 800 feet elevation. Collections and observations were made on April 18 and again on April 22, when several sections of log were transferred to Berkeley, yielding the basis for most of the following data. The gulch is a narrow canyon forested primarily with *Sequoia*, *Pseudotsuga*, *Lithocarpus*, and *Umbellularia*. Riparian elements include *Acer*, *Cornus*, *Salix*, and a variety of less dominant forms. The gulch was spared when an extensive fire denuded the west side of the valley some 30 years ago, and subsequent succession has left Lily Gulch an island of redwood–douglas fir forest in an area which mostly recovered in manzanita brush. The tree which had been colonized by *Leptalia* was a standing, moss-covered snag of indeterminate age, perhaps dating back to the fire. Recently, probably within the past year, the upper section had fallen into the dry creek bottom, and our collections were made from this section. The wood was rotted, damp and "punky" in consistency with considerable fungus in the bark and surface wood and was currently occupied by larvae of Tipulidae, scardiine Tineidae, two genera of Lucanidae, and various other insects. The *Leptalia* galleries were located in the punky wood to a depth of 1–2 cm below the bark which was no longer easily discernible from the wood.

The second locality, visited a week later, is along Bates Creek, about 2.5 miles northeast of Soquel, Santa Cruz County. Here an excellent second growth redwood forest covers most of a narrow canyon at about 300 feet elevation in the southern edge of the Santa Cruz Mountains.

The Pan-Pacific Entomologist 47: 101–104. April 1971

Although more heavily forested, with mature *Acer* and *Umbellularia* dominant along the creek, the canyon has several cleared areas with scattered *Ceanothus* as principal plant cover; and by contrast to the Marin County site, the immediate area of the *Leptalia* colony was much drier. The *Umbellularia* log appeared to have been cut within the past few years after a tree had fallen across a dirt road. Several upper sections were located in an open clearing on a dry, steep, east-facing slope, and the wood had dried without much fungus growth or insect borer activity. The bark was dry and loose on all but the undersides of the larger sections. The largest of these extended above the ground a foot or so at its lower end and retained sufficient moisture beneath the bark on the shaded portions to support cerambycids and other insects. The *Leptalia* galleries were all located just under the bark, adjacent to the sound wood.

Larval Habits and Pupation

After hatching, the larvae bore through and commence feeding under the bark. The galleries are irregular and filled behind with frass. In relatively dry, recent logs, the galleries are restricted to the bark-wood interface and affect the sound wood only by shallow scoring. In old, decayed logs such as at Lily Gulch, the nature of the wood makes it difficult to trace the galleries. In this case, as is the habit of many Lepturinae, *Leptalia* feeds on media that have been subject to previous decomposition by numerous other wood boring organisms. No definite cambium layer was left under the bark and most of the wood surface was covered by layers of frass from previous inhabitants.

Upon completion of feeding the larvae construct oval (about 6 × 15 mm) pupal chambers longitudinal with the grain of the wood. Examination of numerous chambers indicated that most were made directly under the bark in the old frass material. In some cases, however, the cell was built 2–3 mm below the wood surface. The end of the pupal cells is plugged by frass particles and the pupa is oriented with the head toward the opening.

At the time of our observations, most pupal cells contained either teneral adults or pupae. No larvae were seen within cells but a number of several different instars were collected under the bark. Many of the adults were ready for emergence and became active upon release from the pupal chamber. Observations on adult behavior were made in the laboratory on the freshly emerged beetles.

Mating Behavior

Several pairs of previously unmated adults were placed into a petri dish along with a piece of old bark of *Umbellularia.* Initially, the male made no efforts to attempt to mate. When placed into direct sunlight, individuals of both sexes became very active and the male immediately mounted the female. Joining followed at once as the phallus was inserted into the extruded genitalia of the female. The phallus was visible throughout the course of copulation. No "licking" action by the male was evident, but the palpi were in contact with the female's elytra behind the scutellum. The males legs were positioned as follows: front grasping the sides of the elytra behind the humeri; middle around the middle of the elytra; and the hind legs back on the substrate. The antennae of both beetles were held up and slightly out. After joining, the female remained motionless while the male gently bobbed his head up and down, twitched his antennae, and made slight movements with the abdomen. After these initial movements, both individuals remained motionless except for an occasional movement of the legs by the female. During mating the female cleaned her antennae several times by passing them through her mouthparts. The front legs were cleaned in the same manner and the middle pair by passing the front ones over them.

This same type of behavior sequence was observed in three different pairs under the same conditions. There appeared to be no deviation in mounting, joining, and movement. The three pairs remained joined for an average of 44.5 minutes (40, 44, 49) and in all cases, the male remained mounted for at least seven minutes after disjoining. One male maintained his position on the female even while she was ovipositing. When the female began moving, the male lifted his hind legs onto the sides of the female's elytra near the apex. When left undisturbed, the same pairs mated numerous times and the male remained in position on the female even when not joined.

Michelsen (1963, 1966a) observed and summarized the sexual behavior of a number of lepturine species. A comparison of the activities of the Palearctic species with those of *Leptalia* indicates little similarity. Most males of the former either "licked" the female or bit the antennae. This behavior was not observed in *Leptalia* and the actions during copula were also significantly different. On the basis of the observations made on the sexual behavior of *Leptalia,* it is difficult to integrate this behavior into the evolutionary system proposed by Michelsen (1966b).

Oviposition Behavior

Shortly after the cessation of copulation, the female *Leptalia* began searching for suitable oviposition niches. As she walked, the ovipositor was extruded and probed over the bark. When an acceptable crevice was located, the ovipositor was inserted into it and the egg deposited. The only apparent indication of this action was a gentle pulsing of the abdomen and slight to and fro motions of the body. The antennae apparently are not used in locating oviposition sites.

The eggs are elongate (about 1.5 × 0.5 mm), whitish, and rather translucent. Recovery of a number of eggs indicated that no sticky coating was present over the surface when laid.

Since Craighead (1923) included a complete larval description of this species, it will not be reproduced here. Known hosts include *Alnus* and *Salix* in addition to *Umbellularia*. Taxonomy and biology of *Leptalia* and related genera will be given elsewhere (Linsley and Chemsak, 1971).

Description of Pupa

Head with a long dark seta on each side at base of mandibles, two setae on each side of clypeus near base, and several on each side at bases of antennal tubercles. Pronotum faintly rugulose, apical edge with a row of sclerotized seta-bearing asperites, several also present on lateral tubercles; base of disk with a medially interrupted row of asperate setae, setae also present on sides at middle and toward the sides near base. Abdomen dorsally with acute, sclerotized, seta-bearing spines which increase in size posteriorly, these arranged three on each side of middle and one on each side a little above and nearer the middle, segments six and seven additionally with a spine on lateral margins near the base, eighth segment with a row of spines along posterior margin. Legs with several long setae at apices of femora.

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Host-Plant Relations of Phytophagous Beetles in Mexico

(Coleoptera: Bruchidae, Chrysomelidae, Curculionidae)

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This project was undertaken primarily to supplement the recorded information on the habits and distribution of the Mexican Chrysomelidae. Conducted during a two-month period during the summer of 1967, the field investigations were carried out throughout the entire country, with the exception of the California and Yucatan peninsulas.

There exists more information in print on the subject of host-plant relations relative to the Chrysomelidae than any other family of beetles; nonetheless, very little information is available for the species inhabiting Mexico. Mexican representatives of this family remain scantily collected and very frequently have not been the subject of recent taxonomic elucidation. For these reasons this research was undertaken to complement similar studies on the better known species inhabiting the United States and to provide a reference for those planning collecting trips to Mexico in the future. At the outset of this project there were only two published reports of the host-plant relations of the Clytrinae; those concerned only two species in all of North America. This paper presents information on more than 50 taxa of clytrines observed during this research. The findings clarify the general pattern of behavior exhibited by this group, a pattern not expected from the information previously available. It is to be expected, then, that the information presented below may be of equivalent significance to others who study the Chrysomelidae and the closely related Bruchidae and Curculionidae.

It is a frequent observation that insects in the adult stage often congregate in large numbers on certain plants. These plants are often closely "related" in taxonomic terms or are known to share the presence of specific chemical compounds. Where oviposition is the primary object of such aggregations, it is likely that such plants will furnish the energy and nutrition requirements for the subsequent generation (host-plant in the strict sense). Very frequently, however, a correlation with larval food habits is not observed, even though the choice of plants as aggregation sites may be more or less constant over wide geographic areas. The determination of the identity of such plants is of great value to the field collector, and a broader definition of host-plant as that plant which incites approach from a distance and inhibits extensive loco-

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motory activity on contact proves more useful for a project such as this one.

The significance of this distinction is unfortunately often not realized until more advanced neurological investigation into the behavior of the species in question has been conducted. The ultimate goal of any such studies as this one is to determine by what means a phytophagous insect classifies the available plants and how it ultimately identifies a suitable host individual(s). Studies on individual host-plant selection is the first-step in understanding the process of coëvolution (Ehrlich and Raven, 1964).

The initial orientation response in the search for a suitable host-plant may be the result of quite a varied range of stimuli. These possess in common the feature of operating over relatively long distances (vision, non-ocular radiation sensors, phototaxis, geotaxis, hygrotaxis, generalized olfaction, etc.). Owing to the generalized nature of the stimulus a great number of plant species may initially be visited, but unless the plant provides the necessary subsequent stimuli the insect soon leaves. These subsequent stimuli are nearly always olfactory and require contact (gustation) or near-contact; on occasion the responses may be the result of more generalized physical parameters (pilosity, tough cuticle, etc.) which also require subsequent contact examination (reviewed by Thornsteinson, 1960). A given phytophagous species at this stage of orientation seldom forms aggregates and the individuals are highly motile. Although the attempt was made not to collect individuals in this stage of orientation, undoubtedly some of the references which follow are the result of initial investigatory behavior; further research along these lines will clearly distinguish between these possibilities for any given case.

Once the insect has found a plant which satisfies the initial visual, tactile, and chemical requirements its behavior changes markedly. If not actively feeding, individuals often move back and forth within an area "dragging" their antennae and/or palps along the surface. Phytophags may exhibit clumping at this stage, though not necessarily on the species the larvae will consume.

In this study collections were made of such aggregations; however, the distinction could seldom be made as to whether the larvae habitually consume the plant on which the adults were observed, owing to the inconspicuous nature of oviposition and the temporal segregation of stages in the life-cycle. Although larval food-plant was determined in certain cases (e.g., contemporaneous larvae and adults of *Cassida pallidula* Boh., oviposition scars of *Mastotethus*, pupation chambers of

Pseudochlamys, eggs of *Chlamisus*, etc.) special indication will not be made in this report.

Herbarium specimens were made of all plants involved in this study (Andrew Moldenke ##1486–2342). Identifications were obtained from Harold Moldenke, former curator of the N. Y. Botanical Gardens; the Compositae were determined by Rogers McVaugh, University of Michigan; and some of the Leguminosae by H. Irwin of the N. Y. Botanical Gardens. Nomenclatural designations reflect the system employed by the N. Y. Botanical Gardens and the specialists. Token samples of observed beetle populations were preserved and subsequently have been prepared with reference to my field notes. Determinations have been made of the Bruchidae by J. M. Kingsolver, U. S. National Museum; the Chlamisinae by J. Karren, Rollins College, Va.; and the Tanymecinae by A. Howden, Ottawa, Canada, in return for use of the specimens. The Clytrinae were determined by the author. All other identifications are necessarily tentative and were made by the author with reference to the *Biologia Centrali-Americana* and the extensive collections of the California Academy of Sciences in San Francisco. (My thanks to Hugh Leech and E. S. Ross of the Academy for assisting me in the use of the collection.) Specimens of any beetle group may be obtained from myself for further study on the part of interested parties. Only relatively certain determinations are cited in this report (ca. 50–60% of the collected specimens).

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BRUCHIDAE[1]

Acanthoscelides chiricahuae (Fall):	*Quercus undata* Trel. (FAG—Dur.)
	Gymnosperma glutinosum (Spreng.) Less. (COMP—DF)
Acanthoscelides spp.:	*Brickellia vernicosa* Rob. (COMP—Dur.)
	Neltuma glandulosa (Torr.) Br. & Rs. (MIMO—Son.)
Algarobius prosopis (LeC.):	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Jal.)
Algarobius n.sp. Kingsolver:	*Gymnosperma glutinosum* (Spreng.) Less. (COMP—Zac.)
Merobruchus n.sp. Kingsolver:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Dur.)
	Quercus undata Trel. (FAG—Dur.)

[1] Determined by J. M. Kingsolver.

Mimosestes amicus (Horn):	*Gymnosperma glutinosum* (Spreng.) Less. (COMP—Zac.)
	Hymenoclea salsola Torr. & Gray (COMP—Son.)
Mimosestes humeralis (Gyll.):	*Eupatorium collinum* DC. (COMP—Chps.)
Mimosestes sallaei (Shp.):	*Quercus undata* Trel. (FAG—Dur.)
	Parthenium hysterophorus L. (COMP—Sin.)
	Mimosa monancistra Benth. (MIMO—Dur.)
Sennius celatus (Shp.):	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Sin.)
Sennius discolor (Horn):	*Earleocassia covesii* (A. Gray) Britt. (CAESAL—Son.)
Stator sordidus (Horn):	*Baccharis ramulosa* (DC.) A. Gray (COMP—Nay.)
Zabrotes planifrons (Horn):	*Havardia pallens* (Benth.) Br. & Rs. (MIMO—Sin.)
Zabrotes n.sp. Kingsolver:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Micho.)

CHRYSOMELIDAE

Aulacoscelinae

Aulacoscelis canduzei Chap.: unident. palm

On three separate occasions individuals of this genus were observed on palms.

Criocerinae

Lema confusa Chevr.:	*Datura inoxia* Mill. (SOLAN—Micho.)
Lema sp.:	*Pithecellobium dulce* (Roxb.) Benth. (MIMO—Mor.)

Megalopodinae

Several individuals of *Mastotethus* were observed ovipositing on a certain plant. The herbarium specimens taken were sterile and not identifiable, but they definitely were *not* solanaceous.

Lamprosomatinae

Two different species of *Lamprosoma* were observed on *Vachellia Farnesiana* (L.) Wight & Arn.

Cryptocephalinae

Cryptocephalus militaris Suffr.:	*Quercus purulbana* Trel. (FAG—Nay.)
Cryptocephalus spp.:	*Mimosa monancistra* Benth. (MIMO—Dur.)
	Salix Goddingii Ball (SALIC—Ariz.)
	Vachellia Farnesiana (L.) Wight & Arn. (MIMO—Ariz.)
	Brickellia vernicosa Rob. (COMP—Dur.)
	Ceanothus buxifolia Willd. (RHAM—Dur.)

Cryptocephalus spp.:	*Eysenhardtia polystachya* (Ort.) Sarg. (FABA—Jal.)
	Pithecellobium dulce (Roxb.) Benth. (MIMO—Mor.)
	Hymenoclea salsola Torr. & Gray (COMP—Sin.)
	Baccharis ramulosa (DC.) A. Gray (COMP—Nay.)
	Neltuma glandulosa (Torr.) Br. & Rs. (MIMO—Son.)
	Senegalia Greggii (A. Gray) Br. & Rs. (MIMO—Son.)
	Ceanothus Fendleri A. Gray (RHAM—Ariz.)
	Hymenoclea salsola Torr. & Gray (COMP—Sin.)
	Quercus grisea Liebm. (FAG—Dur.)
	Poponax cymbispina (Sprague & Riley) Br. & Rs. (MIMO—Jal.)
Griburius spp.:	*Viguiera dentata* (Cav.) Spreng. (COMP—Guanj.)
	Vachellia Farnesiana (L.) Wight & Arn. (MIMO—Col., Chps.)
Lexiphanes sp.:	*Baccharis angustifolia* Michx. (COMP—Sin.)
Pachybrachys spp.:	*Poponax cymbispina* (Sprague & Riley) Br. & Rs. (MIMO—Micho.)
	Vachellia Farnesiana (L.) Wight & Arn. (MIMO—Dur., Jal.)
	Cirsium sp. (COMP—Nay.)
	Ceanothus buxifolia Willd. (RHAM—Dur.)
	Brickellia vernicosa Rob. (COMP—Dur.)
	Oenothera rosea Ait. (ONAG—Dur.)
	Senegalia Greggii (A. Gray) Br. & Rs. (MIMO—Son.)
	Quercus purulbana Trel. (FAG—Nay.)
	Eupatorium havanense H.B.K. (COMP—Dur.)
	Ipomoea mutabilis Lind. (CONV—Nay.)
	Salvia inconspicua Benth. (LAB—Micho.)

CHLAMISINAE[2]

Chlamisus maculipes (Chevr.) :	*Ipomoea pedicellaris* Benth. (CONV—Nay.)
Chlamisus spp.:	*Larrea divaricata* Cav. (ZYGO—Son.)
	Sida glutinosa Commers. (MALV—Jal.)
	Salvia albida H. B. K. (LAB—Nay.)
	Mimosopsis aculeaticarpa (Ort.) Br. & Rs. (MIMO—Micho.)
	Baccharis glutinosa Pers. (COMP—Micho.)
	Salvia sp. (LAB—Jal.)
	Melampodium divaricatum (Rich.) DC. (COMP—VC.)

[2] Determined by J. Karren.

Diplacaspis memnoniata (Lac.):	*Neltuma glandulosa* (Torr.) Br. & Rs. (MIMO—Son.)
Diplacaspis moestifica (Lac.):	*Larrea divaricata* Cav. (ZYGO—Son.)
Diplacaspis prosternalis (Schaeff.):	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—VC.)
Exema spp.:	*Ceanothus buxifolia* Willd. (RHAM—Dur.)
	Hymenoclea salsola Torr. & Gray (COMP—Son., Sin.)
	Viguiera dentata (Cav.) Spreng. (COMP—Micho., Ariz.)
	Brickellia vernicosa Rob. (COMP—Dur.)
	Viguiera pauciflora Brand.? (COMP—Micho.)
	Verbesina sphaerocephala A. Gray (COMP—Jal.)
	Wedelia filipes Hemsl. (COMP—Micho.)
	Eupatorium havanense H. B. K. (COMP—Dur.)
	Verbesina Greenmani Urb. (COMP—Jal.)
	Baccharis heterophylla H. B. K. (COMP—Jal.)
	Baccharis ramulosa (DC.) A. Gray (COMP—Nay.)
	Encelia halimifolia Cav. (COMP—Son.)
	Senegalia Greggii (A. Gray) Br. & Rs. (MIMO—Son.)
	Franseria ambrosioides Cav. (COMP—Son.)
Pseudochlamys megalostomoides Lac.:	*Sida cordifolia* L. (MALV—Oax.)
	Ipomoea pedicellaris Benth. (CONV—Mor.)

CLYTRINAE

An account of the biology of this subfamily is presented in my *Revision of the Clytrinae of North America north of the Isthmus of Panama* (Moldenke, 1970). This research project amply demonstrated that in nearly every instance upon ecdysis the males assemble in groups (often in excess of 100) on the young vegetative portions of the Mimosaceae (and occasionally the Fabaceae). They are soon joined by the later emerging females, who leave soon after coition has been completed. Mated females are most often observed singly on isolated dead twigs 1½–3 feet from the ground (usually on composites). In these sites oviposition takes place, the female hanging beneath the substrate with her first two pair of legs, the hind pair helping to form the egg-covering which is either attached to the stalk atop a silken thread or dropped to the ground. Adult food consists of small quantities of flowers, buds, and young leaves of legumes.

CHRYSOMELINAE

Calligrapha consputa (Stal):	*Sida carpinifolia* L. f. (MALV—Micho.)
Calligrapha felina Stal:	*Sida pyramidata* Cav. (MALV—Jal.)
Calligrapha labyrinthica Stal:	*Baccharis heterophylla* H. B. K. (COMP—Jal.)
Calligrapha multipustulata (Stal):	*Guazuma ulmifolia* Lam. (STERC—Jal.)
Calligrapha pantherina Stal:	*Verbesina sphaerocephala* A. Gray (COMP—Jal.)

Leptinotarsa decemlineata (Say):	*Solanum* sp. (SOL—Nay.)
	Abutilon americanum (L.) Sweet (MALV—Sin.)
	Solanum diversifolium Schlecht. (SOL—Micho.)
Leptinotarsa puncticollis Jac.:	*Verbesina virginica* L. (COMP—Jal.)
Leptinotarsa typographica Jac.:	*Verbesina serrata* Cav. (COMP—Nay.)
Leptinotarsa violascens (Stal):	*Cordia cylindrostachya* (Ruiz & Pav.) Roem. & Schult. (EHRET—Micho.)
Leptinotarsa sp.:	*Pithecellobium dulce* (Roxb.) Benth. (MIMO—Mor.)
Zygogramma arizonica Schffr.:	unident. composite (COMP—Ariz.)
Zygogramma exclamationis (Fabr.):	*Xanthium strumarium* L. (COMP—Ariz.)
Zygogramma malvae Stal:	*Sphaeralcea* sp. (MALV—Chih.)
Zygogramma opifera Stal:	unident. composite (COMP—Ariz.)
Zygogramma piceicollis Stal:	*Verbesina encelioides* (Cav.) Benth. & Hook. (COMP—D.F.)
	Croton morifolius Willd.? (EUPHORB—Oax.)
	Eupatorium lasium Rob. (COMP—Micho.)
	unident. composite (COMP—Chih.)
Zygogramma signatipennis (Stal):	*Viguiera dentata* (Cav.) Spreng. (COMP—Micho.)
	unident. composite (COMP—Chih.)

EUMOLPINAE

Chrysodina ornata Jac.:	*Baccharis glutinosa* Pers. (COMP—Micho.)
	Desmodium Lindheimeri Vail (FABA—Micho.)
Colaspis favosa Lefev.:	*Kallstroemia hirsutissima* Vail (ZYGO—Micho.)
Colaspis gemmigeri (Har.):	*Solanum diversifolium* Schlecht. (SOL—Nay.)
	Mimosa pigra L. (MIMO—Nay.)
Colaspis lebasi Lefev.:	*Prosopis* sp. (MIMO—Jal.)
	Pithecellobium dulce (Roxb.) Benth. (MIMO—Mor.)
	Vachellia Farnesiana (L.) Wight & Arn. (MIMO—Micho.)
Colaspis prasina Lefev.:	*Solanum Hernandezii* Sesse & Moc.? (SOL—Pueb.)
	Solanum diversifolium Schlecht. (SOL—Nay.)
	Solanum aculeatissimum Jacq. (SOL—Nay.)
	Verbesina Greenmani Urb. (COMP—Micho.)
Colaspis suturalis Lefev.:	*Adipera indecora* (H. B. K.) Br. & Rs. (CAESALP—Oax.)
Colaspis sp.:	*Pithecellobium dulce* (Roxb.) Benth. (MIMO—Mor.)
Coytiera fulvipes Jac.:	*Ipomoea stans* Cav. (CONV—Micho.)
Coytiera rugipennis Jac.:	*Ipomoea stans* Cav. (CONV—Micho.)
Eumolpus suranamensis (Fab.):	*Leonurus nepetaefolia* (L.) R. Br. (LAB—Jal.)

Euphrytus opacicollis Jac.:	*Poponax cymbispina* (Sprague & Riley) Br. & Rs. (MIMO—Jal.)
Fidia plagiata humeralis (Lefev.):	*Parthenocissus inserta* (Kerner) K. Fritsch (VIT—Ariz.)
Fidia spuria Lefev.:	*Encelia halimifolia* Cav. (COMP—Son.)
Glyptoscelis albicans Baly:	*Crotolaria mucronata* Desv. (FABA—Chps.)
Glyptoscelis prosopis Schffr.:	*Prosopis* sp. (MIMO—N.L.)
Metaxyonychia godmani Jac.:	*Verbesina sphaerocephala* A. Gray (COMP—Jal.)
	Verbesina Greenmani Urb. (COMP—Micho.)
Nodonota spp.:	*Pithecellobium dulce* (Roxb.) Benth. (MIMO—Mor.)
	Vachellia Farnesiana (L.) Wight & Arn. (MIMO—Micho.)
	Baccharis glutinosa Pers. (COMP—Micho.)
	Verbesina encelioides (Cav.) Benth. & Hook. (COMP—D.F.)
	Prosopis sp. (MIMO—Jal.)
	Pluchea odorata (L.) Cass. (COMP—Chps.)
Paria quadriguttata LeC.:	*Eupatorium havanense* H. B. K. (COMP—Dur.)
	Salvia sp. (LAB—Jal.)
Prionodera amasia (Marshall):	*Baccharis heterophylla* H. B. K. (COMP—Micho.)
Promecosoma dilatatum Lefev.:	*Verbesina sphaerocephala* A. Gray (COMP—Jal.)
Promecosoma dugesi Lefev.:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Nay.)
Promecosoma fervidum Lefev.:	*Parthenium hysterophorus* L. (COMP—Micho.)
	Eupatorium daleoides (DC.) Hemsl. (COMP—Micho.)
Promecosoma inflatum Lefev.:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Col.)
Promecosoma lugens Lefev.:	*Prosopis* sp. (MIMO—Guanj.)
Promecosoma sallaei Lefev.:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Col.)
	Eupatorium quadrangulare DC. (COMP—Jal.)
Rhadbophorus mexicanus Jac.:	*Eysenhardtia polystachya* (Ort.) Sarg. (FABA—VC.)
Typophorus chalceus Lefev.:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Chps.)
Typophorus cyanipennis Lefev.:	*Malvastrum coromandelianum* (L.) Garcke (MALV—Micho.)
Typophorus mexicanus Jac.:	*Parthenium hysterophorus* L. (COMP—Micho.)
	Ipomoea stans Cav. (CONV—Micho.)
Typophorus viridicyaneus (Crotch):	*Cordia ferruginea* (Lam.) Roem. & Schult. (EHRET—VC.)
	Pithecellobium dulce (Roxb.) Benth. (MIMO—Mor.)
Xanthonia tuberosa Jac.:	*Quercus purulbana* Trel. (FAG—Nay.)

HALTICINAE

Allochroma nigroplagiatum Jac.:	*Buddleia tomentella* Standl. (LOGAN—D.F.)
Blepharida marmorata Jac.:	*Bursera copallifera* (DC.) Bullock (BURS—Guerr.)
Disonycha brevilineata Jac.:	*Wedelia filipes* Hemsl. (COMP—Micho.)
Disonycha crenicollis Say:	*Bebbia juncea* (Benth.) Greene (COMP—Son.)
Disonycha spp.:	*Amaranthus Palmeri* S. Wats. (AMAR—Chih.)
	Ipomoea longifolia Benth. (CONV—Dur.)
	Jatropha macrorhiza Benth. (EUPHORB—Chih.)
	Xanthium sp. (COMP—Chih.)
Homophoeta simulans Jac.:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—VC.)
	Crotolaria mucronata Desv. (FABA—Chps.)
Oedionychis conspurcata Jac.:	*Buddleia sessiliflora* H. B. K. (LOGAN—Dur.)
	Eupatorium collinum DC. (COMP—Dur.)
Oedionychis panamensis Jac.:	*Quercus purulbana* Trel. (FAG—Nay.)
	Lantana Camara L. (VERB—Oax.)
Oedionychis spp.:	*Eupatorium daleoides* (DC.) Hemsl. (COMP—Micho.)
	Verbesina serrata Cav. (COMP—Nay.)
	Buddleia tomentella Standl. (LOGAN—D.F.)
	Salmea scandens (L.) DC.? (COMP—Chps.)
	Ipomoea pedicellaris Benth. (CONV—Chps.)
	Buddleia sessiliflora H. B. K. (LOGAN—Micho.)
	Buddleia sp. (LOGAN—Jal.)
Phrynocepha pulchella Baly:	*Prosopis* sp. (MIMO—Jal.)
Systena variabilis Jac.:	*Eupatorium quadrangulare* DC. (COMP—Jal.)
	Eupatorium collinum DC. (COMP—Dur.)
Systena spp.:	*Baccharis ramulosa* (DC.) A. Gray (COMP—Jal., Micho.)
	Amaranthus Palmeri S. Wats. (AMAR—D.F.)
	Buddleia sessiliflora H. B. K. (LOGAN—Micho.)
	Verbesina serrata Cav. (COMP—Nay.)

HISPINAE

Bradycoryna pumila Guer.:	*Waltheria americana* L. (STERC—Jal.)
	Abutilon americanum (L.) Sweet (MALV—Sin.)
	Sida cordifolia L. (MALV—Oax.)
Bradycoryna sp.:	*Abutilon americanum* (L.) Sweet (MALV—Sin.)
Chalepus acuticornis (Chap.):	*Aloysia gratissima* (Gill. & Hook.) Troncoso (VERB—Dur.)
Chalepus amicus Jac.:	*Philodendron anisostomum* Schott (ARA—Chps.)
Chalepus consanguineus Jac.:	*Verbesina Greenmani* Urb. (COMP—Jal.)
	Benthamantha mollis (H.B.K.) Alef. (FABA—Micho.)

Chalepus morio (Fabr.):	*Desmodium Lindheimeri* Vail (FABA—Micho.)
	Benthamantha mollis (H.B.K.) Alef. (FABA—Micho.)
Chalepus omogerus (Crotch):	*Benthamantha mollis* (H.B.K.) Alef. (FABA—Micho.)
Microrhopala rubrolineata Mann.:	*Brickellia vernicosa* Rob. (COMP—Zac.)
	Encelia halimifolia Cav. (COMP—Son.)
Octotoma scabripennis Guer.:	*Lantana glandulosissima* Hayek (VERB—Micho., Jal.)
	Eupatorium collinum DC. (COMP—Dur.)
	Quercus astriglans Warb. (FAG—Dur.)
Stenopodius sp.:	*Sphaeralcea* sp. (MALV—Zac.)
Uroplata sulcifrons Jac.:	*Melanthera nivea* Sm. (COMP—Chps.)

CASSIDINAE

Cassida pallidula Boh.:	*Solanum elaeagnifolium* Cav. (SOL—Zac.)
Charidotis yucatanensis Jac.:	*Verbesina sphaerocephala* Gray (COMP—Jal.)
Chelymorpha biannularis fasciata (Boh.):	*Mandevilla foliosa* (Muell. & Arg.) Hemsl. (APOCY—Micho.)
	Ipomoea murucoides R. & S. (CONV—Micho.)
Chelymorpha catenulata Boh.:	*Ipomoea mutabilis* Lind. (CONV—Nay.)
Chelymorpha juvenca Boh.:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Col.)
Chelymorpha vittata Jac.:	*Pithecellobium dulce* (Roxb.) Benth. (MIMO—Jal.)
Chirida signifera (Herbst.):	*Ipomoea ampullacea* Fern. (CONV—VC.)
	Ipomoea mutabilis Lindl. (CONV—Nay.)
Coptocycla emarginata Boh.:	*Ipomoea pedicellaris* Benth. (CONV—Nay.)
	Ipomoea murucoides R. & S. (CONV—Micho.)
	Vernonia sp. (COMP—Micho.)
	Pharbitis cathartica (Boiv.) Choisy (CONV—Micho.)
Coptocycla spp.:	*Ipomoea pedicellaris* Benth. (CONV—Nay.)
	Ipomoea mutabilis Lindl. (CONV—Nay.)
	Ipomoea murucoides R. & S. (CONV—Jal.)
	Ipomoea ampullacea Fern. (CONV—VC.)
	Ipomoea purga (Wender) Hayne (CONV—Chps.)
	Ipomoea stans Cav. (CONV—Zac.)
	Ipomoea hirsuta Jacq. (CONV—Ariz.)
Mesomphalia punicea Boh.:	*Ipomoea ampullacea* Fern. (CONV—VC.)
Physonota caudata Boh.:	*Diphysa spinosa* Rydb. (FABA—VC.)
Physonota disjuncta (Chevr.):	*Senecio salignus* DC. (COMP—Micho.)
	Baccharis heterophylla H. B. K. (COMP—Jal.)

CURCULIONIDAE

Apion spp.:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Dur.)

Apion spp.	*Platymiscum trifoliatum* Benth. (FABA—Nay.)
	Sphaeralcea sp. (MALV—Chih.)
	Myrmecodendron Hindsii (Benth.) Br. & Rs. (MIMO—Dur.)
	Robinia neomexicana A. Gray (FABA—Ariz.)
	Hymenoclea salsola Torr. & Gray (COMP—Son.)
	Brickellia vernicosa Rob. (COMP—Dur.)
	Neltuma glandulosa (Torr.) Br. & Rs. (MIMO—Son.)
	Acaciella texensis (Torr. & Gray) Br. & Rs. (MIMO—Dur.)
	Helenium Hoopesii A. Gray (COMP—Nay.)
	Baccharis ramulosa (DC.) A. Gray (COMP—Nay.)
Cactophagus sp.:	*Opuntia* sp. (CACT—Jal.)
Cautoderus nigrocinctus Champ.:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Micho.)
Coleocerus spp.:	*Poponax cymbispina* (Sprague & Riley) Br. & Rs. (MIMO—Micho.)
	Vachellia Farnesiana (L.) Wight & Arn. (MIMO—Micho.)
Conotrachelus sp.:	*Prosopis* sp. (MIMO—Jal.)
Cratosomus sp.:	*Quercus purulbana* Trel. (FAG—Nay.)
Curculio sp.:	*Ipomoea stans* Cav. (CONV—Micho.)
Epicaerus spp.:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—VC.)
	Baccharis ramulosa (DC.) A. Gray (COMP—Nay.)
	Ipomoea stans Cav. (CONV—Zac.)
	Colubrina glomerata (Benth.) Hemsl. (RHAM—VC.)
Exophthalmus sp.:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Chps.)
Geraeus sp.:	*Vachellia Farnesiana* (L.) Wight & Arn. (MIMO—Jal.)
Hadromeropsis sp.:	*Mimosopsis aculeaticarpa* (Ort.) Br. & Rs. (MIMO—D.F.)
Isodachrys crispum Howden:	*Quercus clivicola* f. *consanguinea* CH Muell. (FAG—Dur.)
Laemosaccus plagiatus (Fabr.):	*Quercus undata* Trel. (FAG—Dur.)
	Vachellia Farnesiana (L.) Wight & Arn. (MIMO—Ariz.)
	Ceanothus buxifolia Willd. (RHAM—Dur.)
Lixus sp.:	*Franseria ambrosioides* Cav. (COMP—Son.)
	Baccharis angustifolia Michx. (COMP—Sin.)
Minyomerus sp.:	*Senegalia Greggii* (A. Gray) Br. & Rs. (MIMO—Son.)
Pandeleteinus lucidillus Howden:	*Neltuma glandulosa* (Torr.) Br. & Rs. (MIMO—Son.)

Pandeleteius rotundicollis Fall:	*Quercus grisea* Liebm. (FAG—Dur.)
Pandeleteius spp.:	*Acacia cochliacantha* Humb. & Bonpl. (MIMO—VC.)
	Quercus purulbana Trel. (FAG—Dur.)
	Quercus grisea Liebm. (FAG—Dur.)
	Quercus aristata Hook. & Arn. (FAG—Dur.)
Rhodobaenus sp.:	*Eupatorium quadrangulare* DC. (COMP—Jal.)
	Verbesina Greenmani Urb. (COMP—Jal.)
	Melampodium divaricatum (Rich.) DC. (COMP—VC.)
Rhynchites spp.:	*Quercus purulbana* Trel. (FAG—Nay.)
	Quercus grisea Liebm. (FAG—Dur.)
	Quercus clivicola f. *consanguinea* CH Muell. (FAG—Dur.)
Tachygonus sp.:	*Robinia neomexicana* A. Gray (FABA—Ariz.)

PLANT FAMILY ABBREVIATIONS USED.—AMAR—Amaranthaceae; APOCY—Apocynaceae; ARA—Araceae; CACT—Cactaceae; CAESALP—Caesalpiniaceae; COMP—Compositae; CONV—Convolvulaceae; EHRET—Ehretiaceae; EUPHORB—Euphorbiaceae; FABA—Fabaceae; FAG—Fagaceae; LAB—Labiatae; LOGAN—Loganiaceae; MALV—Malvaceae; MIMO—Mimosaceae; ONAG—Onagraceae; PALM—Palmae; RHAM—Rhamnaceae; SALIC—Salicaceae; SOLAN—Solanaceae; STERC—Sterculiaceae; VERB—Verbenaceae; VIT—Vitaceae; ZYGO—Zygophyllaceae.

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THORNSTEINSON, A. J. 1960. Host selection in Phytophagous insects. An. Rev. Entomol., 5: 193–218.

BOOK NOTICE

GALL MIDGES OF ECONOMIC IMPORTANCE. VOL. VIII. GALL MIDGES—MISCELLANEOUS. By W. Nijveldt. Crosby Lockwood & Son Ltd., 26 Old Brompton Road, London, S.W. 7. 222 pp., frontispiece, 29 figs. 1969. $5.40.

This is the final volume in a series by the late H. F. Barnes, to whom this one is dedicated by W. Nijveldt of the Institute of Phytopathological Research, Wageningen. It includes "gall midges whose larvae are zoophagous and fungivorous, as well as those living on certain weeds," and is divided into two parts. Part I, pp. 19–135, includes discussions of the groups just mentioned; Part II is on the identification of gall midges, with a short essay on "The biological approach to the species problem" from notes left by Barnes. Finally, there are 13 pages each of Addenda to Vols. I–VII, and References, plus an excellent index of plants, prey, parasites, etc., and one of taxonomic and popular names.—HUGH B. LEECH, *California Academy of Sciences, San Francisco.*

New Neotropical Methiine Cerambycidae
(Coleoptera)

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Knowledge of the New World Methiini has increased with the availability of more material from the Neotropical areas. During the past six years attempts have been made to achieve a better understanding of the generic relationships within the tribe (Chemsak and Linsley, 1964a, 1964b, 1965, 1967, and Martins, Chemsak, and Linsley, 1966). The following new genera and species are described at this time because of their significance in broadening generic limits and also because of the mimetic relations.

Support through National Science Foundation Grant GB-4944X is gratefully acknowledged. We wish to thank the United States National Museum, American Museum of Natural History, and British Museum (Natural History) for making the material available and Celeste Green for preparing the illustrations.

Methicula Chemsak and Linsley, new genus

Form small, depressed. Head moderate sized, front short; eyes finely faceted, deeply emarginate, lower lobe large, upper lobes widely separated on vertex; genae short, subacute; mandibles small, arcuate; maxillary palpi longer than labial, apical segments slender; antennae short, stout, segments through seventh densely fringed all over with erect pubescence, scape cylindrical, unarmed, third segment equal in length to scape, fourth shorter than third, fifth equal to third, eleventh short, rounded. Pronotum broader than long, sides obtusely tuberculate; apex and base narrowly constricted; disk with prominent elevated tubercle at middle toward base; prosternum deeply excavated, prosternal process narrow, arcuate, coxal cavities wide open behind; mesosternal process rather broad, emarginate at apex, coxal cavities closed to epimeron. Elytra entire, explanate slightly behind middle; apices rounded. Legs with femora pedunculate; tarsi slender, first segment longer than two following together. Abdomen normally segmented.

Type species: *Methicula dimidiata* Chemsak and Linsley.

We have tentatively placed this genus into the Methiini on the basis of the head structure and conical front coxae. The short tufted antennal segments, shape of pronotum, and pedunculate femora are unlike other methiines but the specimen cannot be readily placed into any other tribe of Cerambycinae. A single species is presently known.

The Pan-Pacific Entomologist 47: 117–122. April 1971

Methicula dimidiata Chemsak and Linsley, new species
(Fig. 1)

FEMALE.—Form slightly expanded posteriorly; color black, elytra yellowish behind middle, the yellow margins extending back down margins then up toward suture in a W-shape. Head with front deeply impressed transversely; antennal tubercles prominent, not apically produced; eyes with upper lobes small, separated by more than diameter of antennal scape; antennae short, stout, segments from seventh densely clothed with long suberect hairs, segments eight to eleven short, densely pubescent. Pronotum deeply impressed near apex, shallowly at base; disk with four obtuse tubercles in addition to the median glabrous one; punctures indistinct, surface finely scabrous; pubescence fine, sparse; prosternum transversely rugose, subglabrous; prosternal process distinct, not extending beyond coxae; meso- and metasternum finely, sparsely punctate, more densely punctate at sides; mesosternal process lying below level of coxae. Scutellum small, rugose. Elytra over three times longer than basal width, sides expanding behind middle; basal punctures coarse, deep, confluent, rugose appearing, becoming finer and shallower toward apex; each elytron bicostate, median costae extending almost to apex; pubescence obsolete; apices rounded. Legs shining, sparsely pubescent and punctate. Abdomen shining, glabrous, very sparsely pubescent; apex of last sternite broadly rounded. Length, 11 mm.

Holotype female (British Museum, Natural History), from CHIGUINDA, 80.14. Although we have not definitely placed this locality, it appears to be in Peru near 75° longitude and between 5°–8° latitude. The fact that we have four species of lycid models from this area with identical data makes the description of *M. dimidiata* significant.

Haplidoeme punctata Chemsak and Linsley, new species

MALE.—Form slender, depressed; color testaceous, antennae, head, prothorax, and meso- and metasterna darker brown; pubescence dense, long, erect. Head broader than pronotum; antennal tubercles prominent, obtusely produced above; vertex coarsely, confluently punctate, tempora small, convergent; pubescence rather sparse, long, erect; eyes coarsely faceted, deeply emarginate, upper lobes small, widely separated above; antennae about as long as body, segments somewhat thickened, third slightly shorter than scape, fourth shorter than third, fifth equal to third, eleventh vaguely appendiculate, basal segments shining, others opaque, segments to fifth with few long, erect hairs. Pronotum broader than long, sides broadly rounded; apex narrowly constricted, base barely constricted; disk shining, coarsely, confluently punctate; pubescence sparse, long, bristling; stridulatory plate of mesonotum evenly convex; scutellum finely densely pubescent; prosternum coarsely, transversely punctate, pubescence moderate, erect; meso- and metasternum moderately densely punctate and pubescent. Elytra more than three times as long as broad; each elytron strongly costate; surface shining, coarsely, separately punctate at base, more finely toward apex; pubescence moderate, long, suberect; apices rounded. Legs slender, rather densely pubescent. Abdomen obscurely punctate, moderately densely pubescent; apex of last sternite very shallowly emarginate. Length, 10.5–12 mm.

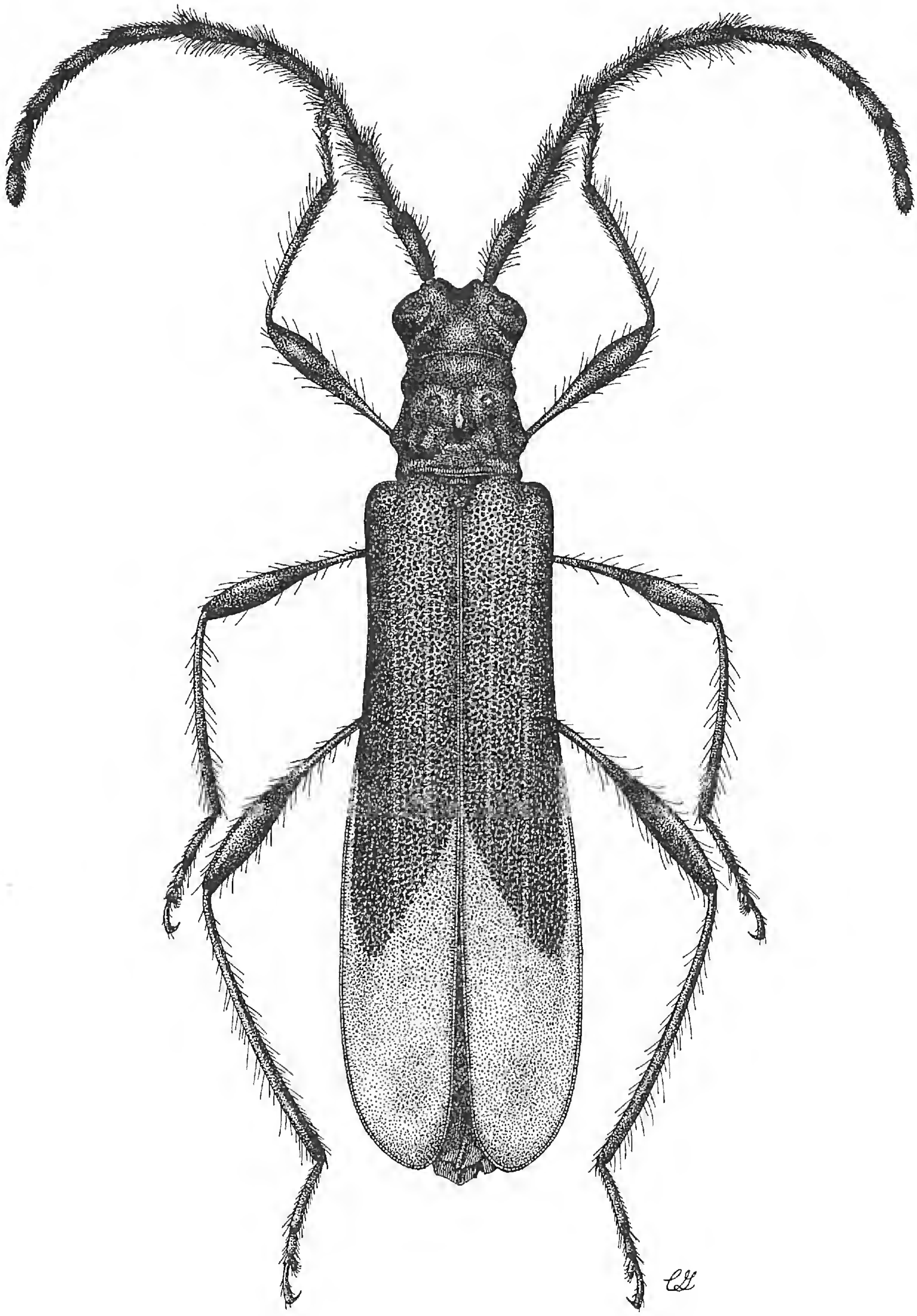

FIG. 1. *Methicula dimidiata* Chemsak and Linsley, ♀ holotype.

Holotype male (United States National Museum), and 2 male paratypes from 3 MILES E. ZIMAPAN, HIDALGO, MEXICO, 6,400 FT., 31 July–1 August, 1963 (Duckworth and Davis).

The coarse, dense punctation and rather dense, long, erect pubescence will readily separate this species from *H. schlingeri* from Riverside County, California.

Methia lycoides Chemsak and Linsley, new species

(Fig. 2)

MALE.—Form small; elytra entire, expanding apically; head mostly orange, prothorax orange except for darker bands extending back from behind eyes, and dark median longitudinal band, elytra orange, violaceous black behind middle, appendages and underside fuscus. Head slightly broader across eyes than pronotum; eyes divided, lobes connected by a line but no facets, upper lobes separated on vertex by more than diameter of antennal scape, very widely separated beneath; antennae slender, extending at least four segments beyond elytra, scape stout, unarmed, segments rather densely clothed with erect pubescence all over. Pronotum slightly broader than long, sides arcuate; disk finely scabrous, moderately densely clothed with short, golden, depressed pubescence, sides with longer erect hairs; mesonotum with stridulatory plate not grooved. Elytra more than three times longer than basal width, apices moderately flaring behind middle; each elytron strongly tricostate, two median costae joining at middle; punctures obsolete, surface minutely scabrous; pubescence short, subdepressed, golden on yellow surface and dark on dark surface. Legs short, front tibiae strongly angulate. Abdomen with apex of last sternite deeply notched. Length, 8.5 mm.

Holotype male (United States National Museum), from TAMPICO, MEXICO, 29-12 (E. A. Schwarz).

This is perhaps the most distinctive species of *Methia* known. Its lycid-like appearance in coloration and apically expanded elytra are quite striking.

Methia batesi Chemsak and Linsley, new species

Callia (?), Bates, 1885, Biologia Centrali-Americana, Coleoptera, 5: 425.

MALE.—Form elongate, slender, elytra entire; head except mouthparts, eyes, and bands at side orangish, pronotum with a longitudinal, orange band on each side of middle, elytra orange over a little more than basal half, apical portion with a bluish caste. Head as wide as pronotum; eyes completely divided, lobes connected by a line, upper lobes separated on vertex by a distance greater than diameter of antennal scape, very broadly separated beneath; antennae slender, extending about three segments beyond elytra, scape unarmed. Pronotum broader than long, sides subtuberculate; pubescence dense, depressed; stridulatory plate of mesonotum not grooved. Elytra over 3.5 times longer than broad; disk costate, punctures obsolete; pubescence dense, golden, suberect, dark on dark surface; anterior edge of dark stripe directed up from suture; apices rounded. Legs short, tibiae densely pubescent. Abdomen with apex of last sternite deeply notched. Length, 12 mm.

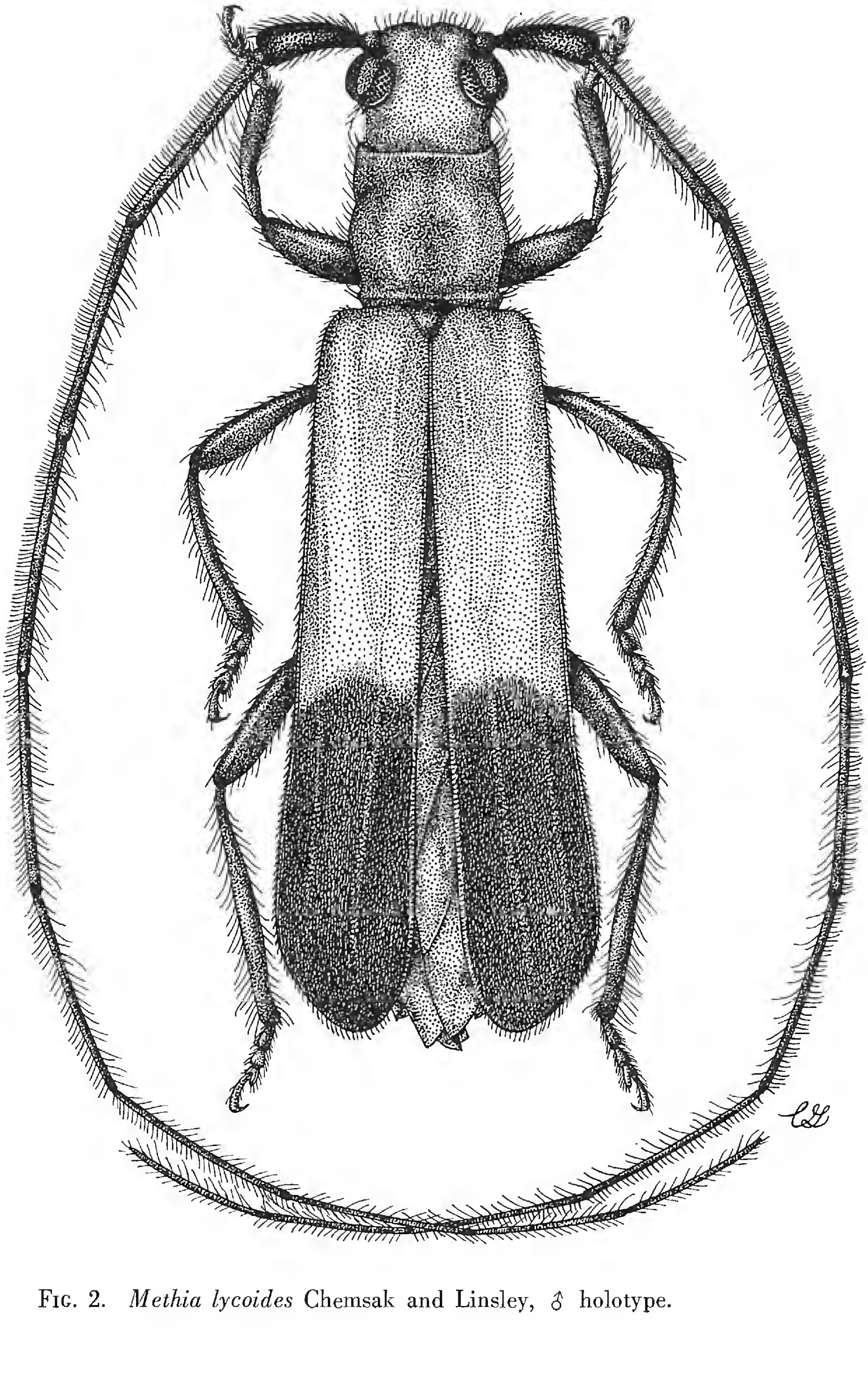

FIG. 2. *Methia lycoides* Chemsak and Linsley, ♂ holotype.

Holotype male (British Museum, Natural History), from MEXICO, Sallé Coll.

Although this specimen is in fairly poor condition, it can be definitely characterized as another lycid-like *Methia.* Because of its possible significance in future mimicry studies, we have described it at this time. The elongate elytra, dense pubescence, and the coloration will separate this species from other *Methia.*

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BOOK NOTICES

The following four facsimile printings of standard works have been issued by the Hafner Publishing Company, 31 East 10th Street, New York, N. Y. 10003.

INSECT MICROBIOLOGY. AN ACCOUNT OF THE MICROBES ASSOCIATED WITH INSECTS AND TICKS WITH SPECIAL REFERENCE TO THE BIOLOGIC RELATIONSHIPS INVOLVED. By Edward A. Steinhaus. xiv + 763 pp., 250 figs. Reprinted 1967. $15.00.

This is a facsimile of the second (1947) printing of the first edition, which was issued by Cornell University Press. The paper is whiter and most illustrations equally well reproduced in the 1967 printing.

PRINCIPLES OF INSECT PATHOLOGY. By Edward A. Steinhaus. xii + 757 pp., 219 figs. Reprinted 1967. $15.75.

The original was issued by the McGraw-Hill Book Company, Inc., in 1949.

FLEAS OF EASTERN UNITED STATES. By Irving Fox. viii + 191 pp., including 31 pls. Reprinted 1968. $7.00.

A facsimile of the 1940 edition published by the Iowa State College Press.

FLEAS OF WESTERN NORTH AMERICA: THEIR RELATION TO THE PUBLIC HEALTH. By Clarence Andresen Hubbard. Frontispiece, x + 533 pp., 3 un-numbered pls., 4 + 235 figs. Reprinted 1968. $12.50.

Reprinted from the 1947 edition published by the Iowa State College Press.
—HUGH B. LEECH, *California Academy of Sciences, San Francisco.*

Fluctuations of Populations of *Lygus hesperus* Knight in California Alfalfa Fields
(Hemiptera: Miridae)

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Fluctuation is an outstanding characteristic of populations of insects and an understanding of the nature of the fluctuation and the factors causing it is fundamental to the prediction of population growth and decline. For example, increases in populations on preferred host plants may be reflected by migrations of adults to less preferred hosts. Thus, *Lygus* spp. build up on alfalfa in the spring and migrate to cotton during the summer as the alfalfa is cut or becomes mature (Stern et al., 1967). As a result, population studies of lygus bugs have centered on alfalfa as the primary source of the infestation in cotton.

Recent investigations of *L. hesperus* Knight in Arizona alfalfa fields have remarked on a relatively uniform increase and decrease in the adult populations each year (Butler and Wardecker, 1970). It was therefore of interest to consider the populations of lygus bugs in California to derive a possible cause of the rate of change in both Arizona and California. Smith and Hagen (1966) studied populations of alfalfa aphids and other insects in 51 alfalfa fields distributed through several climatic districts of middle lowland California throughout the year and in many fields for several consecutive years. They assessed the local climate of each field in terms of relative humidity, temperature, and rainfall. These investigators made the data on lygus bugs and conditions available for the analytical study reported here.[1]

Methods and Materials.—The number of lygus bug adults per 100 net sweeps from the weekly samples of either 2, 5, 10, or 100 net sweeps was calculated from individual fields reported by Smith and Hagen (1966) and weekly totals were obtained for the San Joaquin Valley and for the Salinas Valley in 1957, 1958, and 1959. Then regression equations, $\hat{y} = a + bX$, where $\hat{y}$ is the logarithm of the number of lygus bugs per 100 net sweeps and X is the day of the year, were calculated for each valley and year. The equation used is the linear expression of the classical formula describing the curve of geometric increase of an infinitely expanding population. The rate of increase is

[1] Appreciation is expressed to Drs. R. F. Smith and K. S. Hagen for graciously providing all the data presented in this paper and for the permission to publish an analysis.

TABLE 1. Regression equations for the rate of increase of adult lygus bug populations in alfalfa in California.

Location	Year	No. Fields	Dates	n	Regression Equation[a]	r^2
San Joaquin	1957	11	17 April –9 July	11	–0.2745 + 0.0152X	.82
	1958	10	2 April –1 July	13	–2.2314 + 0.0265X	.81
	1959	9	10 March–8 July	18	–0.8310 + 0.0180X	.86
Salinas	1957	8	30 April –9 July	10	–0.1795 + 0.0152X	.76
	1958	6	10 April –1 July	11	–1.9066 + 0.0253X	.92
	1959	2	16 March–8 July	16	–0.7287 + 0.0192X	.74

[a] Regression equation $\hat{y} = a + bX$, where $\hat{y}$ is the logarithm of the number of adult lygus bugs per 100 sweeps and X is the date.

also equivalent to the term r_m "the innate capacity for increase" used by Andrewartha and Birch (1940:35) which "is the only statistic which adequately summarizes the physiological qualities of an animal which are related to its capacity for increasing."

Results and Discussion.—Regression equations for the rate of increase of adult lygus bugs in the San Joaquin and Salinas Valleys from April to July 1957 and 1958, and from March to July 1959 are shown in Table 1. The rates of increase or "b" in the two areas are very similar for each of the three years at both locations. The lowest rate occurred in 1957 and the highest in 1958. Also, the tests of the homogeneity of the regression coefficients indicated that the rate of increase in 1958 differed from that in 1957 and 1959, and that the rates in 1957 and 1959 were similar. These rates in 1957 and 1959 are also similar to the values (average "b" of 0.016) determined for other years in Arizona (Butler and Wardecker, 1970).

Since the rates of increase in the two areas were similar in 1957, 1958, and 1959, the results for each year were pooled. Then, a comparison was made between the pooled results in which the average rate of increase for 1957 + 1959 was compared with that for 1958. A significant difference between the slopes (or rates) was obtained ($F = 11.28$, 75 df, $P = > 0.99$).

Analyses of the average mean monthly temperatures showed that during March and April 1957 and 1959 temperatures were higher than those in 1958. May temperatures were higher in 1958 than in the other years. Since threshold temperatures for the development of different stages of *L. hesperus* are about 45° C (Butler and Wardecker, 1971), the average monthly temperature above this threshold was determined and regression equations were calculated for the monthly increase from

TABLE 2. Rate of increase and decrease of average monthly temperatures in Arizona and at two sites in California.

		Period of Increase March to July		Period of Decrease July to November	
Location	Year	b[a]	r^2	b[a]	r^2
Arizona					
Casa Grande	1967	0.0035	.95	–0.0032	.88
	1968	0.0038	.97	–0.0034	.88
California					
Salinas Valley	1957	0.0032	.97	–0.0041	.75
	1958	0.0056	.85	–0.0029	.64
	1959	0.0037	.96	–0.0043	.74
San Joaquin Valley	1957	0.0048	.94	–0.0053	.80
	1958	0.0073	.84	–0.0042	.72
	1959	0.0037	.96	–0.0045	.78

[a] From the regression equation $\hat{y} = a + bX$, where $\hat{y}$ is the logarithm of the mean monthly temperature minus 45°F, and X is the date.

March to July (Table 2). The rates of increase in temperatures in 1957 and in 1959 were similar in both areas and tests of the homogeneity of regression of those slopes showed that they followed a similar pattern to those observed for the increase of lygus bugs. Also, the pooled values for 1957 and 1959 were significantly different from those for 1958; therefore, the temperature increase was different during the 1958 season. The increase in temperature and in population of lygus bugs thus had a correlation coefficient of 0.881 (6 df, $P = > 0.99$), indication of an association between the increase in number of lygus bugs and the increase in the average monthly temperature.

One of the unique characteristics of the population of lygus bugs in Arizona is the rate of increase in the spring being so similar to the rate of decrease in the fall. No such uniformity was observed in California. Again, an explanation can be found in the temperatures. The average monthly rate of increase in temperatures in the spring in Arizona is very uniform and the decrease in the fall is very similar. In California, where hot weather often occurs in August and September, the rate of decrease differs and shows less conformity to a linear decline. Reproductive diapause (Beards and Strong, 1966) also affects the numbers present in the fall.

Conclusions.—The average rates of increase in the number of adult *L. hesperus* in alfalfa in two areas of California in 1957 and 1959 were similar to the average yearly rate of increase observed in Arizona. However, in 1958, March and April were relatively cool, while May temperatures were high. This caused a marked acceleration in the rate of increase. Although uniformity in the buildup of lygus bugs is being stressed in current studies, the number in a given population is in a state of oscillation.

In Arizona, increases and decreases in the average monthly temperature during the spring and fall are relatively uniform which causes a corresponding uniform fluctuation in the population of adult lygus bugs. Although there are numerous factors affecting the fluctuation in population of lygus bugs, heat input and temperature extremes play a dominant role.

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BOOK REVIEW

An English-Classical Dictionary for the Use of Taxonomists. Compiled by Robert S. Woods. Pomona College, Claremont, California 91711. xiv + 331 pp. 1966. $5.50.

This is the perfect companion to the scholarly Roland W. Brown's *Composition of scientific words.* It is a listing of "all words found in unabridged classical Greek and Latin lexicons which could conceivably be used in scientific nomenclature, including those which would be applicable only in a metaphorical sense." Because the alphabetized words are in English, in boldface capitals, it is easy to use, and full of suggestions for the student wanting to choose a name for a new taxon. After each term the Greek and Latin words are given; at this point one refers to Brown's book or to a dictionary for restricted meanings and details. Every page contains a number of words not in Brown, or found there only by patient searching. Mr. Woods' book deserves much wider advertising than it has had.—Hugh B. Leech, *California Academy of Sciences, San Francisco.*

Psocoptera from Sleeping Nests of the Dusky-footed Wood Rat in Southern California[1]

(Psocoptera: Atropidae, Psoquillidae, Liposcelidae)

EDWARD L. MOCKFORD
Illinois State University, Normal, Illinois 61761

A small collection of psocids from sleeping nests of the dusky-footed wood rat, *Neotoma fuscipes* Howell, in San Diego County, California, was sent to me by Mr. Tom Ashley of El Cajon, California. The material includes 21 specimens of four species, three of which are new to science and are here described. One of the new species is also represented in material received from Mr. R. F. Wilkey of the California Department of Agriculture, Sacramento. These records are also included.

Two of the new species belong to the genus *Liposcelis*, a group still little studied, though well represented, in North America. Badonnel has developed a classification of this genus in a series of papers (1962, 1963, 1967, 1969), which I follow in this work.

The other new species is in the genus *Rhyopsocus*, and is a brachypterous species very similar to *R. squamosus* Mockford and Gurney (1956). Comparison requires a redescription of the latter species, the female of which has not previously been described and the male not in sufficient detail.

Details of the collecting data and occurrence of the species in each nest are presented in the text. *Lepinotus reticulatus* Enderlein, a species common in the arid regions of southwestern United States, is the species most frequently encountered in the rat nests. Only one species, *Rhyopsocus micropterus* Mockford, is represented by both sexes. This may be a question of sampling accident in case of both *Liposcelis* species, but *Lepinotus reticulatus* is parthenogenetic in North America.

It is of interest to note that two of the new species, *Rhyopsocus micropterus* Mockford and *Liposcelis triocellatus* Mockford, have greatly reduced compound eyes. This fact suggests the possibility that these species may be closely associated with rodent nests. The association is certainly not obligatory in the case of *Liposcelis triocellatus*, two records of which are from samples of ground litter and soil.

Several papers have documented the association of psocids with warm-blooded vertebrates. Pearman (1960) recorded eight species of psocids

[1] Some materials used in this study were provided by a National Science Foundation grant, NSF GB-7729, to Illinois State University.

collected on rats in Tanzania and one from St. Helena. The rat species involved were *Rattus rattus* (Linnaeus), *R. rattus alexandrinus* (Geoffroy Saint-Hilaire), and *Mastomys natalensis* (Smith). It should be noted that all but one of the species of psocids reported by Pearman are known from habitats not associated with rats. Badonnel (1969) listed two species of psocids, *Liposcelis entomophilus* Enderlein and *L. bostrychophilus* Badonnel, from the fur of mammals in Angola. Seven species of mammals were involved, five of them rodents, one an insectivore, and one a fissiped. Gurney (1950) cited records of psocids infesting the fur of chinchillas, puppies, and human hair. Mockford (1967) recorded psocids from plumage of five species of birds.

Records of psocids in the nests of birds have been cited by Hicks, Rapp, and Wlodarczyk (literature references in Mockford, 1967). Wlodarczyk and Martini (1969) have studied quantitatively the occurrence of psocids in bird nests in the Lodz Uplands of Poland.

Four species of psocids (three of *Liposcelis*) were recorded from a nest of a tree mouse, *Dendromus mysticallis ansorgei* Thomas and Wroughton, and one (also a *Liposcelis*) from the nest of a lemuroid primate, *Galago demidovi phasma* Cabrera and Ruxton, in Angola by Badonnel (1969). Psocids are probably much more common in the nests both of birds and mammals than the scanty literature records suggest.

Measurements for the new species are presented in Tables 1 and 2. Abbreviations used in connection with the measurements are explained as follows:

Post. tib. = posterior tibia.
Post. tars. t_1, etc. = first posterior tarsomere, etc.
Ant. f_1, etc. = first flagellar segment, etc.
Ant.-Post. eye diam. = antero-posterior eye diameter.
IO/D = smallest distance between compound eyes divided by greatest antero-posterior diameter of compound eye in dorsal view.
PO = transverse diameter of compound eye in dorsal view divided by greatest antero-posterior diameter of eye in same view.
Mx. plp. seg. 4 = distal segment of maxillary palpus.
Post. tr. = posterior trochanter (measured with femur in *Liposcelis*).
S_I = the longest seta of the lateral margin of the pronotum.
S_{II} = the longest antero-lateral marginal seta of the mesonotum.
Md_{IX} = the longest lateral seta of the ninth abdominal tergum.
Se = the longest seta of the epiproct.

Photomicrographs were made by Dr. David Weber of the Department of Biological Sciences, Illinois State University, using a Zeiss Photomicroscope II. For the sculpture of the cuticle of the *Liposcelis* species, phase-contrast microscopy, a 40× oil immersion lens, and high contrast film were used. Specimens were prepared for photography of the cuticle by clearing in hot 8% KOH solution, staining in a saturated solution of light green in 95% ethyl alcohol, and mounting in euparal.

Family ATROPIDAE

LEPINOTUS RETICULATUS Enderlein

This species is represented by eleven adult females in three nests. It has an extremely wide range (all continents) and has been captured on the plumage of living birds (Mockford, 1967).

RECORDS.—San Diego County, California, T. Ashley collector: Cuyamaca Reservoir, 15 April 1968, nest No. 0-12F7-6, 2 ♀; 5 miles south of Lakeside, 16 April 1968, nest No. 0-12B9-14, 3 ♀; Dulzura, 22 April 1968, nest No. 0-12W12-15, 6 ♀.

Family PSOQUILLIDAE

Rhyopsocus micropterus Mockford, new species

DIAGNOSIS.—Brachypterous. Differing from the other known brachypterous species, *R. squamosus* Mockford and Gurney, primarily in following features:

1) Compound eye size and number of facets:—much smaller eye with fewer facets in this species; 2) Distal segment of maxillary palpus:—decidedly clavate in *R. squamosus*, much less so in this species; also, lateral sensilla of this segment differing (Fig. 4 vs. Fig. 9); 3) Shape of distal end of hypandrium, it being slightly bilobed in *R. squamosus* (Fig. 10) and rounded in this species (Fig. 7); 4) Shape of tips of external parameres (= porifers), these being bent in *R. squamosus* (Fig. 11) and curved in this species (Fig. 14); 5) Sclerite of orifice of spermathecal duct, it being heavier in *R. squamosus* than in this species (Fig. 13 vs. Fig. 15); 6) Shape of accessory bodies of spermatheca,[2] the sides being approximately parallel in *R. squamosus* and one side being indented, producing a bean-shaped structure in this species.

MALE AND FEMALE.—*Measurements.*—(Table 1). *Morphology.*—Forewings extending to just short of half length of abdomen (♂), just beyond one-third length of abdomen (♀). Hindwings about one-third length of forewings. Epicranial suture present; frontal sutures absent (♀), present but faint in ♂. Ocelli absent, their places marked by three minute brown spots in cuticle anterior to epicranial

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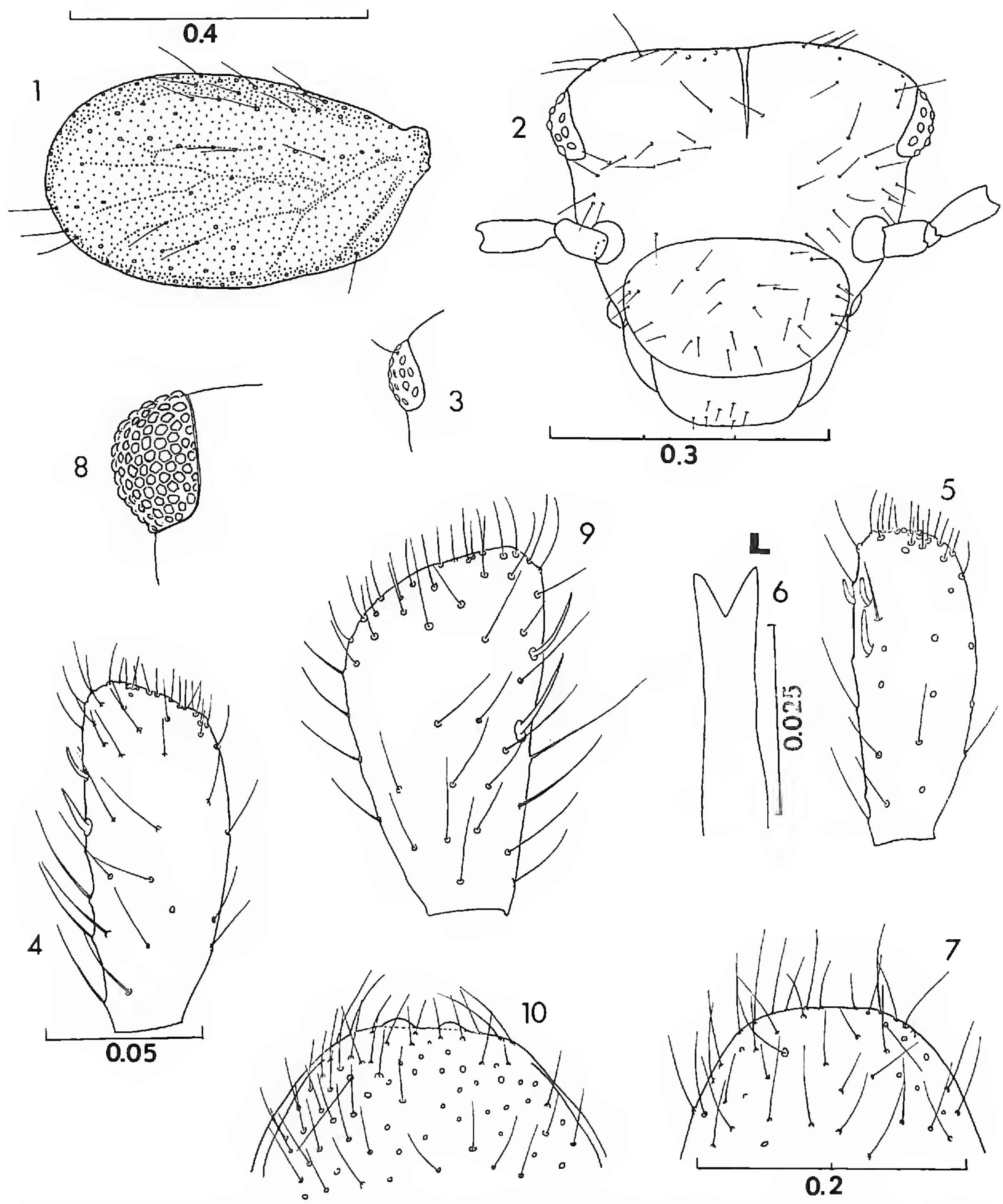
[2] Term coined by Pearman (1931). Badonnel (1949) suggests the possibility that they may be homologs of the spermathecal maculae of Atropidae. Such a homology seems likely in view of presence of inward-directed double spines on the pores of these bodies in *R. micropterus* and *R. squamosus*, similar to the spines of the spermathecal maculae of *Lepinotus inquillinus* Heyden (personal observation).

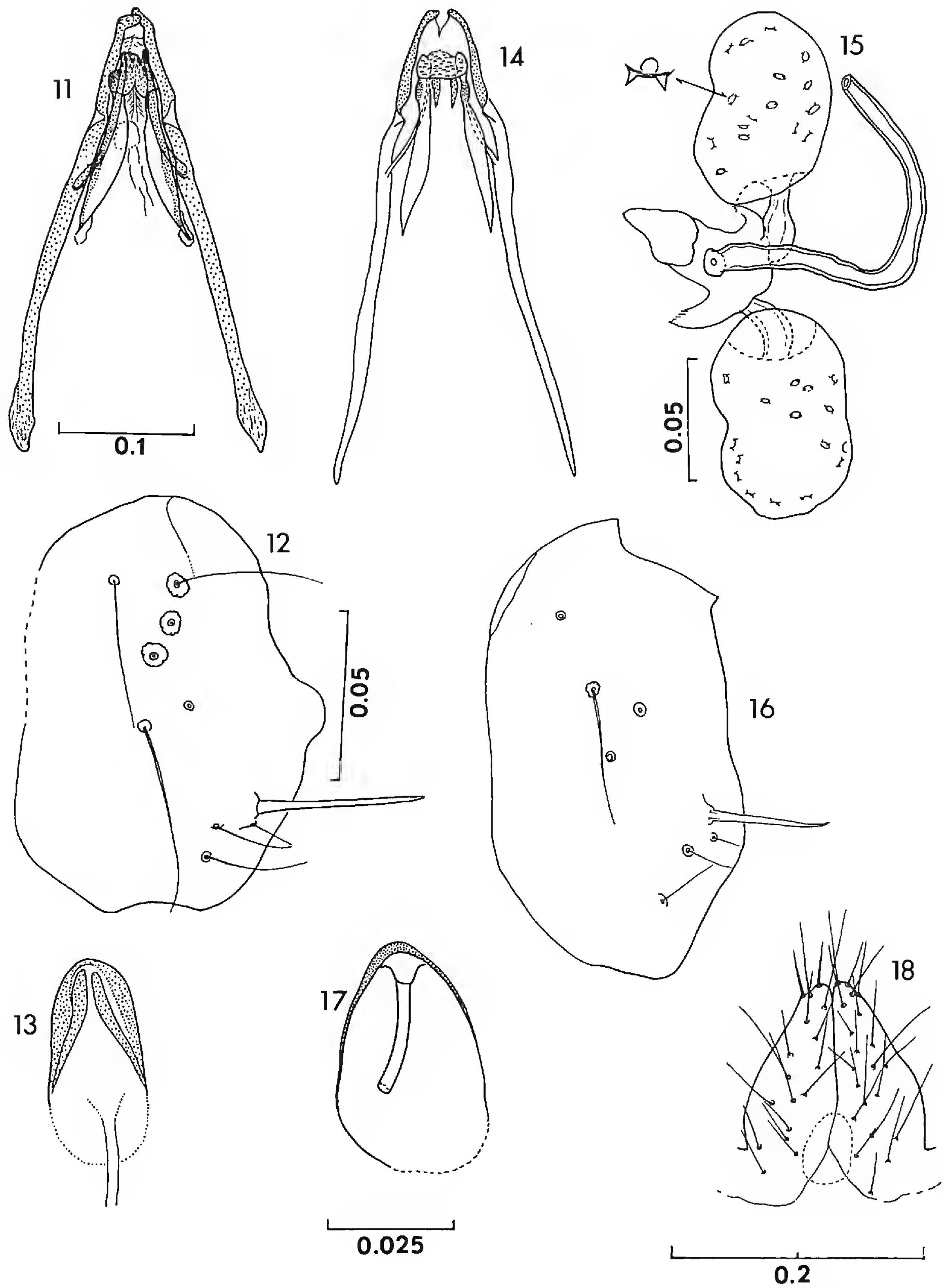


FIGS. 1–10. FIGS. 1–7, *Rhyopsocus micropterus* Mockford, n. sp.: FIG. 1. ♀, forewing; FIG. 2. ♀, head in anterior view; FIG. 3. ♂, compound eye; FIG. 4. ♀, distal segment of maxillary palpus; FIG. 5. ♂, distal segment of maxillary palpus; FIG. 6. lacinial tip (L indicates lateral tyne); FIG. 7. ♂, hypandrium. FIGS. 8–10, *Rhyopsocus squamosus* Mockford and Gurney: FIG. 8. ♀, compound eye; FIG. 9. ♀, distal segment of maxillary palpus; FIG. 10. ♂, hypandrium. Scale of Fig. 2 also applies to Figs. 3 and 8; scale of Fig. 4 also applies to Figs. 5 and 9; scale of Fig. 7 also applies to Fig. 10. Scales are in mm.

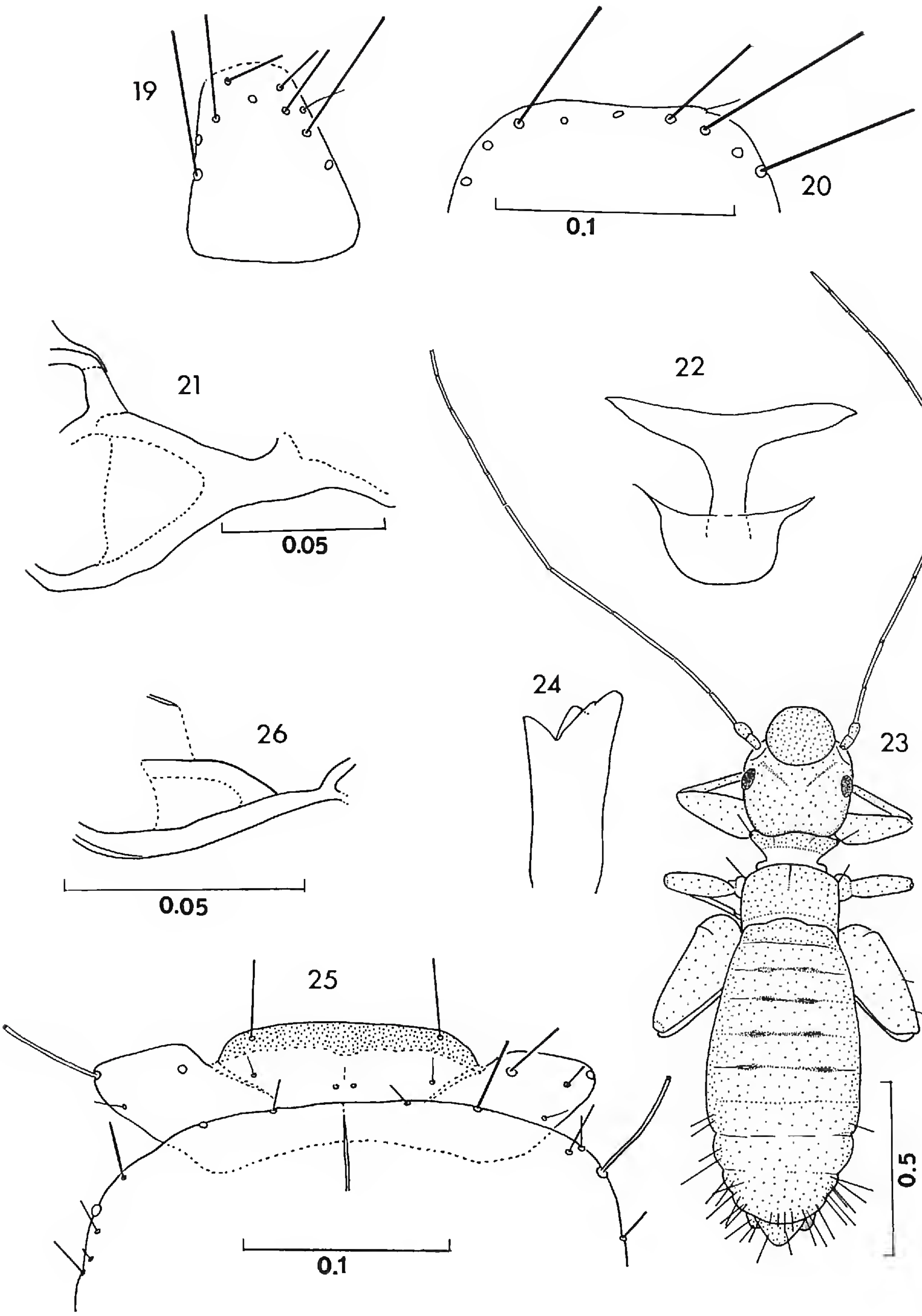
suture. Distal segment of maxillary palpus slightly clavate. Pronotum beset with transverse row of long, backward-directed curved setae. Mesonotum roughly triangular with base anterior; showing no trace of divisions into notal lobes. Metanotum with scutellum distinct. *Color* (in alcohol; sexes same).—Compound eyes

TABLE 1. Measurements (in mm.) of specimens of *Rhyopsocus squamosus* Mockford and Gurney and *R. micropterus* Mockford.

	Forewing length	Post. tib. length	Post. tars. t_1 length	Post. tars. t_2 length	Post. tars. t_3 length	Ant. f_1 length	Ant. f_2 length	Ant. f_3 length	Ocular Interval	Ant.-Post. Eye Diam.	IO /D	PO
						R. squamosus						
♂	0.47	0.44	0.18	0.06	0.06	0.07	0.05	0.06	0.27	0.15	1.79	0.67
♀	0.63	0.48	0.19	0.05	0.05	0.07	0.04	0.07	0.31	0.16	1.96	0.68
♀	0.51	0.44	0.17	0.06	0.05	0.07	0.04	0.06	0.29	0.16	1.88	0.60
						R. micropterus						
♂	0.61	0.46	0.18	0.04	0.05	0.07	0.04	0.05	0.31	0.08	3.85	—
♀	0.52	0.44	0.19	0.05	0.05	0.07	0.04	0.06	0.33	0.08	4.08	—



FIGS. 11–18. FIGS. 11–13, *Rhyopsocus squamosus* Mockford and Gurney: FIG. 11. ♂, phallosome; FIG. 12. ♂, paraproct; FIG. 13. ♀, sclerite of spermathecal orifice. FIGS. 14–18, *Rhyopsocus micropterus* Mockford, n. sp.: FIG. 14. ♂, phallosome; FIG. 15. ♀, spermathecal duct and accessory bodies; FIG. 16. ♂, paraproct; FIG. 17. ♀, sclerite of spermathecal orifice; FIG. 18. ♀, gonapophyses. Scale of Fig. 11 also applies to Fig. 14; scale of Fig. 12 also applies to Fig. 16; scale of Fig. 17 also applies to Fig. 13. Scales are in mm.



FIGS. 19–26. FIGS. 19–25, *Liposcelis villosus* Mockford, n. sp., ♀: FIG. 19. prosternum; FIG. 20. chaetotaxy of mesosternum; FIG. 21. stem of gonapophyses; FIG. 22. T-shaped sclerite; FIG. 23. habitus, dorsal view; FIG. 24. lacinial tip; FIG. 25. chaetotaxy of pronotum and anterior edge of mesonotum. FIG. 26, *Liposcelis triocellatus* Mockford, n. sp., ♀, stem of gonapophyses. Scale of Fig. 20 also applies to Fig. 19; scale of Fig. 21 also applies to Fig. 22; scale of Fig. 26 also applies to Fig. 24. Scales are in mm.

black. Head, thorax, and forewings pale tawny-brown. Legs and antennae somewhat paler. Abdomen with colorless cuticle, the internal structures showing through, producing a yellowish-white appearance.

Holotype male, and allotype, 5 MILES SOUTH OF LAKESIDE, SAN DIEGO COUNTY, CALIFORNIA, 16 April 1968, in nest of *Neotoma fuscipes* (nest No. 0-12B9-14), collected by T. Ashley. Types are in my collection.

RHYOPSOCUS SQUAMOSUS Mockford & Gurney

MALE.—Hypandrium (Fig. 10) bearing a pair of lobes of low relief on its distal margin. Phallosome (Fig. 11): lateral struts (parameres of authors, paraphallia of Pearman, 1961) somewhat widened near their bases; the external (pore-bearing) distal branches of the struts (external parameres of authors, porifers of Pearman, 1961) bent inward near their apices. Paraproct (Fig. 16) with two or three trichobothria with distinct basal florets.

FEMALE.—*Measurements.*—(Table 2). *Morphology.*—Brachypterous; wings relatively slightly shorter than in male, the forewings reaching from just beyond one-third to just short of half length of abdomen. Epicranial and frontal sutures present, the latter faintly developed. Ocelli small but visible on cleared head. Terminal segment of maxillary palpus clavate (Fig. 9) with 2 lateral sensilla in form of sensory hairs, thicker and with larger follicles than surrounding hairs. Compound eyes as in male, large and with many facets (Fig. 8). Gonapophyses developed as in *R. micropterus.* Accessory bodies of spermatheca (Fig. 39) lacking lateral indentations. Sclerite of spermathecal orifice (Fig. 13) decidedly thickened at apex. *Color* (in alcohol).—Essentially as for male; both specimens showing faint purple subcuticular annulations on all preclunial abdominal segments.

MATERIAL.—Bentsen Rio Grande Valley State Park, Hidalgo County, Texas, 28 January 1958, 1 ♂, 3 ♀, E. L. Mockford collector.

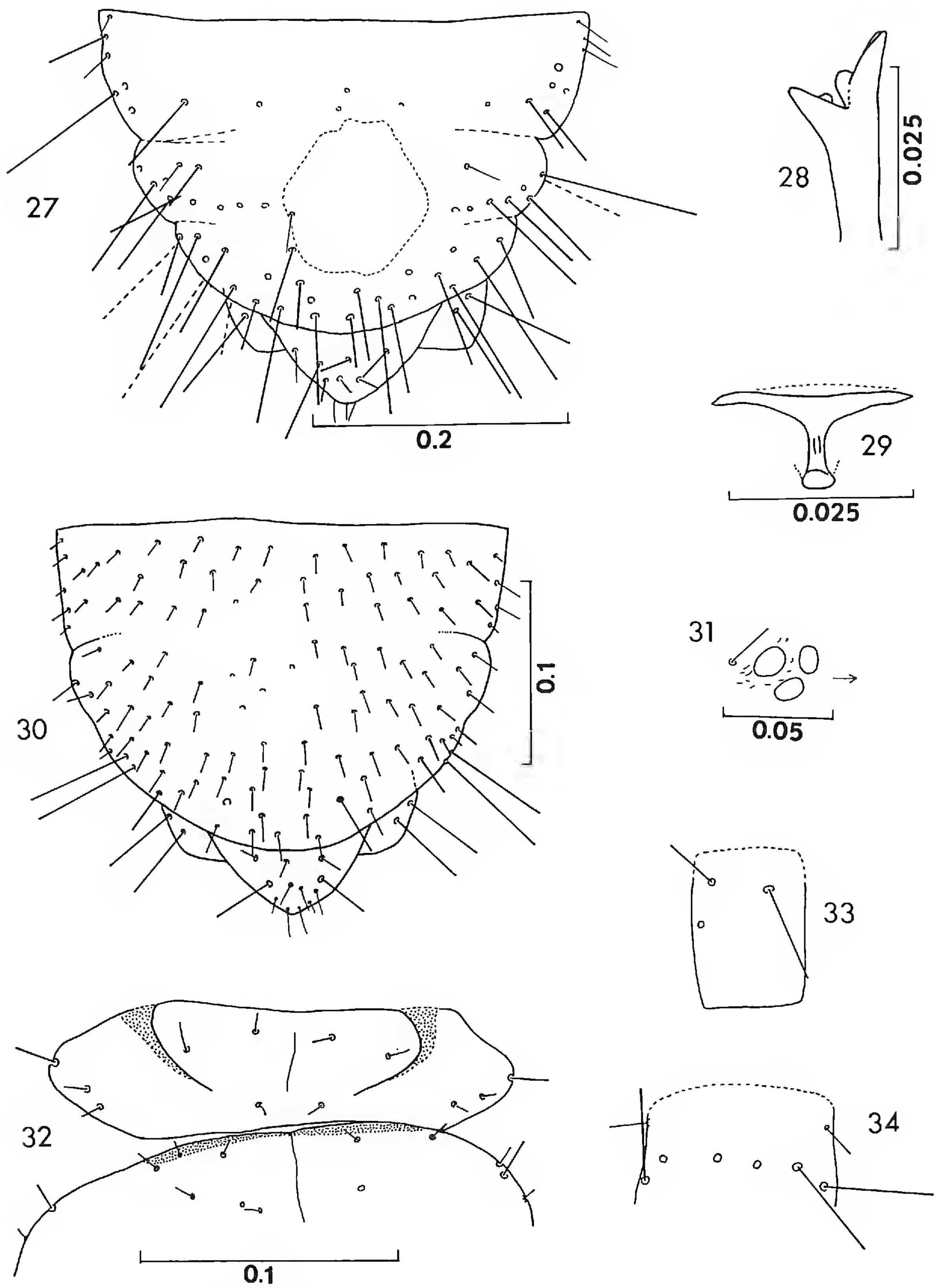
Family LIPOSCELIDAE

Liposcelis villosus Mockford, new species

DIAGNOSIS.—Species of Section I, Group A, subgroup Ab of Badonnel (1962, 1963, 1967), close to *L. castrii* Badonnel, *L. nasus* Sommerman, the complex *L. discalis–reticulatus–laparvensis*, Badonnel, *L. hirsutus* Badonnel, *L. distinctus* Badonnel, and *L. puber* Badonnel. Differing from *L. castrii* and *L. nasus* in details of coloration, being apparently darker than both, and in possession of larger number of setae on prosternum. Differing from the complex *L. discalis–reticulatus–laparvensis*: from all by absence of fine reticulate pattern on abdominal intersegmental membranes; from each species by details of coloration (this species without dark mark along anterior margins of abdominal segments 7 and 8). Differing from *L. hirsutus* by lack of truncated setae on abdominal terga 3–7. Differing from *L. puber* in details of coloration and from *L. distinctus* in sculpture of vertex.

TABLE 2. Measurements (in mm.) of specimens of *Liposcelis triocellatus* Mockford and *L. villosus* Mockford. Figures represent lengths of structures except where otherwise stated.

	Mx. plp. Seg. 4	Greatest Head Width	Ant. f_1	Ant. f_2	Ant. f_3	Post. Tr. + Femur	Post. Femur Width	Post. Tib.	Post. Tars. t_1	Post. Tars. t_2	Post. Tars. t_3	Setae SI	Setae SII	Setae Mdɪx	Setae Se
							L. villosus								
♀	0.114	0.30	0.109	0.139	0.187	0.37	0.192	0.28	0.129	0.043	0.054	0.059	0.062	—	—
							L. triocellatus (San Diego County, California)								
♀	0.075	0.24	0.048	0.054	0.051	0.23	0.131	0.18	0.071	0.032	0.037	0.019	0.019	0.061	0.048
♀	0.080	0.24	0.049	0.060	0.065	0.20	0.131	0.19	0.075	0.031	0.043	0.023	—	—	0.048
							L. triocellatus (Los Angeles County, California)								
♀	0.077	0.24	—	—	—	0.22	0.126	0.18	0.073	0.035	0.043	0.032	0.030	0.055	0.049
♀	0.075	0.24	—	—	—	0.23	0.129	0.18	0.075	0.034	0.041	0.033	0.029	0.050	0.048
							L. triocellatus (Kern County, California)								
♀	0.083	0.26	—	—	—	0.25	0.150	0.20	0.073	0.031	—	0.025	0.017	0.058	0.046
♀	0.085	0.25	—	—	—	0.24	0.141	0.19	0.076	0.039	0.045	0.023	0.016	0.061	0.051



FIGS. 27–34. FIG. 27, *Liposcelis villosus* Mockford, n. sp., ♀, chaetotaxy of abdominal terga 8–11. FIGS. 28–34, *Liposcelis triocellatus* Mockford, n. sp., ♀: FIG. 28. lacinial tip; FIG. 29. T-shaped sclerite; FIG. 30. chaetotaxy of abdominal terga 8–11; FIG. 31. compound eye (arrow indicates anterior direction); FIG. 32. chaetotaxy of pronotum and anterior margin of mesonotum; FIG. 33. prosternum; FIG. 34. chaetotaxy of mesosternum. Scale of Fig. 32 also applies to Figs. 33 and 34. Scales are in mm.

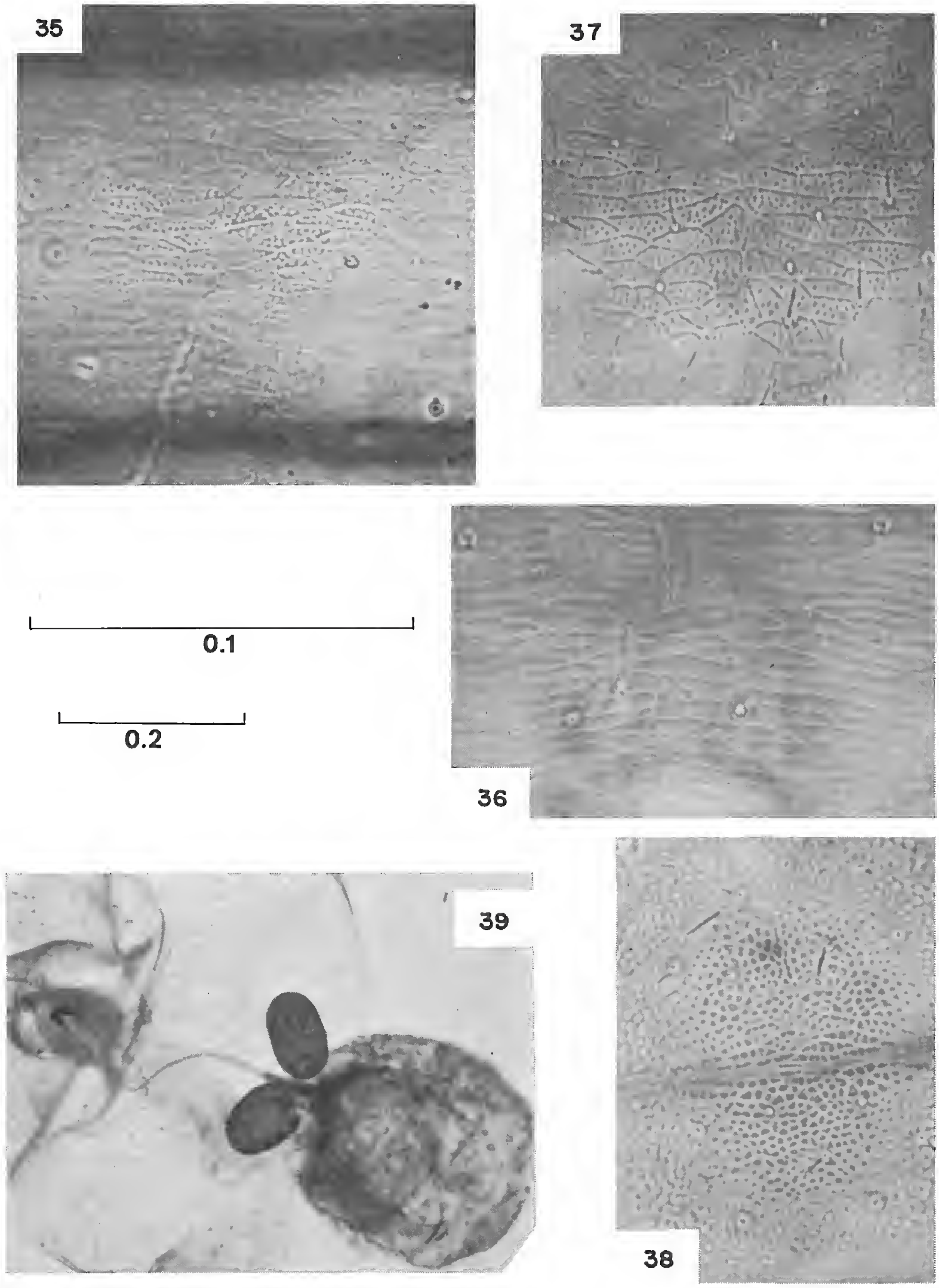
FEMALE.—*Measurements.*—(Table 2). *Morphology.*—Median suture of vertex absent. Thoracic parapsidal sutures not visible. Lacinial tip (Fig. 24). First abdominal tergum with a single sclerotized area. Common trunk of gonapophyses (Fig. 21), rather narrow basally. T-shaped sclerite of subgenital plate (Fig. 22) with expanded area around base of stem. *Sculpture.*— vertex (Fig. 36) with small, slender, transversely oriented arcoles separated by depressed lines and bearing exceedingly minute granulations visible with phase-contrast microscopy. Abdominal terga: first tergum with very distinct transverse clear lines separating narrow areoles bearing finc granulations. Remaining terga (Fig. 35 of 5th tergum) bearing broader areoles covered with much larger granules, each granule clear in its center. *Chaetotaxy.*—hairs of vertex sparse, long (about 24 μ), generally shorter than distances between them, but near epistomal suture distances less than hair lengths. Prothorax with S_I long, one other long seta along anterior margin of each lateral lobe, and two long setae along anterior margin of median lobe near its lateral edges; a few scattered small setae more posteriorly. Prosternum bearing 10 setae arranged in a U-shaped curve. Synthorax (Figs. 20, 25) with S_{II} about same length as S_I, two other long setae along its anterior margin, and several shorter setae scattered over its dorsal surface; mesosternal row of 9 long setae. Setae of abdominal terga sparse, very variable in length; first tergum with single transverse row of setae; terga 2–7 each with a transverse row and several scattered setae anterior to this. Setae of abdominal terga 8–10 (Fig. 27). *Color* (in alcohol). —Compound eyes black. Head reddish-brown, decidedly darker on clypeus than on vertex and frons. Subcutaneous red pigment granules scattered on vertex and frons, concentrated somewhat along epicranial and frontal sutures, and, more strongly around antennal sutures. Thorax, abdomen, and legs medium brown with slight reddish hue. Abdomen dorsally with narrow purple band bordering each intersegmental membrane between abdominal segments 1–2, 2–3, 3–4, 4–5, and 5–6, the first two rather faint. A narrow, colorless posterior membranous area present on abdominal segments 6 and 7.

Holotype female, CUYAMACA RESERVOIR, SAN DIEGO COUNTY, CALIFORNIA, 15 April 1968, in nest of *Neotoma fuscipes* (nest No. 0-12F7-6), T. Ashley collector. One ♀ paratype, same data as type. Types are in my collection.

Liposcelis triocellatus Mockford, new species

DIAGNOSIS.—A species of Section I, by absence of posterior membranous regions on abdominal terga 3 and 4, and of Group B by having the humeral seta of only medium length and lacking an anterior transverse row of setae on each lateral lobe of pronotum. Differing from all other members of this group by possession of only 3 ocelloids in each compound eye.

FEMALE.—*Measurements.*—(Table 2). *Morphology.*—Median suture of vertex recognizable for short distance as an irregular break in sculpture. Thoracic parapsidal sutures recognizable only as bands of tuberculate sculpture bordered by empty areoles. Lacinial tip (Fig. 28) with denticles strongly diverging. First abdominal tergum divided into three sclerotized areas: one anterior and two pos-



FIGS. 35–39. FIGS. 35 and 36, *Liposcelis villosus* Mockford, n. sp., ♀: FIG. 35. fifth abdominal tergum showing sculpture of integument; FIG. 36. central region of vertex showing sculpture of integument. FIGS. 37 and 38. *Liposcelis triocellatus* Mockford, n. sp., ♀; FIG. 37. central region of vertex showing sculpture of integument; FIG. 38. regions of abdominal terga 3 and 4 bordering intersegmental line, showing sculpture of integument. FIG. 39, *Rhyopsocus squamosus* Mockford and Gurney, ♀, spermatheca with its accessory bodies, duct, and sclerite of the orifice.

terior. Common trunk of gonapophyses (Fig. 26) elongate, narrow basally. T-shaped sclerite of subgenital plate (Fig. 29). *Sculpture.*—vertex (Fig. 37) with roughly polygonal areoles, their long axes mostly oriented transversely, separated by depressed lines, and bearing numerous granulations. Abdominal terga: sclerotized areas beset with large, irregular granules oriented in some areas into transverse areoles narrowly separated by lines. The areoles much better developed posterior to segment 4 than anterior to it. On membranous portions of terga 5–7, granules much smaller than anteriorly, becoming increasingly smaller posteriorly and replaced by transverse lines immediately anterior to posterior border of each segment. *Chaetotaxy.*—hairs of vertex generally shorter than distances between hairs, the hairs about 9 μ in length. Prothorax (Figs. 32, 33) with S_I of medium length; other dorsal setae few, somewhat shorter than S_I. Three prosternal setae. Synthorax (Figs. 32, 34) with S_{II} about same length as S_I; other setae generally shorter, sparse; two setae on parapsidal suture of each side; mesosternal row of 6 setae. Abdominal setae oriented in distinct transverse rows on terga 1 and 2, with one row per tergum; on tergum 3 a distinct anterior and a distinct posterior row with several setae scattered between; more posteriorly row orientation absent, setae scattered; setae on anterior terga about 8 μ in length. Terminal abdominal setae (Fig. 30); epiproct with 2 straight setae much longer than others. *Color* (in alcohol).—Compound eyes black; body and appendages pale straw-brown dorsally, somewhat paler ventrally.

Holotype female, CUYAMACA RESERVOIR, SAN DIEGO COUNTY, CALIFORNIA, 15 April 1968, in nest of *Neotoma fuscipes* (nest No. 0-12F7-6), T. Ashley collector. Two ♀ paratypes, same data as type. Same locality, situation, and collector, 22 May 1968, 3 ♀ paratypes. Types are for the present in my collection.

OTHER RECORDS.—California: Los Angeles County, 2 miles south of Pearblossum, 31 March 1959, *ex* litter and soil (sandy loam) under *Cupressus Macnabiana* Murray along base of hills, F. C. Raney collector, 21 ♀; Kern County, 11 miles northeast of Caliente, 31 March 1959, *ex* litter and soil under *Pinus Sabiniana* Douglas, F. C. Raney collector, 10 ♀.

DISCUSSION.—This species is probably most closely related to *L. kidderi* (Hagen) (= *L. simulans* race A Broadhead according to Pearman, 1951), which has only 5 to 6 ommatidia in the compound eye. It is similar in size and chaetotaxy to *L. kidderi*, but is closer to *L. simulans* (race B) Broadhead in sculpture of the abdominal terga. It is paler in color than *L. kidderi* or *L. simulans*. The three previously known species with greatly reduced number of ommatidia, *L. paetus* Pearman, *L. paetulus* Broadhead, and *L. parvulus* Badonnel, belong to Section II.

←

All figures showing sculpture of integument are oriented with the anterior direction upward. Upper scale applies to Figs. 35, 36, 37, and 38; lower scale applies to Fig. 39. Scales are in mm.

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Five New Species of Mordellidae from Louisiana and Mississippi[1]

(Coleoptera)

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This study was based on specimens sorted from light-trap collections received from the Gulf Coast Mosquito Control Commission, Gulfport, Miss., and the Mississippi Test Support Facility, NASA. The identification is based on Brimley (1951), following Liljeblad's classification (1945). The new species belong to the genus *Mordellistena* Costa. Their types are mounted in polyvinyl alcohol and deposited in the U. S. National Museum.

[1] This investigation was supported by an Academic Grant from Loyola University.

THE PAN-PACIFIC ENTOMOLOGIST 47: 140–145. April 1971

Mordellistena longictena Khalaf, new species

Length to apices of elytra around 3.3 mm, pygidium very long and slender, 2.2 mm, hypopygium 0.5 mm. Color of head and prothorax brownish red, venter red, abdomen infuscated. Last abdominal segment (sometimes), pygidium, and elytra black, except for reddish humeral spot occupying proximal one-third of elytron. Antennae dark, except yellowish on first four segments and base of fifth. Palpus brownish, darker distally. First two pairs of legs brownish. Pubescence yellowish.

Eyes moderately large, pear shaped, hairy, and finely granular. Antennae subserrate, 1.2 mm long, nearly reaching base of pronotum. Proportions of segments 2–5 as 11:10:9:15 and segments 10–11 as 3:4. Terminal segment of maxillary palpi triangular, narrow proximally, apical and inner edges subequal.

Scutellum triangular, with obtuse apex. Penultimate segment of front and middle tarsi only slightly notched. Middle tibia shorter than tarsus. Long tibial spur about twice length of the small. Metatibia with three oblique combs, preapical and apical not included, second long and crossing outer face, proximal comb sometimes rudimentary. Basitarsus with from four combs to five and a rudiment. Second segment of tarsus with three combs, proximal sometimes rudimentary.

Cross vein r light in color (Fig. 1). Medial fleck separated by its own length from posterior wing margin. Four anal veins present. Distinct dark spot present on cross vein r-m. Basal part of anterior fleck distinct.

Holotype female, EDWARD BAYOU, MISSISSIPPI, 21 September 1966. Paratypes: 1 ♀, Edward Bayou, Miss., 25 September 1966; 1 ♀, Pearlington, Miss., 1 September 1966.

This species is somewhat allied to *M. husseyi* Liljeblad. Variations in the latter species were described by Ray (1946). *Mordellistena longictena* differs from *M. husseyi* in color (especially the possession of a humeral spot), presence of three combs on second hind tarsal segment, shape of last segment of maxillary palpi, very long pygidium, and smaller size.

Mordellistena gigantea Khalaf, new species

Length to apices of elytra 5–5.5 mm, pygidium 2.2–2.5 mm, hypopygium 0.75 mm. Color dark brown, abdomen dark, metasternum and metacoxae lighter in male. A black patch in male between eyes. Legs (except knees and tarsi), basal four segments of antennae, and palpi yellowish brown, darker in female. Antennae dark, except basal four segments. Palpi yellow, terminal segment infuscated, darker in female. In female, isolated elytra lighter in color distally. Upper surface with short, dense pubescence.

Eyes moderately large, hairy, and finely granulate. Antennae short, 1.2 mm long, subserrate, not reaching base of prothorax. Proportions of segments 2–5 as 13:16:14:16 and segments 10–11 as 14:16. Terminal segment of maxillary palpi club shaped or only faintly triangular, apical edge shortest.

Scutellum triangular, apex somewhat obtuse. Penultimate segment of front and middle tarsi only slightly notched. Long tibial spur about twice length of the small. Metatibia with three oblique combs, preapical and apical not included, second long and crossing outer face. Sometimes, one or two rudiments replace proximal comb, and additional rudiment may be present just beyond long comb. Basitarsus with four combs; sometimes additional rudiment present; second segment with two and a rudiment.

In wing (Fig. 2), cross vein r somewhat faint. Medial fleck separated by nearly its own length from wing margin. Four anal veins pigmented; jugal present. Radial cell relatively long. Spurious, pigmented fleck present proximal to vein Rs.

Holotype female, ANSLEY, MISSISSIPPI, 30 September 1966. Allotype, Ansley, Miss., 5 September 1966.

This species differs from *M. husseyi* in the form and proportions of antennal segments, and the dimensions of the terminal segment of maxillary palpi.

Mordellistena mississippiensis Khalaf, new species

Small species, total length about 3 mm, pygidium almost 1 mm, proportion of length of pygidium to that of hypopygium 98:35. Color yellowish brown, darker on apical half of elytra, due to dark wings underneath. Ventrally, first two or three visible abdominal segments black. Last four antennal segments infuscated. Pubescence yellow.

Eyes small, hairy. Antennae long (1–1.1 mm), filiform, extending beyond base of pronotum. Proportions of basal five antennal segments: 7.5:9.5:6:7:11; segment eleven slightly longer than tenth. Terminal segment of maxillary palpi triangular, apical edge slightly longer than or subequal to inner.

Scutellum semitriangular, apex obtuse and rounded. Penultimate segment of front and middle tarsus hardly notched. Middle tibia shorter than tarsus. Long tibial spur twice length of the small. Metatibia with two oblique combs, preapical not included, upper one long and crossing outer face. Basitarsus with three combs and second segment with two. Additional, small, rudimentary comb sometimes is present on tibia and first tarsal segment.

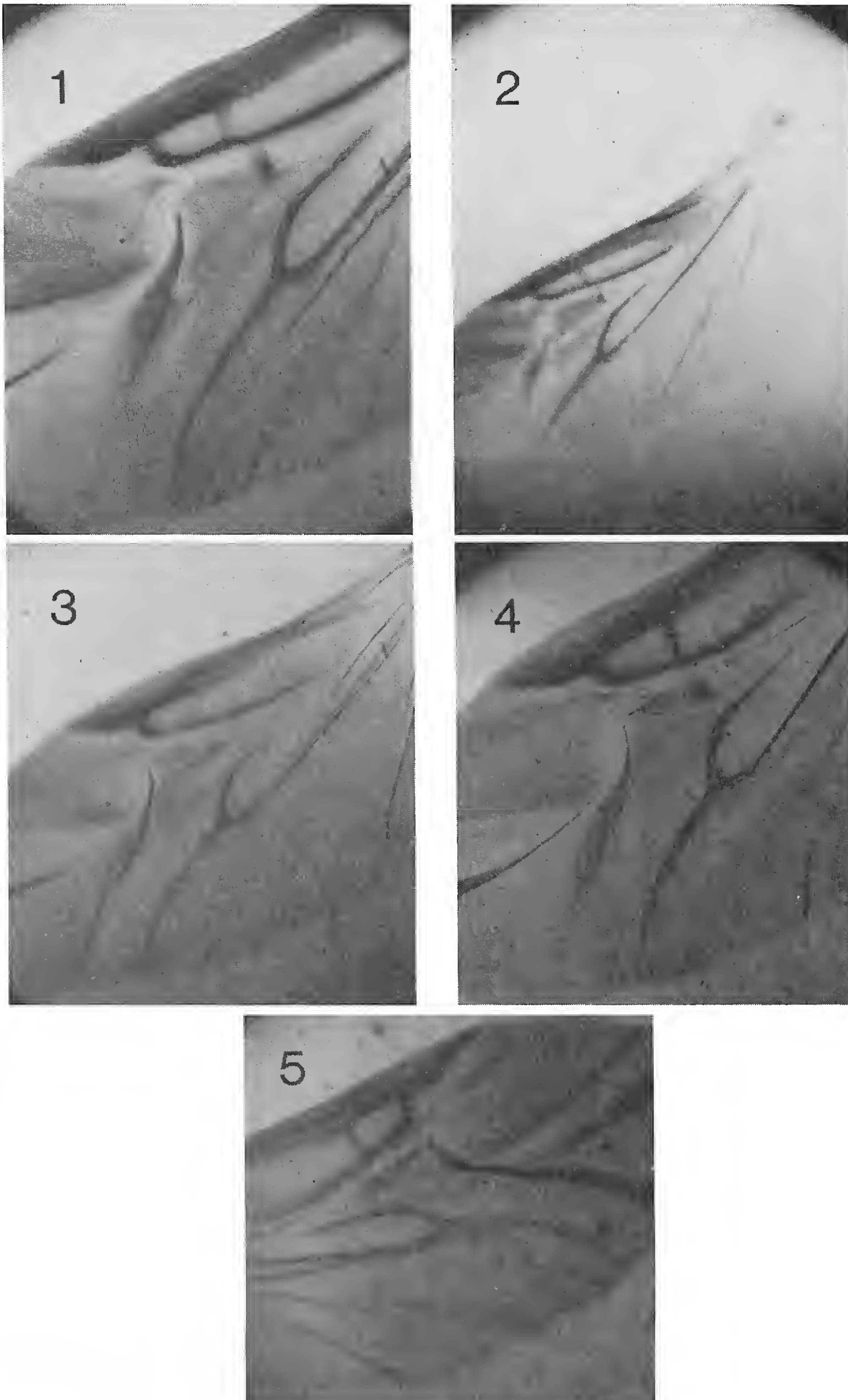
In wing (Fig. 3), cross vein r faint. Medial fleck separated by more than its own length from posterior wing margin. Only trace of fourth anal vein present near base of wing.

Holotype male, GULFPORT, MISSISSIPPI, 18 May 1966. Paratypes: 1 ♂, Long Beach, Miss., 29 April 1966; 1 ♂, NASA (Gate A), Miss., 7 September 1966.

This species differs from *M. wickhami* Liljeblad by its distinctly smaller size, and from *M. testacea* Blatchley which is described as being uniform in color. It also differs from *M. subfucus* Liljeblad, in color, size of eyes, proportions of antennal segments, and dimensions of terminal segment of maxillary palpi.

→

FIGS. 1–5. Hind wings of five new species of *Mordellistena*. FIG. 1. *M. longictena*. FIG. 2. *M. gigantea*. FIG. 3. *M. mississippiensis*. FIG. 4. *M. mullahyi*. FIG. 5. *M. louisianae*.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Mordellistena mullahyi Khalaf, new species

Length to apices of elytra 3 mm, pygidium 1 mm, hypopygium 0.45 mm. Head, palpi, and antennae yellow. First two pairs of legs yellowish, hind legs darker. Rest of body black, except brownish red on apical part of pronotum, humeral vitta (not reaching middle of elytra, margin, or suture), apical edge of elytra, end of abdomen, and pygidium. Sides of pronotum dark brown. Pubescence grayish.

Eyes moderately large, hairy, with moderately coarse facets. Antennae short (0.8–0.9 mm), not reaching base of pronotum. Proportions of antennal segments 2–5 as 80:73:73:105 and segments 10–11 as 95:126, segments 7–10 wide. Terminal segment of maxillary palpi triangular, apical edge shortest.

Scutellum triangular, with obtuse apex. Penultimate segment of front and middle legs faintly notched. Middle tibia slightly shorter than tarsus, proportion 27:30. Metatibia with three short, oblique combs, preapical and apical not included, proximal one small. Basitarsus with three combs and a rudiment, second segment with two.

In wing (Fig. 4), medial fleck separated by its own length from wing margin. Fourth anal vein nearly missing, hardly indicated near base. Cross vein r distinct. Rs widely pigmented. Spur present on stem of first two anal veins. Dark segment of cross vein r-m quite distinct.

Holotype female, THREE RIVERS, MISSISSIPPI, 18 May 1966. This species exhibits some similarity to *M. smithi* Dury. In the latter species however, the head, thorax, and pygidium are black, and the humeral vitta extends beyond the middle of elytra. Moreover, the two species differ in the structure of the antennae.

Mordellistena louisianae Khalaf, new species

Length to apices of elytra 2.5 mm, pygidium 1 mm, hypopygium 0.35 mm. Color of head, thorax, venter, legs, antennae, and palpi yellow. Abdomen and pygidium black, both lighter near tip. Elytra yellow, narrowly black at base, at suture to near apex, and at margin in more than the middle third. Base of prothorax and posterior part of elytra infuscated. (The elytra because of dark wings underneath.)

Pubescence yellow, except in dark areas.

Eyes rather small, finely granular, with erect macrotrichia. Antennae long (1.2 mm), filiform, extending beyond base of pronotum. Proportions of segments 2–5 as 4.7:4:4:7 and segments 10–11 as 6.2:7.5. Terminal segment of maxillary palpi wide triangle, apical edge shortest.

Scutellum triangular, apex broadly rounded. Penultimate segment of front and middle tarsi feebly notched. Middle tibia and tarsus subequal in length. Long tibial spur about twice length of the small. Metatibia with two short, oblique combs, preapical and apical not included, proximal one fine and more oblique. Basitarsus with two combs and a rudiment, second segment with two.

In wing (Fig. 5), medial fleck eroded, separated by more than its own length from wing margin. Pigmented margin of Rs wider basally. Vein Cu faint and narrow except near apex of loop. Fourth anal vein missing. Radial cell short.

Holotype male, INDIAN CAMP (W. PEARL RIVER) LOUISIANA, 4 May 1966.

This species is somewhat allied to *M. dimidiata* Helmuth. However, *M. louisianae* differs in eyes, presence of two combs on second segment of posterior tarsi, color of pygidium, proportions of antennal segments, and shape of maxillary palpus. *Mordellistena pratensis* Smith and *M. errans* Fall are seemingly allied species, but were only briefly described. *Mordellistena pratensis* is a much smaller species with different coloration, while *M. errans* is described as entirely yellow testaceous with the unusual character of having the fourth antennal segment longer than the fifth.

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BOOK REVIEW

THE COMPARATIVE ANATOMY OF THE MALE GENITAL TUBE IN COLEOPTERA. 1969 reprint without change. By David Sharp and Frederick A. G. Muir. Entomological Society of America, 4603 Calvert Road, College Park, Maryland 20740. $10.00.

The original of this invaluable work with its 37 plates appeared in Part III of The Transactions of the Entomological Society of London for the year 1912, and was published on 24 December 1912. It has been increasingly hard to obtain and as many of the illustrations of male genitalia are still the only ones in print for their respective genera the reprinting is most welcome. This is especially so because the new edition includes as an Appendix, reprints (with original paginations) of two subsequent papers by Sharp and four by Muir, all dealing with continuations of their original study. There is a 2-page preface to the book, by E. C. Zimmerman, and a 2-page introduction by him to the six shorter papers; in the latter he draws attention to corrections to be made in the 1912 work.

As Zimmerman remarks, it would be preferable to have a completely revised and expanded edition of Sharp and Muir, but with the help of Lindroth and Palmén's chapter in Tuxen's *Taxonomist's glossary of genitalia in insects*, and papers by specialists in various families, the student can make excellent use of this first-class reprinting. Counting the plates it is a book of 300 pages, but with the parts in their original pagination, so is not separately paged.—HUGH B. LEECH, *California Academy of Sciences, San Francisco.*

A New Species of *Leptohyphes* from Mexico[1]
(Ephemeroptera: Tricorythidae)

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An undescribed species of *Leptohyphes* Eaton, 1882, was recently found in a collection of mayfly nymphs from Mexico. I take pleasure in naming this species in honor of Richard K. Allen, in recognition of his contributions to the knowledge of this genus. I thank Jerry Battagliotti for preparing the illustrations.

Leptohyphes alleni Brusca, new species

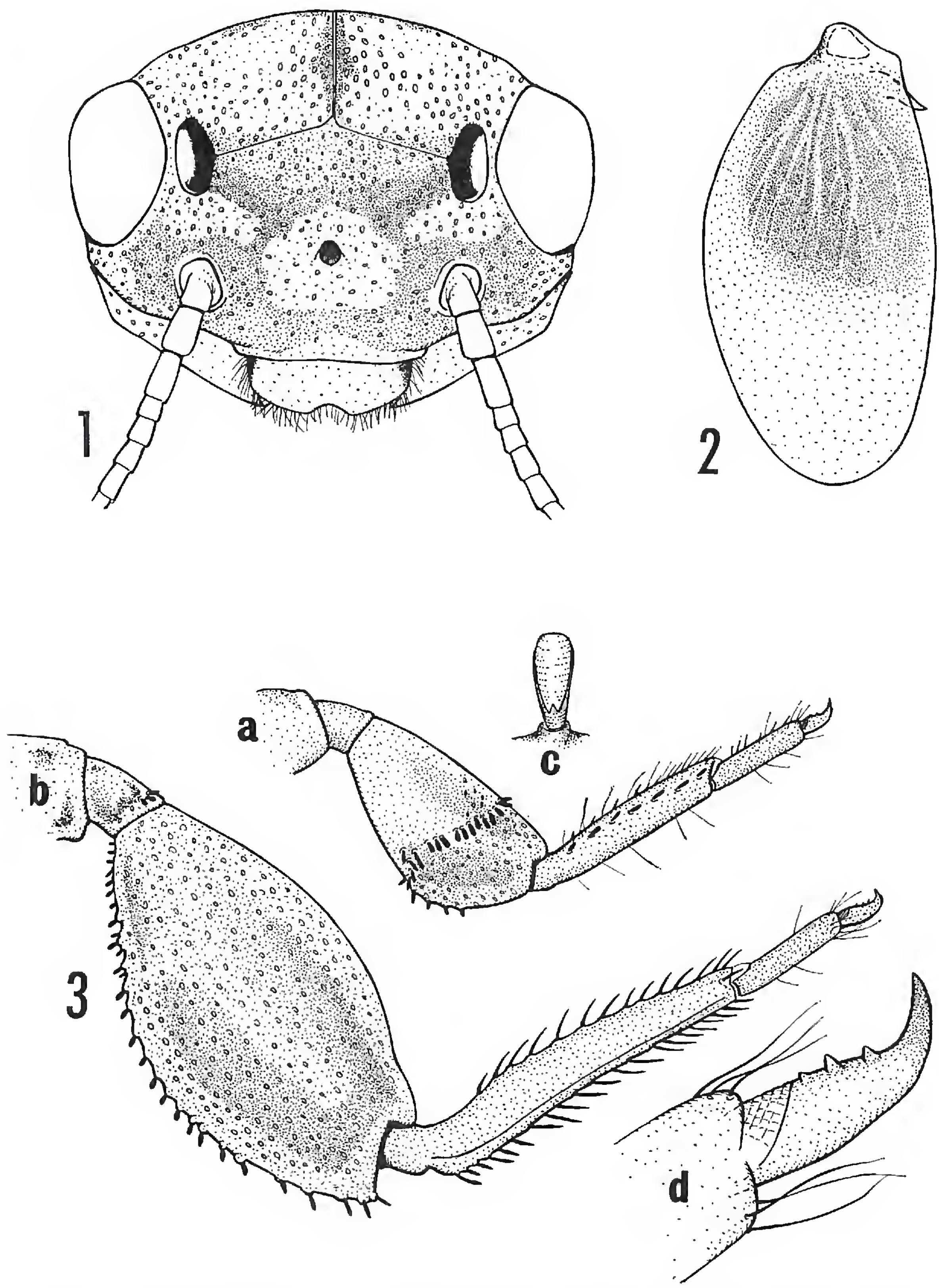
NYMPH.—Length: body 4.0–5.0 mm; caudal filaments 4.5–5.5 mm. General color tan to reddish-brown with gray to black markings. Head tan with scattered black markings and numerous pale spots (Fig. 1); maxillary palpi 3-segmented; labrum pale with black lateral margins and marginal setae; labrum deeply emarginate; lateral ocelli moderate in size, median ocellus small. Thoracic nota brown with variable gray markings and numerous pale spots; legs reddish-brown with numerous pale spots on femora (Fig. 3a, b); femora with large, diffuse, black maculae; tibiae reddish-brown with faint black streak along ventral margin; tarsi pale, without markings; femora with short spines (Fig. 3c); fore femoral band of spines (Fig. 3a); hind femora with marginal spines in raised sockets; hind femora without spines on anterior surface; hind femora produced apically, and 50 per cent longer than fore femora (Fig. 3b); tibiae with large marginal spines; tarsal claws with 3–4 marginal denticles (Fig. 3d); tarsal claws red apically. Abdominal terga reddish-brown with numerous pale spots and diffuse, black, transverse band; terga 1–9 with long posterolateral spines; sterna reddish-brown with diffuse black markings; operculate gills pale at apex and along margin, dark at base; operculate gill with short lateral spine near base (Fig. 2). Caudal filaments brown with pale annulations.

Holotype mature nymph, STREAM 10 MILES NORTH HUAJUAPAN DE LEON, OAXACA, MEXICO, 7 September 1968. R. K. Allen, in collection California Academy of Sciences, San Francisco. Paratopotypes: 3 mature nymphs, same data as holotype, in collection California State College at Los Angeles.

REMARKS.—Mature nymphs were collected in a small stream (elevation 5,400 ft.) with a temperature of 70° F. *Leptohyphes alleni* and *Leptohyphes murdocki* Allen are the only described species of *Leptohyphes* in which the head, body, and femora are covered with small, white spots. The femoral spines of both species are short and broad,

[1] The research upon which this report is based was supported by National Science Foundation Grant GB-5740X.

THE PAN-PACIFIC ENTOMOLOGIST 47: 146–148. April 1971



FIGS. 1–3. *Leptohyphes alleni* Brusca, n. sp., nymph: FIG. 1. head, front view; FIG. 2. operculate gill; FIG. 3a. right fore leg; FIG. 3b. right hind leg; FIG. 3c. fore femoral spine; FIG. 3d. tarsal claw.

and the number of denticles on the tarsal claws is indentical. *Leptohyphes alleni* appears to be geographically and seasonally isolated from *L. murdocki* as the former has been collected in November from southern Mexico, and the latter in May from Panama. *Leptohyphes alleni* is distinguished from all described *Leptohyphes*, by the following combination of characters: (1) the maxillary palpi are 3-segmented; (2) the femora are reddish-brown with black maculae; (3) the hind femora are expanded, with an apical projection; (4) the ratio of length of fore femora to hind femora is 50 per cent; (5) the middle and hind tibiae have long spines on the dorsal and ventral margins; and (6) the hind femora are without spines on the anterior surface. *Leptohyphes alleni* is the first species of the genus to be described from southern Mexico.

SCIENTIFIC NOTE

On the identity of *Panurginus ineptus* Cockerell (Hymenoptera: Andrenidae).—The type of *P. ineptus* recently passed through my hands and I identified it as a true *Panurginus* although it was transferred to *Pseudopanurgus* in the Synoptic Catalog (U. S. Dep. Agr. Monogr., 2: 1,100). The first recurrent nervure in this species, as I now recognize it, is received almost interstitially with the first intercubitus, or from about one to three widths of the nervure beyond the intercubitus, so that in some cases it is received about as far from base as the second recurrent nervure is from the apex of the second submarginal cell.

Synonymy: *Panurginus ineptus* Cockerell, 1922, Amer. Mus. Novitates, 36: 8, 10, ♀.

Panurginus bakeri Crawford, 1926, Proc. Entomol. Soc. Wash., 28: 213, ♂ (new synonymy).

The material recorded below seems to be correctly identified with *P. ineptus*, although the wing nervures run more or less darker than in the type. The males agree closely with Crawford's description of *P. bakeri* and with his figures.

Colorado: 1 female, type of *ineptus*, Tennessee Pass, 10,500 feet, 6–8 August 1920 (Lutz); 1 female, Elk Springs, Moffat Co., on *Stanleya pinnata*, 23 June 1950 (C. D. Michener); 1 female, Gothic, 9,500 feet, Gunnison Co., 14 August 1964 (Michener and Downhower); 1 male, Slumgullion Pass, 29 June 1937 (R. H. Beamer). Utah: 1 male, Logan Canyon, 25 May 1954 (Knowlton and Bohart); 1 female, 20 miles east of Salt Lake City, 11 June 1952 (W. E. LaBerge); 9 males, Wellsville, Cache Co., 13 May 1954 (G. E. Bohart); 1 male, Wellsville, 3 June 1937 (F. C. Harmston); 1 male, Mill Creek Canyon, Salt Lake Co., 8 June 1955 (J. C. Downey); 1 female, Navajo Lake, 9,800 feet, 8 July 1964 (G. F. Knowlton). Washington: 1 male, Van Trump, Mt. Ranier, 21 July 1922 (A. L. Melander). Oregon: 1 female, Aneroid Lake, Wallowa Co., 1 August 1941 (R. F. Rieder).—P. H. TIMBERLAKE, *University of California, Riverside 92502.*

Some Aspects of Adult Assembly and Sexual Behavior of *Rosalia funebris* Motschulsky under Artificial Conditions

(Coleoptera: Cerambycidae)

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During the first week of July 1970, we were informed of the presence of large numbers of *Rosalia funebris* in the business district of Santa Rosa, California. The beetles were aggregating on the outside walls of a bank building (Fig. 1), and had elicited considerable interest and curiosity from residents. The local newspaper contained an illustrated article referring to the incident.

Since few accounts of such assemblages have been published (Essig, 1943, reported on a collection of 150 specimens of *Rosalia* from a commercial paint shop in Ukiah, California), we proceeded to Santa Rosa on 7 July 1970 in order to make first hand observations. Upon our arrival at 11:05 a.m. (PST), numerous adults were visible on the walls of the bank building. Specimens were collected from the outside walls, bushes, and sidewalks around the structure. They were sluggish and not easily disturbed, the males resting much higher than the females.

By 12:05 p.m. the sun was shining brightly on the front of the building and at that time only three males were evident, the others having moved into shade. At 12:30 p.m. the male nearest to the corner of the wall moved around it into the shade; the other two followed at 12:44 p.m. and 1:14 p.m., respectively; the individual closer to the edge moving first.

According to bank officials, the beetles had been coming to the building over a period of 10 days to two weeks, reaching a peak during a hot spell at the end of the previous week (1–3 July) when daytime temperatures had risen to 101°–102° F. On 4 July, the temperature began to fall off and by 6 July, noticeably fewer specimens were evident about the building. On 7 July, the first individual seen in flight, a male, arrived at 12:35 p.m., alighting on the northside shady wall. Five additional specimens (4 males, 1 female), appeared during the next 22 minutes, all settling on shady portions of the building.

[1] Appreciation is expressed to Dr. L. D. Anderson, University of California, Riverside for calling our attention to the aggregating site of *Rosalia* in the city of Santa Rosa, to Mr. R. F. Davenport, Wells Fargo Bank, Santa Rosa, to officials of the Speed Space Corporation, Santa Rosa for access to facilities to which *Rosalia* were attracted and for information on the prior history of such behavior, and to Dr. W. Loher for helpful suggestions. This study was undertaken with support of the National Science Foundation under grant GB-4944X.

Although the level of activity as reported to us had decreased by 7 July, we collected 32 accessible males and 11 females from the building and immediate vicinity and estimated that 30–40 individuals still remained on the walls out of reach, in spite of the fact that Dr. Anderson had taken 75 specimens, 48 males and 27 females, the previous day. According to bank personnel, the beetles had occurred in such large numbers during the peak period that they were a definite nuisance.

While in Santa Rosa, we were also informed of reports of large numbers of *Rosalia* on the grounds of a prefabrication building plant 4.5 miles north of town. At this site we found the beetles concentrated in the paint shop and painting areas, including the assembly area for prefabricated products (Fig. 1). Both sexes were attracted to sites where a flat white latex undercoating was applied to the products. In the several hundred foot long assembly building, the beetles inside were found primarily within 100 feet of the large open end of the structure. Numerous individuals were also present in and about the paint storage sheds nearby (Fig. 1). One empty five gallon paint can contained six females trapped in the paint residue and another three adults (Fig. 1). Most specimens taken in the paint shed were either recently dead or very sluggish to the point of being immobilized. However, the latter individuals became active immediately when captured and placed in plastic bags. Thirty-six specimens (21 males, 15 females) were collected in the plant. All of these were on or near dry paint and none were present on the wet, freshly applied coats on the walls of the finished structures.

According to the foreman and several of the workers, beetles had been present during each of the past five years, individuals arriving after the first hot spell of summer.

In view of the report by Essig (1943) on the attractiveness of paint to *Rosalia*, and our observations at the assembly plant, an inquiry at the bank building in Santa Rosa revealed that it had been painted recently. The high temperatures in early July had presumably caused volitilization of certain ketones in the paints, suggesting that these were involved in the attraction of *Rosalia*. According to Essig, the Ukiah specimens were also attracted during a hot spell. Further indication that high temperatures might be a factor in activating attractive elements in the paint was the fact that in the laboratory at room temperatures, fresh samples of the same paint used on the building in Santa Rosa elicited no response from the beetles. However, the adults were not long lived enough to permit us to determine whether or not the age of the paint after application might have also been involved. Another

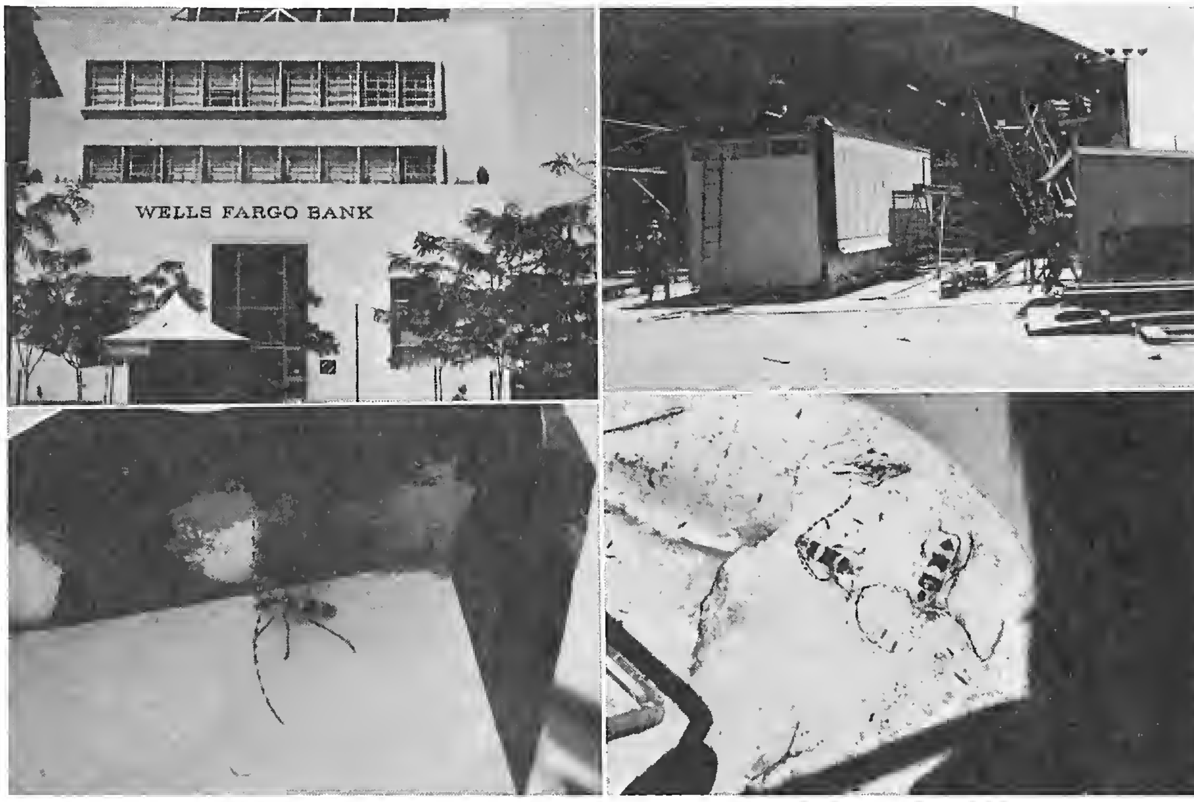

FIG. 1. *Upper left.*—site of adult *Rosalia funebris* Motschulsky assembly in Santa Rosa, California. *Upper right.*—area of *Rosalia* assembly north of Santa Rosa. *Lower left.*—male *Rosalia* on paint shed. *Lower right.*—adult *Rosalia* entrapped in residue in paint bucket.

consideration may be that high temperatures trigger a gregarious response in the beetles.

Since very little information on the habits of *Rosalia funebris* has been published, all of the live adults collected at Santa Rosa were brought into the laboratory for observations. Reported hosts for this species are *Alnus* spp., *Fraxinus* spp., *Quercus* spp., *Salix* spp., and *Umbellularia californica* (Hook. & Arn.) Nutt. (Linsley, 1964). Although *Umbellularia* has not been confirmed as a primary host since the species was designated as the California Laurel Borer by Essig (1926), the adults were introduced into a large rearing cage containing four 10 inch diameter logs of *U. californica.* These logs had been attacked previously by *Leptalia macilenta* LeConte, lucanids (*Platycerus*), and other deadwood species and were fairly dry at this time. In addition most of the bark had been removed in order to study *Leptalia,* in particular. However, *Rosalia* were attracted to the logs and mating and subsequent oviposition were readily observable.

MATING BEHAVIOR.—This activity was studied with individual couples placed in cardboard cartons with transparent tops, as well as those individuals (about 20 males and 10 females) which were introduced into the large cage containing the four laurel logs.

The same basic mating pattern occurred in all of the numerous cases observed, both in the confinement of the small containers and the relative freedom of movement possible within the cage. After the initial contact, the male mounted the female from the side (Fig. 2). He quickly assumed a parallel position while palpating her pronotum with his palpi and mandibles (Fig. 2). The front legs grasped the female behind the humeri, while the middle legs were extended laterally and the hind pair posteriorly but not in contact with her body. During mating the antennae of the male were gradually arched outward and posteriorly and those of the female were arched forward. Immediately upon assuming this position on the female, the male curved the abdomen forward with the apex forming a scoop-like right angle and attempted to insert the phallus. If joining was successful, the male moved back slightly and gently extracted the female genitalia while lowering the head and touching the pronotum with his mouthparts. The pulling and bowing motions persist for from 30 to 60 seconds and just prior to disjoining, these actions become very rapid. Usually the bowing occurred every four seconds with faint stridulations audible during the upward motion. The sounds are produced by the movement of the pronotum over the mesonotal plate. In most cases after disjoining, the female would explore the substrate with her ovipositor while the male remained in amplexus with his body at an angle to hers with his mouthparts contacting her elytra.

The various couples exhibited very little variation in these actions, the principle differences involving the length of time from initial contact to complete separation. One pair uncoupled after 8 minutes and remained motionless. One minute later the female moved her antennae and ran her front legs over the scape. About 20 minutes later the male appeared immobile but tightened his grip when the female moved her antennae. A little later the male moved back assuming a 45° angle while the female extruded her ovipositor. In several cases the male grasped the antennae of the female during the rapid terminal copulatory motions and appeared to bite strongly.

Competition with other males appeared to be a factor influencing the length of time an individual male remained in contact with a female. Although the high individual density and confined conditions of the cage provided an artificial situation, at least some of the antagonistic behavior exhibited probably occurs in nature. Fighting between males was common, both between individuals and between single males and mating males. The latter situation developed when single males attempted

FIG. 2. *Upper left.*—male *Rosalia* mounting female. *Upper right.*—typical mating position of *Rosalia*. *Lower left.*—male intruding upon a mating pair. *Lower right.*—female seeking oviposition niches.

to dislodge the male in a mating pair. When thus interrupted, mating males leave the female and engage the intruder. Usually they run directly at the intruder making contact with the head and mandibles. While the two were entangled, each attempted to bite the appendages of the other. Usually one or the other became dislodged from the log and ran off while the victor engaged the female. Size was important in determining the outcome of these encounters and the larger males easily dislodged small opponents. A small male could not successfully mate with a large female since his genitalia could not reach hers while he was engaged in palpating the pronotum.

In one instance, a male came upon a mating pair from the front. He hooked his front legs over the antennae of the female and remained face to face with the mounted male (Fig. 2). When the female attempted to move forward, he pushed her backward and when she moved backward, he grasped her antennal scape with his mandibles and held her immobile. The trio remained in this position until the mating male dismounted and the female broke loose and attempted to oviposit.

In most cases, copulation between the same individuals occurred a number of times. After each joining, the male remained with the female while she oviposited. When an egg was laid, the male usually attempted to couple again immediately, with the entire behavioral sequence being repeated.

In conclusion, the sexual behavior of *Rosalia funebris* may be summarized briefly for comparison with a number of species studied by Michelsen (1966a, 1966b). It involves licking during amplexus, tapping, sound production, and pulling the ovipositor during copulation. This suggests a relatively high degree of evolution of sexual behavior from the "pure licking" of the more primitive forms of Cerambycidae.

OVIPOSITION.—After copulation, the females search for oviposition niches. While searching she extrudes the ovipositor and holds her antennae forward and extended somewhat laterally with the apices bent to touch the substrate surface (Fig. 2). When a suitable niche or crack was found, the ovipositor was inserted, the antennae were drawn backward and extended laterally and a single egg was deposited with gentle pulsations of the body. In most cases, the ovipositor remained in the substrate for a minute or two. On the *Umbellularia* logs, the niches most commonly selected were split openings at the ends of the logs. However, eggs were also laid in artificial crevices made by the insertion of a knife into the wood.

Rosalia eggs are elongate (3+ mm long, .75 mm diameter), whitish, and translucent. The end attached to the substrate is narrower with the surface covered by a slightly sticky gelatinous coating.

Unfortunately, the condition of the logs was not conducive to the hatching of eggs and larval development. The reasons for this are not clear but probably involved the nature and moisture content of the wood. In nature the hosts are generally present along water courses and washes where a relatively high moisture content is maintained by the dead wood. It is also possible that *Umbellularia* is not a suitable host for larval development. Further studies of host requirements for this species are obviously needed.

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An Extraordinary New Subspecies of *Cercyonis oetus* from Central Nevada[1]
(Lepidoptera: Satyridae)

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The small dark woodnymph, *Cercyonis oetus* Boisduval, occurs from the western ridge of the Sierra Nevada to the eastern flank of the Rocky Mountains, in most of the mountain ranges of the western United States and north into western Canada. Three rather weakly differentiated subspecies are known (see Emmel, 1969, for review). *Cercyonis oetus oetus* Boisduval, with an acutely-angled mesial band and brownish secondaries ventrally, is found in the western third of the species' range. *Cercyonis oetus charon* Edwards, with mottled dark brown secondaries ventrally, is distributed from Arizona and New Mexico north to the Canadian border. *Cercyonis oetus phocus* Edwards has a uniform slate or black-brown phenotype and is found in British Columbia with occasional populations in adjacent areas.

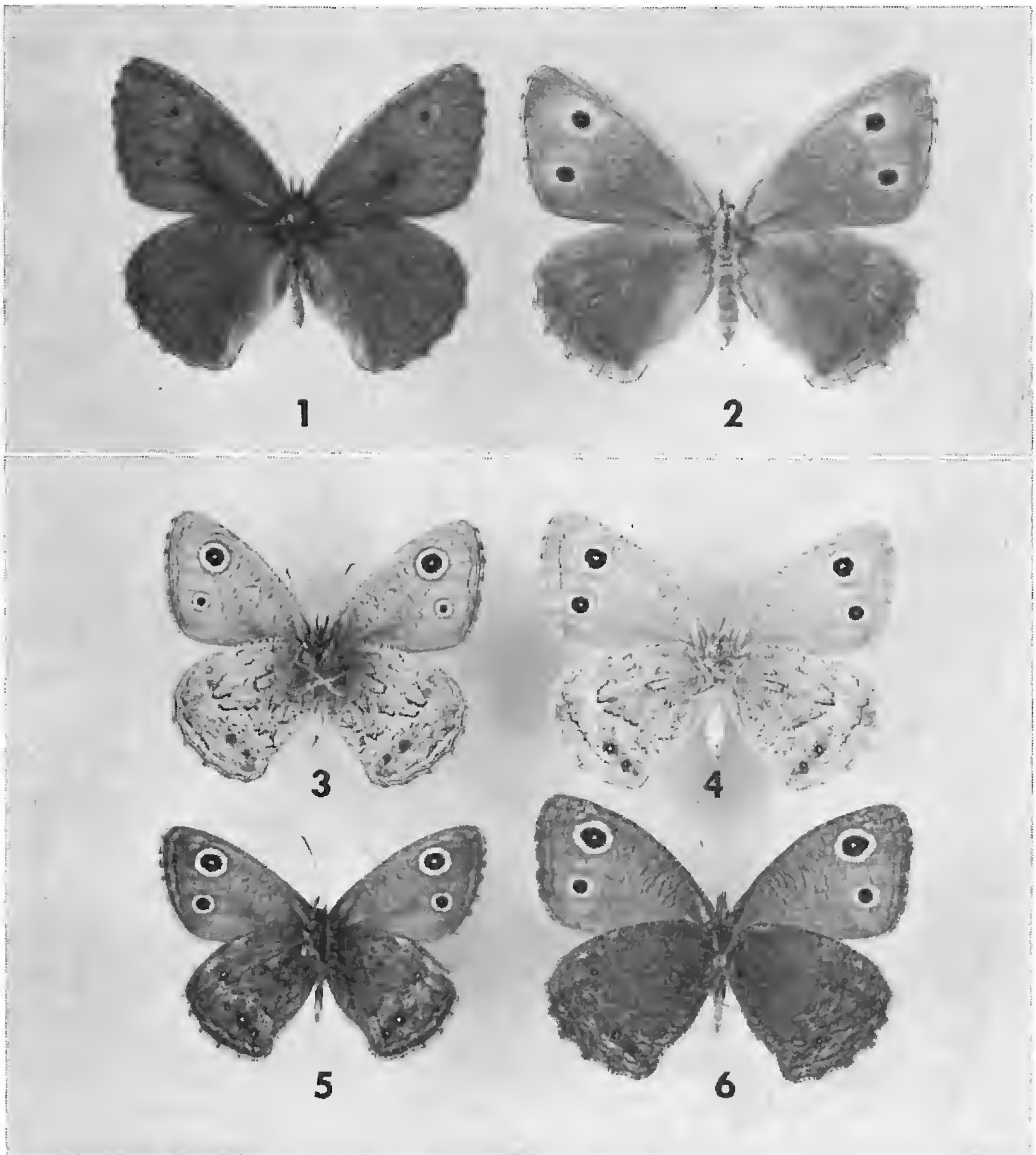
Because of this relative uniformity of phenotype over a broad range, it was particularly surprising to find in 1969 an extraordinarily distinct set of populations in the center of Nevada. (Several specimens indicating a strange phenotype were taken here also in 1967.) The collectors, John F. Emmel and Oakley Shields, were able to secure nearly 80 specimens of both sexes from several localities in the Reese River Valley, west-southwest of Austin in Lander County. This region (5,700 feet elevation) is a relatively flat plain coated with bright white alkaline salts, making the habitat appear mantled by a thin layer of snow. Saltbush (*Atriplex*), composites, and a few other herbs and grasses poke through the alkali crust. The whitish coloration of this new *Cercyonis* aids in concealment against such an environmental background.

Cercyonis oetus pallescens Emmel & Emmel, new subspecies
(Figs. 1, 2, 3, 4)

MALE.—*Forewing radius*: 19–21 mm. *Dorsal surface*: soft mouse gray-brown on both primaries and secondaries; in fresh specimens, noticeably lighter than

[1] Contribution No. 180, Bureau of Entomology, Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Gainesville.

[2] Research Associate, Florida State Collection of Arthropods, Division of Plant Industry, Florida Department of Agriculture and Consumer Services. Travel and research supported in part by grants from the Los Angeles County Museum of Natural History, The Allyn Foundation, and the Division of Sponsored Research, University of Florida.



FIGS. 1–4. *Cercyonis oetus pallescens* Emmel and Emmel, new subspecies. Dorsal (Fig. 1) and ventral (Fig. 3) surfaces of holotype male and dorsal (Fig. 2) and ventral (Fig. 4) surfaces of paratype female; both from 4 miles northeast of Reese River crossing of State Highway 2, 5,700 ft. elevation, west-southwest of Austin, Lander County, Nevada, 12 July 1969. FIG. 5. *Cercyonis oetus oetus* Boisduval, male, ventral surface, from Tioga Pass, Yosemite, California, 28 July 1960. FIG. 6. *Cercyonis oetus charon* Edwards, female, ventral surface, from Hyde State Park road, 7,900 ft. elevation, near Santa Fe, Sante Fe County, New Mexico, 1 August 1963.

coloration in all other subspecies. One black ocellus, lacking any lighter ring, on the forewing. Androconial distribution as in other subspecies. *Ventral surface*: Both forewings and hindwings heavily suffused with white scaling. Two forewing ocelli usually present, some specimens with one, three, or even four forewing ocelli; on hindwing, from none to six small ocelli. All ocelli almost always pupilled with bright white scales. Mesial band marked by dark brown zigzag lines on about half the specimens. *Head, thorax, abdomen*: Same color as adjacent wing surfaces; thus quite white ventrally, in contrast to dark bodies of other named subspecies.

FEMALE.—*Forewing radius*: 21–23 mm. Coloration as for male but with two dorsal forewing ocelli and often three or four ventral forewing ocelli; white scaling even heavier on ventral surface of secondaries.

Holotype male, REESE RIVER VALLEY, 4 ROAD MILES NORTHEAST OF REESE RIVER CROSSING ON NEVADA HIGHWAY 2, 5,700 FT. ELEVATION, WESTSOUTHWEST OF AUSTIN, SOUTHWEST CORNER OF T. 19 NORTH, R. 43 EAST, LANDER COUNTY, NEVADA, collected 12 July 1969, by John F. Emmel and Oakley Shields, deposited in the senior author's collection at the University of Florida.

PARATYPES.—61 males, 9 females, from same locality and date as holotype; 5 males, 1 female, Reese River at old U. S. Highway 50, ca. 10 road miles west of Austin, 5,700 ft., Lander County, Nevada, 12 July 1969, same collectors. Paratypes deposited in collections of the Allyn Foundation, Los Angeles County Museum, California Academy of Sciences, Carnegie Museum, American Museum of Natural History, Florida State Collection of Arthropods, and the authors.

The name of this insect refers to its most distinctive feature: the whitish scaling on the ventral surfaces. It should be noted that each of the four species of *Cercyonis* is now known to contain such a form, found in arid, alkaline flats in the West:

Cercyonis pegala gabbi Edwards—Utah, basins near Great Salt Lake especially.
Cercyonis sthenele paulus Edwards—Nevada principally.
Cercyonis meadi alamosa Emmel & Emmel—San Luis Valley, Colorado.
Cercyonis oetus pallescens Emmel & Emmel—Reese River Valley, Nevada.

Genetic and physiological research on these situations and other adaptive strategies in the genus *Cercyonis* are currently in progress. Earlier publications (Emmel, 1969; Emmel & Emmel, 1969) give a general taxonomic treatment of these satyrids.

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EMMEL, T. C., AND J. F. EMMEL. 1969. A new subspecies in the *Cercyonis meadi* group (Satyridae). J. Lepidopt. Soc., 23: 161–164.

A Description of the Larva of *Ceratophyus gopherinus* Cartwright with a Revised Key to the Larvae of North American Geotrupini and Notes on the Biology[1]
(Coleoptera: Scarabaeidae)

PAUL O. RITCHER AND ROBERT DUFF
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California State College, Long Beach 90804

In 1962, a strange, deep burrowing, geotrupid beetle was found in Santa Barbara County, California, which could be of economic importance in golf courses and lawns (Anonymous, 1963). It was described as a new species of *Ceratophyus* by Cartwright in 1966. *Ceratophyus* is an old world genus occurring from Morroco and Southwestern Europe to Siberia, South Russia, and Sikkim (Cartwright, 1966). It seems probable, therefore, that *Ceratophyus gopherinus* is a species of foreign origin that was introduced into California some 10 years ago.

The larvae of *Peltotrupes youngi* Howden, of *Mycotrupes gaigei* Olsen and Hubbell, and of several species of *Geotrupes* were described by Howden (1952, 1954, 1955, 1964). In 1967 Howden described the larva of a Mexican species, *Ceratotrupes bolivari* Haeffter and Martinez. In 1955 he gave a key to the genera known at that time. The larvae of several species of *Geotrupes* were described by Ritcher (1947, 1966) together with keys to the known genera of Geotrupini.

Robert Duff discovered the larva of *Ceratophyus* in February 1970. This is the only genus of Geotrupini now occurring in North America whose larva was unknown.

CERATOPHYUS GOPHERINUS Cartwright, Third-Stage Larva

Description based on 12 third-stage larvae collected by Robert Duff from cells deep in the soil 8, 14, and 22 February 1970, at Vandenburg Village, Santa Barbara County, California.

Maximum width of head (Fig. 1) 4.14 to 4.86 mm with a mean width of 4.42 mm. Surface light yellow brown to light red brown, finely granulose. Frons, on each side, with one or two posterior frontal setae, one or two setae in each anterior angle, one exterior frontal seta, and one anterior frontal seta. Clypeofrontal suture absent. Epicranial stem continued on frons past juncture of frontal sutures. Epicranium, on either side, with an oblique row of 3 or 4 setae.

[1] Technical Paper No. 2889. Oregon Agricultural Experiment Station. This investigation was supported in part by grant GB 6194X from the National Science Foundation.

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Labrum wider than long, with slightly trilobed anterior margin; lateral lobes broadly rounded, sides constricted toward base.

Antenna 3-segmented but distal segment very small, cap-like. Segment 2 with a distal, ovate, sessile sense organ (Figs. 1, 7, 8).

Scissorial area of each mandible with a blade-like anterior portion and a posterior tooth. Inner margin of each mandible, between scissorial area and molar region, with prominent process; process bifurcate on left mandible (Fig. 3). Molar areas asymmetrical, left mola overhung dorsally by prominent acia; grinding surface of left mandible concave, that of right mandible rather flat.

Maxilla (Fig. 4) with separate galea and lacinia. Lacinia with 3 apical unci. Stipes with sparsely set row of 8 to 12 short, conical, stridulatory teeth. No stridulatory teeth on palpifer.

Hypopharynx (Fig. 5) with asymmetrical oncyli, more strongly developed on the right. Glossa broadly rounded, not emarginate.

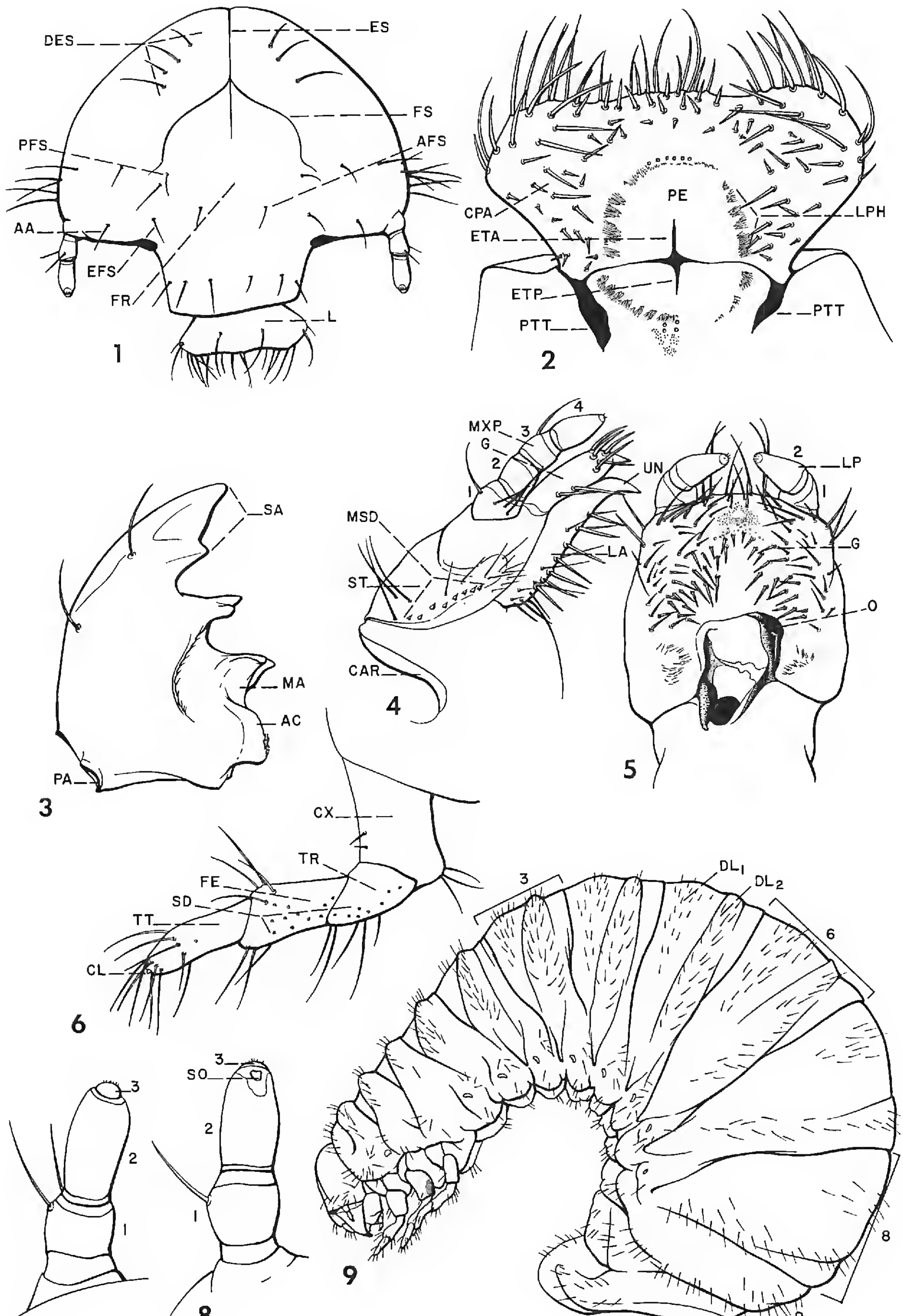
Epipharynx (Fig. 2) very similar to that of *Peltotrupes youngi* Howden. Haptomerum inconspicuous, bare, mound-like. Each chaetoparia sparsely set with about 20 to 25 slender chaetae of varying lengths, most directed mesad. Pedium bare, surrounded anteriorly and laterally by phobae. Each lateral phoba a dense row of short blunt filaments. Anterior phoba row of shorter filaments and with curved row of 6 macrosensilla along its anterior margin. Haptolachus with curved phoba on right side and smaller curved phoba on the left. Torma slightly asymmetrical, united mesally and with thin posterior and anterior epitormae on the midline. Pternotormae prominent, that on right larger.

Spiracles reniform (Fig. 9) ; emargination of prothoracic spiracle facing ventrad, emarginations of abdominal spiracles cephaloventrad. Spiracles on abdominal segments 1–6 similar in size, those on segments 7–8 progressively smaller.

Abdomen bluish, greatly swollen posteriorly as in *Peltrotrupes* and with protruding anal lobes on each side of last segment (Fig. 9). Dorsal lobes inconspicuous, two in number on segments 1–8. Dorsal lobe 1 much broader, especially on abdominal segments 3–8. Last (tenth) abdominal segment short, obliquely flattened, with bare whitish, fleshy anal lobes (Fig. 9). Anal opening bordered dorsally by flap-like lobe (Fig. 10). Endoskeletal figure, below dorsal lobe, triangular, sides converging toward anal opening. Impressed area lateral of anal opening surrounded by same pigmented line that defines posterior endoskeletal figure. Each impressed area with curved dorsal arm expanded apically, and smaller, curved, lateral arm which tapers to a point (lateral lobes not separated from ventral anal lobes by impressed lines).

Legs 4-segmented with some segmental boundaries poorly defined. All three pairs of legs well developed, metathoracic legs smallest (Fig. 9). Small claws on all legs, smallest on metathoracic legs. Metathoracic legs with stridulatory tubercles on inner face of trochanter and femur (Fig. 6), and one or two tubercles on tibiotarsus. Stridulatory structure on mesothoracic legs consisting of faintly striated area on outer surface of each coxa.

Ceratophyus gopherinus, based on larval characters, represents a distinctly different genus which is not closely related to *Ceratotrupes*. The less specialized metathoracic legs and the fusion of the anal and ventral lobes of the last abdominal segment distinguish it from larvae of



FIGS. 1–9. Larva of *Ceratophyus gopherinus* Cartwright. FIG. 1. Head. AA, seta of anterior frontal angle; AFS, anterior frontal seta; DES, dorsoepicranial setae; EFS, exterior frontal seta; ES, epicranial suture; FR, frons; FS, frontal suture; L, labrum; PFS, posterior frontal setae. FIG. 2. Epipharynx. CPA, chaetoparia;

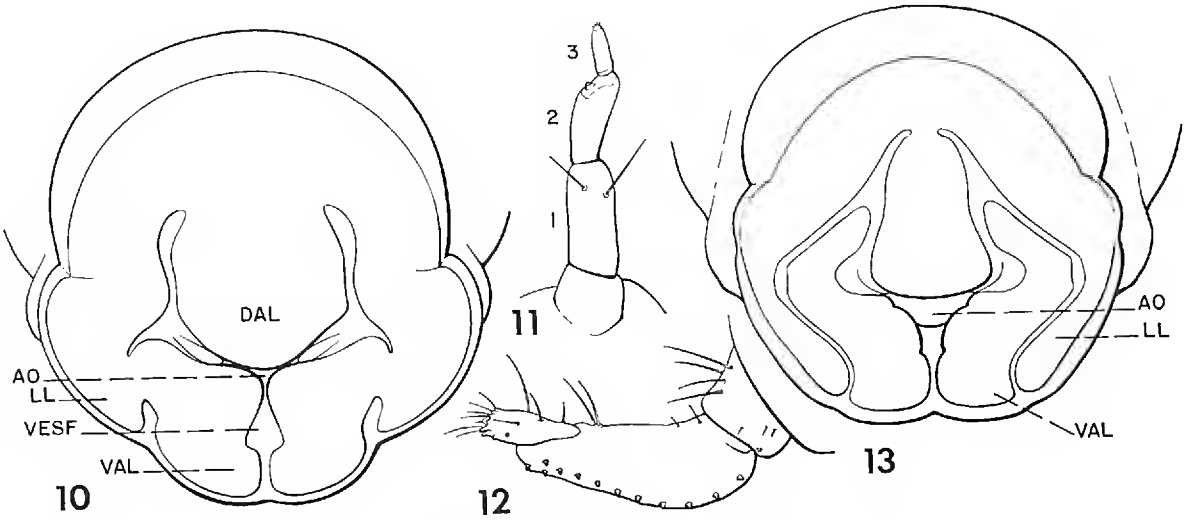


FIG. 10. *Ceratophyus gopherinus.* Caudal view of last abdominal segment. AO, anal opening. DAL, dorsal anal lobe; LL, lateral lobe; VAL, ventral anal lobe; VESF, ventral part of endoskeletal figure. FIG. 11. *Geotrupes blackburnii excrementi* Say. Dorsal surface of right antenna. FIG. 12. *Peltotrupes youngi.* Inner surface of metathoracic leg. FIG. 13. *Peltrotrupes youngi.* Caudal view of last abdominal segment. AO, anal opening; LL, lateral lobe; VAS, ventral anal lobe.

other North American Geotrupini. In common with the larva of *Peltotrupes*, *Ceratophyus* has a greatly swollen body, much reduced last antennal segment, and similar epipharyngeal characters.

The following key (in part from Howden, 1954, 1955, and 1967) can be used to separate the larvae of North American Geotrupini. Larvae of the three genera, *Ceratotrupes*, *Geotrupes*, and *Mycotrupes*, are very closely related. The characters used to separate them in the key represent differences which are often found in species belonging to the same genus.

KEY TO LARVAE OF THE GENERA OF GEOTRUPINI FOUND IN NORTH AMERICA

1. Last antennal segment greatly reduced in size, cap-like (Figs. 1, 7, 8); abdomen greatly swollen (Fig. 9) 2

←

ETA, anterior epitorma; ETP, posterior epitorma; LPH, laeophoba; PE, pedium; PTT, pternotorma. FIG. 3. Dorsal surface of left mandible. AC, acia; MA, molar area; PA, preartis; SA, scissorial area. FIG. 4. Inner surface of left maxilla. CAR, cardo; G, galea; LA, lacinia; MSD, maxillary stridulatory teeth; MXP, maxillary palpus; ST, stipes. FIG. 5. Labium with hypopharynx. G, glossa; LP, labial palpus; O, oncylus. FIG. 6. Inner surface of right metathoracic leg. CL, claw; CX, coxa; FE, femur; SD, stridulatory teeth; TR, trochanter; TT, tibiotarsus. FIG. 7. Ventral surface of right antenna. FIG. 8. Dorsal surface of left antenna. SO, sense organ. FIG. 9. Left lateral view of entire larva.

Last antennal segment reduced in size but subconical or cylindrical in shape, usually one fourth as long as second segment (Fig. 11); abdomen moderately swollen 3

2. Metathoracic legs not greatly reduced in size (Figs. 6, 9), claws present on all legs .... *Ceratophyus*

Metathoracic legs greatly reduced in size (Fig. 12), claws absent on all legs .... *Peltotrupes*

3. Epipharynx with poorly developed pternotormae .... *Mycotrupes*

Epipharynx with well developed pternotormae 4

4. Endoskeletal figure of ventral anal lobe poorly defined .... *Ceratotrupes*

Endoskeletal figure of ventral anal lobe laterally expanded with sharp, fairly truncate angles .... *Geotrupes*

Biology

In January 1962, Stanley Trujillo, County Agricultural Inspector for Santa Barbara County, reported the presence of a new pest species identified as *Ceratophyus* sp. by Cartwright, from an area 6 miles north of Lompoc, California (California Dept. of Agr. Rept. 62-3, courtesy of George Okumura; Cartwright, 1966). The presence of sand mounds 7.5 to 15 cm high above the burrows was reported to be "inconvenient" on lawns and golf courses. The beetle was abundant in scrub oak thickets on the Vandenberg Air Force Base.

In 1962, damage to lawns of model homes in the Vandenberg Air Force base village was reported (Anonymous, 1963). Adults were trapped in cans baited with Japanese beetle bait (anethole-eugenol) and with ammonium carbonate. Depths of "nests" were 1.8 to 2.4 m, deeper than in 1962 (Anonymous, 1963).

Three trips were made (8, 14, and 22 January 1970) to study *Ceratophyus* biology at Vandenberg Village where two excavations were investigated in a chaparral plant community consisting of *Quercus* sp., *Adenostoma fasciculatum* Hook and Arn., *Arctostaphylos* spp., and *Ceanothus* sp. In addition, a third site was studied where the ground cover was composed primarily of *Adenostoma.*

Ceratophyus burrows were marked at the soil surface either by mounds of sand or, occasionally, by "ropes" of sand. Early in the morning "ropes" or mounds of darker colored, moist sand were frequently seen on top of or to the side of the existing mounds but within a few hours many of the "ropes" dried out and crumbled. Presence of fresh, moist sand in the early morning indicated that the adults were active at night. The burrows extended downward, with twists and turns, to a depth of about 1.5 m. They then bent sharply at a horizontal plane. The horizontal portion was enlarged into a chamber 20 to 45 cm long which was filled with dry surface sand, leaf litter, and twigs apparently provisioned by the adults. On several occasions both a male and female were found together in a horizontal chamber. The food material provided for the larvae by the adult beetles was leaf litter and small twigs of *Adenostoma*, *Arctostaphylos*, *Ceanothus*. It appears that the beetles are not particular about the type of leaf litter they carry into their burrows.

A total of 13 third-stage larvae were collected from cells, at depths of from 1 to 1.5 m. The cells were 12.5 to 20 cm long and from 2.5 to 3.75 cm in diameter, lying in a horizontal or slightly inclined position. Many contained moist, decayed leaf material and numerous small twigs. As the larvae feed on the food provisioned by the adults they apparently construct cells from their fecal pellets in a manner similar to that of *Peltotrupes* larvae (Howden, 1952). This habit probably serves to keep out sand and conserve moisture.

Acknowledgment

We are indebted to Mrs. Bonnie Hall for assistance with the illustrations.

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SCIENTIFIC NOTES

***Limnia armipes* Melander synonymized with *Limnia severa* Cresson (Diptera: Sciomyzidae).**—The male holotype of *Limnia severa* Cresson was kindly forwarded to us by Dr. Paul H. Arnaud, California Academy of Sciences, San Francisco. Its gross morphology and genitalia were virtually identical with a large number of specimens previously determined as *L. armipes* Melander. The Cresson type along with representative material from California was sent subsequently for comparison with Melander's male holotype to the U. S. National Museum, Washington, D. C., where both L. V. Knutson and G. C. Steyskal agreed (correspondence L. V. Knutson to R. E. Orth, 24 September 1969) that our material, the Cresson type, and the Melander type were conspecific. Therefore, *Limnia severa* Cresson (Cresson, 1920, March) has precedence over *Limnia armipes* Melander (Melander, 1920, September).

Synonymy: *Limnia unguicornis* var. *severa*, Cresson, 1920. Trans. Amer. Entomol. Soc., 46: 80.

Limnia saratogensis var. *severa*, Melander, 1920, Ann. Entomol. Soc. Amer., 13: 324–325.

Limnia saratogensis var. *armipes*, Melander, 1920, Ann. Entomol. Soc. Amer., 13: 324.

Limnia armipes, Steyskal, 1965, *in* Stone, et al., U. S. Dep. Agr., Agr. Handb., 276: 691.

—T. W. Fisher and R. E. Orth, *University of California, Riverside 92502.*

A new Trichoptera from the Hawaiian Islands.—Recently J. W. Beardsley, University of Hawaii, collected several male and female *Hydroptila arctia* Ross. These were collected in a light trap at the University of Hawaii in Honolulu on 25 April 1969. From the location of the light trap it would appear that these caddis flies "came out of Manoa Stream which flows through the eastern edge of the campus, about 300 yards from our light trap. The stream is permanent with a water flow generally of moderate speed. There are several moderately long ponds along the stream course within the campus," according to Dr. Beardsley.

This record constitutes the first for a member of the genus *Hydroptila* in the Hawaiian Islands. *Hydroptila arctia* Ross is distributed through the western montane region. The species is closely related to *H. consimilis* Morton, which also has a wide distribution. It is possible that *H. arctia* Ross and *H. acoma* Denning may be synonyms of *H. consimilis.*

This new record increases to three the number of Trichoptera known to occur in the Hawaiian Islands: 1) *Oxyethira maya* Denning, well established and quite common. According to Beardsley the species is now known from the islands of Oahu, Kauai, and Hawaii. 2) *Cheumatopsyche analis* (Banks), well established and fairly abundant. It has been collected from the islands of Oahu, Molokai, and Maui. 3) *Hydroptila arctia* Ross, from Oahu. Dr. Beardsley has collected about a hundred specimens in the past year.—D. G. Denning and R. L. Blickle, *Moraga, California 94556, and University of New Hampshire, Durham.*

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Relict Harvestmen from the Pacific Northwest
(Opiliones)

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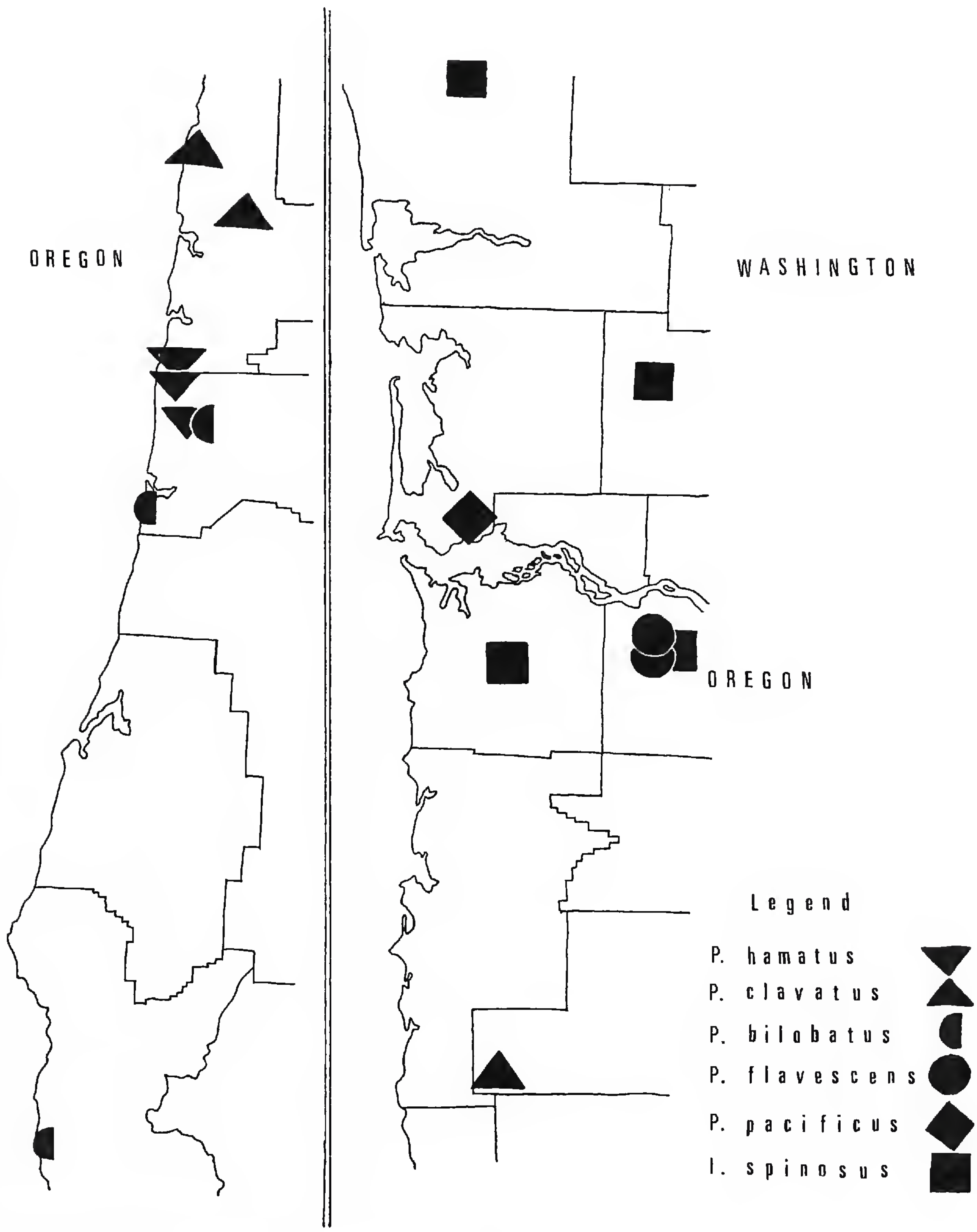
The order Opiliones is divided into three suborders which differ from each other in a number of gross body structures. One such structure is an abdominal plate, the ninth tergite, which is usually present in two of the suborders but in the suborder Laniatores it is fused to an anal plate or absent. A series of peculiar Laniatorids collected in Oregon and Washington were found to have the free ninth tergite. Since reduction of sclerites has long been regarded as an important measure of specialization in arthropods, these phalangids should represent an early evolutionary stage closely allied to the other suborders of Opiliones.

Other primitive structures are borne by this series which belongs to the superfamily Travunoidea and is herein placed in the new family Pentanychidae. Three pairs of apparently vestigial lateral sclerites are located on the abdomen. No other Travunoids have been found to have lateral sclerites, but they appear in the United States species of the Laniatorid family Phalangodidae Simon. The hind claws of adults lack only one pair of branches from the typical six-branched claw of juvenile Travunoids, and the juvenile Pentanychids have an aroleum on their hind claws. Ontogenetic evidence from other members of Travunoidea indicates that six branches and an aroleum are found on the least specialized hind claws. The two Travunoid families that approximate this type of claw, Travuniidae Absolon and Kratochvil and Synthetonychidae Forster, have been regarded as relicts on the basis of their isolation, usually in caves, and their scarcity of individuals.

Degrees of specialization in the superfamily Travunoidea are diagramed (Fig. 1) and a phylogenetic relationship is proposed. The hypothetical ancestral Travunoid would have the greatest number of body sclerites and, possibly, the most complex claw. Oregon has provided the best data for this study and may well be the center of evolution for two families, Erebomastridae Briggs and Triaenonychidae Soerensen.



MAP 1. Distribution of Pentanychidae.

The North American Triaenonychids will be described in a separate paper in which a primitive subfamily, Paranonychinae, is established.

HABITAT AND DISTRIBUTION

The Pentanychidae are restricted to moist coastal forests where westerly winds prevent temperature extremes. These coastal forests of Oregon and Washington have over 50 inches of annual rainfall. The

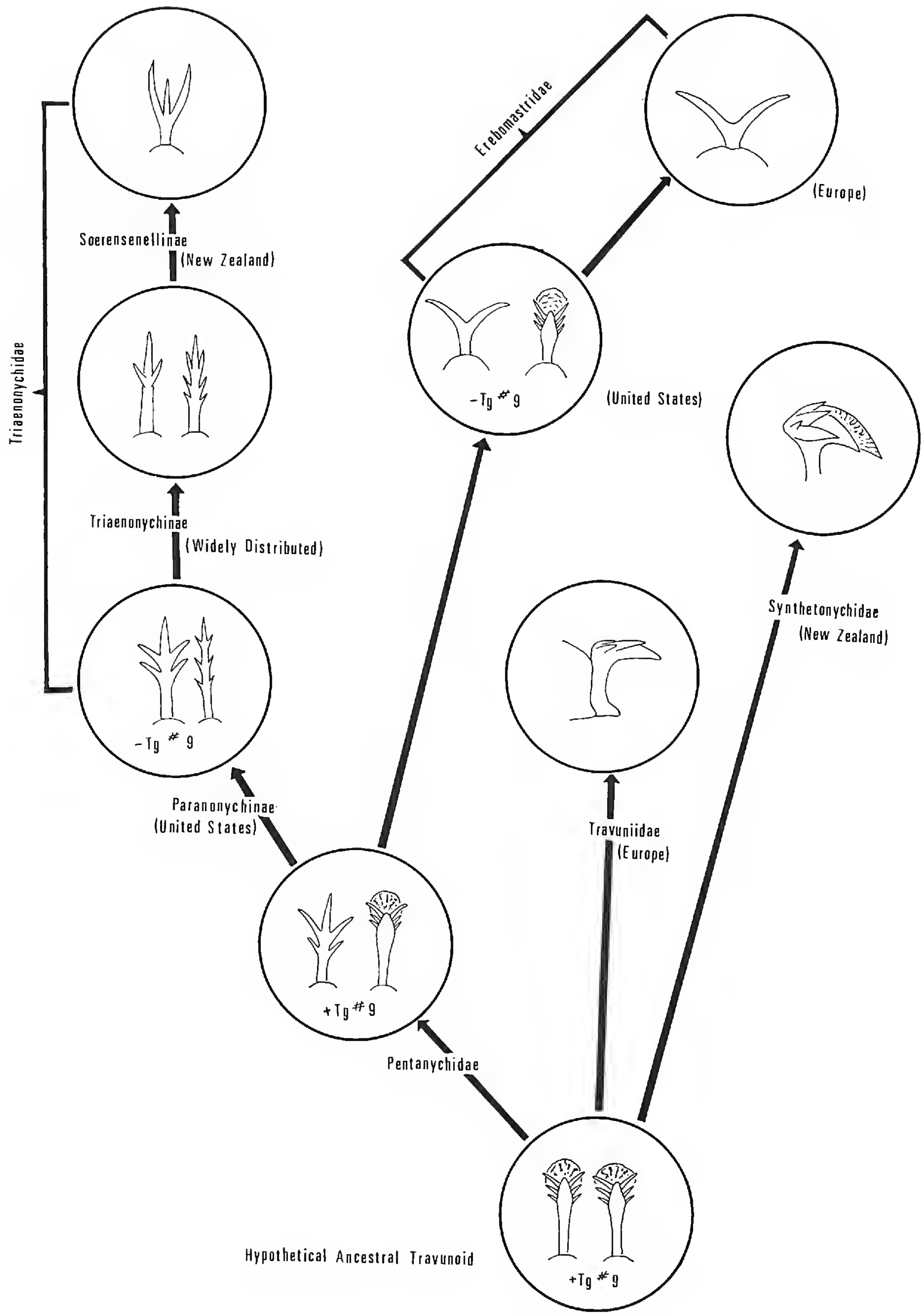
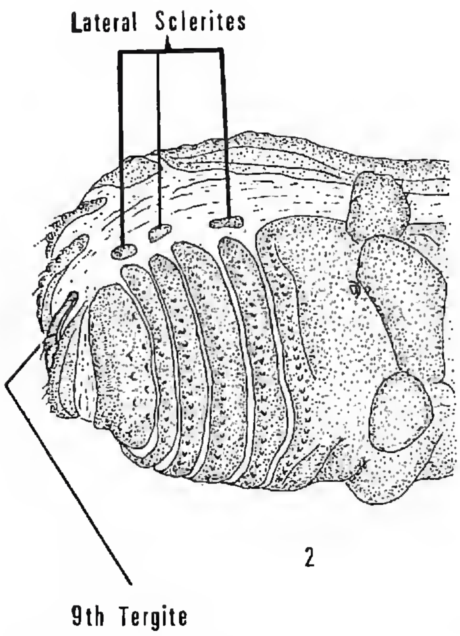


FIG. 1. Evolutionary relationships in superfamily Travunoidea with emphasis on reduction in the hind claw of adults and, where studied, of juveniles (right claw illustration). The presence or absence of a free ninth tergite (Tg #9) is indicated for some families. The stippled area on some claws is an aroleum. Travuniidae also has been reported from Japan and Korea.



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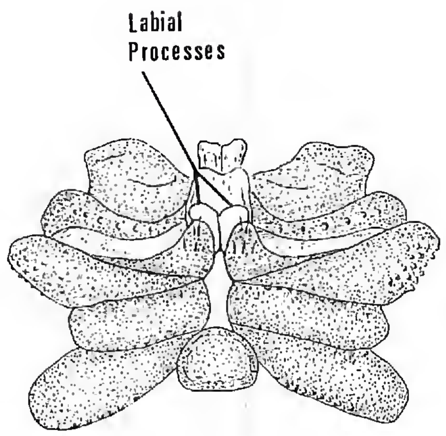

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FIGS. 2–3. Abdomen and sternal area of a typical female *Pentanychus.*

Pentanychids are always found deep under the rotting wood or fallen bark of a well-established stand of spruce and fir. It is unlikely that their habitat ever dries or freezes.

Morphology and Dimorphism

As previously discussed, additional sclerites characterize Pentanychids. The ninth tergite is broader than the anal plate but considerably smaller than the eighth tergite. The lateral sclerites are situated in folds of loose integument which makes them difficult to locate. These tergites and sclerites are best seen when severed from the cephalothorax and spread on a slide. Lateral sclerites may protect the loose integument from being punctured by the free sternites.

The sternal region is of considerable taxonomic importance in Pentanychidae. The sternum itself is broader than sterna of most other Travunoids. Anterior to the opercular opening and bordered by the base of the sternum is a slightly sclerotized, setose space similar to that found in some Erebomastridae and Paranonychinae of Triaenonychidae. It is usually above the anterior of the operculum. Anterior to the acute sternal apex is a region which separates Pentanychidae into two genera. In one genus, *Pentanychus,* this region contains two chitenized plates which join posteriorly along a midline and meet the apex of the sternum along a faint suture. Although these plates may have been referred to as maxillary processes by some workers, they will be called labial processes because they are distinct from the setose maxillary processes of the second coxae to which they are dorsally fused. Labial processes are present in Triaenonychidae and some Erebomastridae. The labial processes of *Pentanychus* are unusually elongate anteriorly and extend above and ahead of the maxillary processes. The other genus, *Isolachus*, lacks visible labial processes and has the sternal apex enclosed by the maxillary processes of the second coxae.

In some species the male labial processes project forward as sharp, recurved spines and hooks. Another dimorphic structure of male Pentanychids is a peculiar set of ventral processes on their palpal femora which modify some of the ventral spines. Male specimens are absent from populations at the northern and southern extremes of the Pentanychid range. In each case extensive collecting only yields females.

All specimens are deposited in the collection of the California Academy of Sciences.

Pentanychidae Briggs, new family

Anterior margin of scute with recess above each chelicera bordered by spurs, three spurs present on margin. Eyes situated on median tubercle. Scute with five undivided areas. Abdomen with tergites six through nine separated by colorless integument, tergite nine always present. Small sclerotized plates (lateral sclerites) exist in soft integument dorsolateral to free tergites. Sternum broad, with setose zone near opercular opening. Palpi robust, with compound spines. Claws of third and fourth legs with two pairs of branches on uniform central prong. Juveniles with aroleum on anterior of six branched hind claws.

TYPE GENUS.—*Pentanychus* Briggs, new genus.

KEY TO GENERA OF PENTANYCHIDAE

1. Hind claws with ectodistal branch elongate, labial processes present .... *Pentanychus* Briggs, n. gen.
   Hind claws with ectodistal branch equal to mesodistal branch, labial processes absent .... *Isolachus* Briggs, n. gen.

Pentanychus Briggs, new genus

Scute with areas weakly delineated. Low, rounded eye tubercle deeply recessed from anterior margin. Sternum with acute apex.

Maxillary processes of second coxae elongate. Labial processes extending above and anterior to maxillary processes, dimorphicly elongated on some males. Spiracles exposed.

Sexual dimorphism of palpal femora pronounced, males with third ventral spine transformed into lobate process with distortion of remaining spines and swelling of dorsal margin.

Chelicerae with elongate basal segment and anterior spines.

First tarsi with five or six segments, second with more than ten. Distitarsi of first legs with two or three segments, of second with about six segments.

Femur of first leg with two small ventral spines, second trochanter with one. Claws on hind legs with two pairs of branches on central prong, posterior pair reduced, ectodistal branch greatly elongated.

Penis with broad, transparent ventral plate. Ovipositor with elongate distal lobes and lateral setae.

TYPE SPECIES.—*Pentanychus hamatus* Briggs, new species.

KEY TO MALES OF PENTANYCHUS

1. Labial processes apically elongated into recurved spines 2
   Labial processes apically blunt, downturned 3
2. Palpal femur with broad hump in place of third ventral spine .... *hamatus* Briggs, n. sp.
   Palpal femur with clavate process at site of third ventral spine .... *clavatus* Briggs, n. sp.
3. Palpal femur with first ventral spine on laterally flattened pedestal 4
   Palpal femur with first ventral spine on rounded pedestal .... *bilobatus* Briggs, n. sp.
4. Palpal femur with pedestal of first ventral spine flattened perpendicular to plane of femur .... *flavescens* Briggs, n. sp.
   Palpal femur with pedestal of first ventral spine flattened 45° to plane of femur .... *pacificus* Briggs, n. sp.

Pentanychus hamatus Briggs, new species

(Figs. 6a, 6b, 10–18)

MALE.—Total body length, 2.14 mm. Scute length, 1.73 mm. Length of eye tubercle, 0.17 mm. Scute width, 1.68 mm. Length of second leg, 4.88 mm. Width of eye tubercle, 0.27 mm.

Anterior margin of scute with slightly truncate shoulders. Scute with light shading of black pigmentation, integument yellow to orange. Areas demarked by low tubercles. Tergites with same coloration as scute, each with row of tubercles.

Maxillary processes enclose cavity anterior to sternal apex. Labial processes in the form of acute spurs bearing large, recurved apical spines. Several seta-bearing tubercles on ectoposterior of second coxae. Lateral sclerites adjacent to fourth, sixth, and seventh sternites.

Chelicerae with lobate basal processes on fingers.

Palpal femora each with broad hump bearing proximal spur in place of third ventral spine, dorsal spines reduced and evenly spaced. Apical claws of palpi thickened basally.

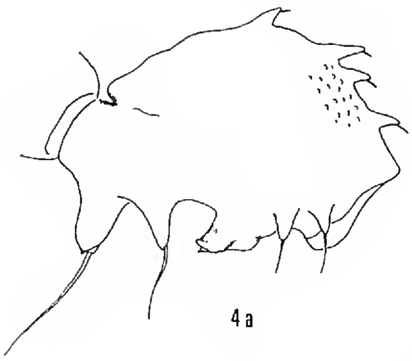
Tarsal formula 6-13 to 15-4-4. Legs lightly dusky, lightest at tarsi.

Penis with aedeagus projecting through acutely convex margin of transparent ventral plate.

FEMALE.—Without altered palpal femora or labial spines. Maxillary processes of second coxae laterally compressed and elongate. Palpal claws and fingers of chelicerae normal. Lateral sclerites free. Labial processes apically blunt, downturned.

→

FIGS. 4–9. Ectal view of palpal femora of Pentanychidae. FIGS. 4a–4b. Male and female *Pentanychus flavescens*. FIGS. 5. Female *Isonychus spinosus*. FIGS. 6a–6b. Female and male *Pentanychus hamatus*. FIGS. 7a–7b. Male and female *Pentanychus bilobatus*. FIGS. 8a–8b. Female and male *Pentanychus pacificus*. FIGS. 9a–9b. Male and female *Pentanychus clavatus*.



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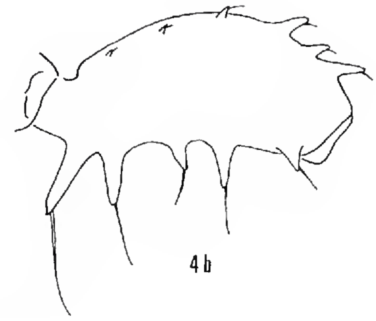

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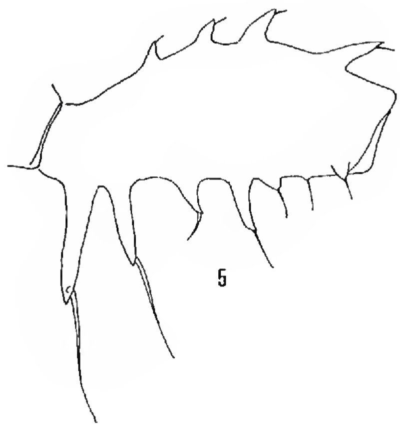

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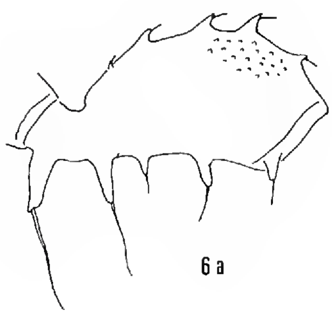

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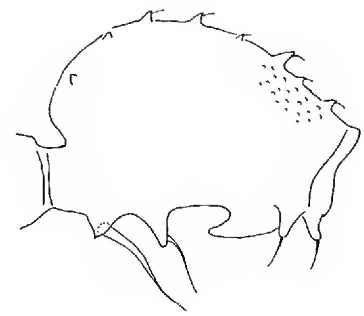

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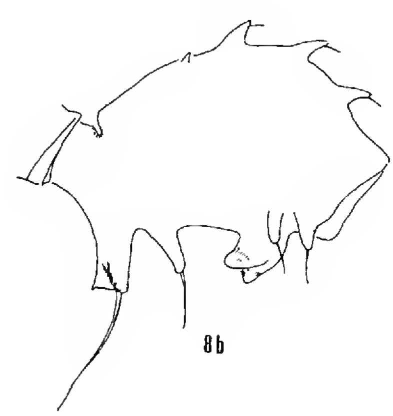

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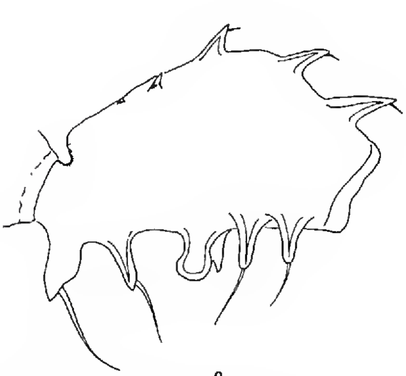

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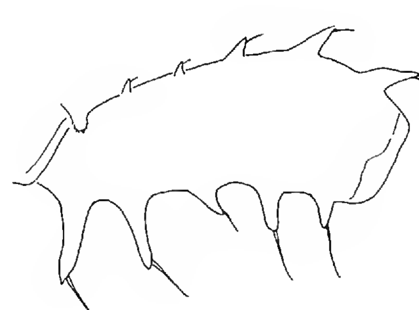


9b

Holotype male and allotype, NEPTUNE STATE PARK ON U.S. HIGHWAY 101, LANE COUNTY, OREGON, 20 June 1966, K. Hom.

OTHER LOCALITIES.—Oregon. Lane County: 0.3 mile and 1.2 miles east Highway 101 on Cape Creek Road near Hecata Head, 3 and 4 September 1970, T. Briggs, K. Hom, R. Lem, W. Lum, and J. Tom. Lincoln County: 0.5 mile east Cape Perpetua on U. S. Highway 101, 7 August 1967, T. Briggs.

NOTE.—Pigmentation on posterior of scute is of variable darkness.

Pentanychus clavatus Briggs, new species

(Figs. 9a–9b)

MALE.—Total body length, 1.88 mm. Scute length, 1.56 mm. Length of eye tubercle, 0.28 mm. Scute width, 1.44 mm. Length of second leg, 5.23 mm. Width of eye tubercle, 0.23 mm.

Anterior margin of scute with shoulders slightly truncate. Scute with faint marbled pattern of black pigment fading anterior to eye tubercle. Marbled pattern terminates in circle of black pigment inside of posterior margin of scute. Areas demarked by low tubercles. Tergites with light band of black pigment and band of tubercles. Eyes dark without black pigment between. Integument yellow.

Maxillary processes of second coxae elongate. Labial processes with small, recurved apical spines. Mesoanterior margins of third coxae with gland opening. One tubercle on ectoposterior of second coxa. Anterior lateral sclerites touch sternies.

Chelicerae with anterior spines directed mesally.

Palpus with clavate lobe and mesal spur in place of third ventral spine on femur, dorsal spines prominent. Palpal claws thickened basally. Palpi lightly pigmented, lightest on tarsi.

Tarsal formula 6-13 to 15-4-4. Legs with dusky black pigment, lightest on tarsi.

Penis with aedeagus projecting through concave anterior margin of ventral plate.

FEMALE.—Similar to male but without modified palpal femora. Labial processes not hamate. Lateral sclerites free.

Holotype male and allotype, 7.7 MILES NORTHWEST EDDYVILLE, LINCOLN COUNTY, OREGON, 20 June 1966, T. Briggs, V. F. Lee, and K. Hom.

OTHER LOCALITIES.—Oregon. Lincoln County: 0.5 mile north of Depoe Bay on U. S. Highway 101, 4 September 1970, T. Briggs, K. Hom, R. Lem, and W. Lum. 1.3 miles east U. S. Highway 101 at Taft, 7 August 1967, T. Briggs. Yamhill County: 10.7 miles northwest Valley Junction, 27 August 1969, T. Briggs.

Pentanychus bilobatus Briggs, new species

(Figs. 7a–7b)

MALE.—Total body length, 2.22 mm. Scute length, 1.56 mm. Length of eye tubercle, 0.27 mm. Scute width, 1.48 mm. Length of second leg, 5.70 mm. Width of eye tubercle, 0.23 mm.

Anterior margin of scute with truncate shoulders. Scute dusky posterior to eye tubercle, with pebbled pattern in median zone behind tubercle. Areas demarked by darker tubercles. Tergites dusky, with band of tubercles. Integument yellow to orange.

Maxillary processes of second coxae stout. Labial processes with blunt, hamate apices. Second coxae with many seta-bearing tubercles on ectoposterior. Lateral sclerites free.

Chelicerae with normal fingers.

Palpal femur with broad hump bearing proximal spur and distal spur in place of third ventral spine, dorsal spines normal. Palpal claw uniform.

Tarsal formula 5 to 7-13 to 15-4-4. Legs darker than body, lightest at tarsi.

Penis with aedeagus projecting through convex anterior margin of narrow ventral plate.

FEMALE.—Similar to male, but without altered palpal femora.

Holotype male and allotype, HONEYMAN STATE PARK, LANE COUNTY, OREGON, 19 and 20 June 1966, T. Briggs and V. Lee.

OTHER LOCALITIES.—Oregon. Curry County: 4.5 miles south Gold Beach, 19 June 1966, 29 January 1967, 3 February 1969, and 4 September 1970, V. F. Lee, K. Hom, R. Lem, W. Lum, and T. Briggs. Lane County: 0.3 mile and 1.2 miles east U. S. Highway 101 on Cape Creek Road near Hecata Head, 3 and 4 September 1970, T. Briggs and K. Hom.

NOTES.—Specimens of *Pentanychus bilobatus* from Gold Beach, Curry County differed slightly from northern specimens in the position of spines on the palpal femora. Extensive collecting at different times of the year only yielded females of this population.

Pentanychus flavescens Briggs, new species

(Figs. 8a–8b)

MALE.—Total body length, 1.94 mm. Scute length, 1.50 mm. Length of eye tubercle, 0.13 mm. Scute width, 1.37 mm. Length of second leg, 5.29 mm. Width of eye tubercle, 0.17 mm.

Anterior margin of scute with rounded shoulders. Scute without black pigment, integument light yellow. Areas with rows of small tubercles. Tergites without black pigment, row of small tubercles on each. Eye tubercle small, eyes present.

Lateral sclerites pale, free. Maxillary processes rounded, with stout, hamate labial processes. Second coxae with uniform cover of small tubercles.

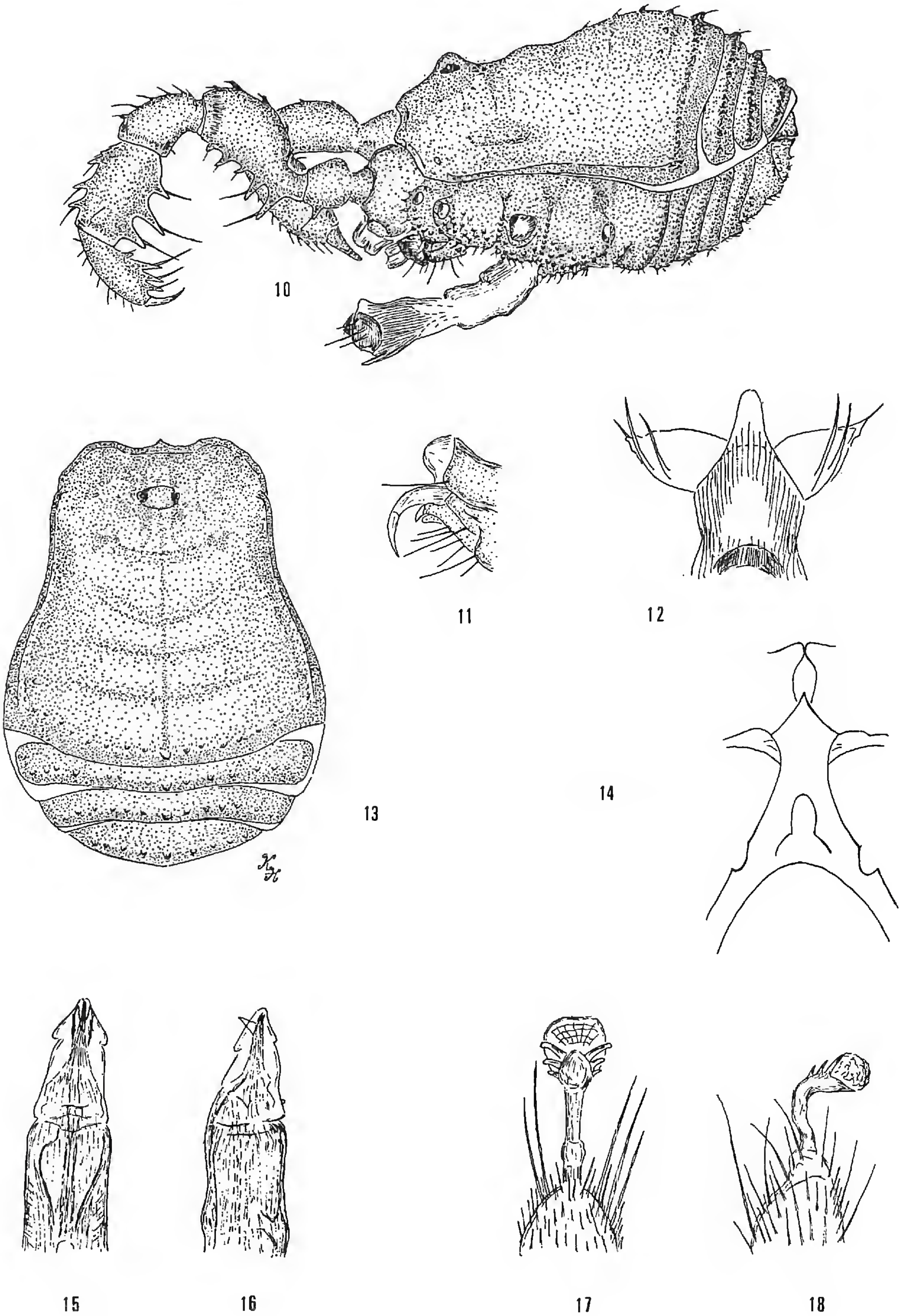
Palpal femur with broad hump-bearing proximal spur in place of third ventral spine, first ventral spine mesal on stout, frontally compressed pedestal, dorsal spines grouped distally.

Tarsal formula 5 to 6-13 to 15-4-4. Legs without dark pigment.

Penis with aedeagus not projecting beyond rounded distal margin of ventral plate. Distal half of ventral plate transparent.

FEMALE.—Palpal femora normal, labial processes thin, not hamate. Maxillary processes of second coxae elongate. Dorsum of palpal femur with six spines in ectal view. Ovipositor with stout lateral setae.

Holotype male and allotype, 5.8 miles south Clatskanie, Columbia County, Oregon, 8 August 1967, K. Hom.



FIGS. 10–18. *Pentanychus hamatus* Briggs, new species. FIG. 10. Lateral view of female. FIG. 11. Labial process of male. FIG. 12. Ventral view of ovipositor. FIG. 13. Dorsum. FIG. 14. Sternum of male. FIGS. 15–16. Ventral and lateral views of penis. FIGS. 17–18. Dorsal and lateral views of juvenile hind claw.

OTHER LOCALITIES.—Oregon. Columbia County: 5.5 miles south Clatskanie, 8 August 1967, T. Briggs.

NOTE.—Half of the specimens examined lacked both retinae. This species displays the only example of blindness in Travunoidea for America. Non-cavernicolous blindness is also found in California in the family Phalangodidae of Oncopodoidea.

Pentanychus pacificus Briggs, new species

MALE.—Total body length, 1.87 mm. Scute length, 1.56 mm. Length of eye tubercle, 0.27 mm. Scute width, 1.36 mm. Length of second leg, 4.97 mm. Width of eye tubercle, 0.23 mm.

Scute dusky posterior to eye tubercle with pebbled pattern in median zone behind tubercle. Eyes normal. Areas demarked by small, darker tubercles. Tergites dusky, with bands of tubercles. Sternum broad, rod-shaped. Maxillary processes of second coxae pigmented. Labial processes hamate. Second coxae uniformly covered with small tubercles. Lateral sclerites pale, free.

Palpal femora each with stout process bearing mesal and ectal spurs in place of third ventral spine, first ventral spine mesodistal on stout pedestal compressed 45° to plane of femur, dorsal spines not closely grouped. Palpi dusky.

Tarsal formula 5 to 6-13 to 15-4-4. Legs dusky, lightest on tarsi.

Penis with aedeagus not projecting beyond rounded distal margin of transparent ventral plate.

FEMALE.—Maxillary processes of second coxae elongate and apically rounded. Dorsum of palpal femur with five spines in ectal view. Labial processes thin, not hamate.

Holotype male and allotype, 5.9 MILES EAST ASTORIA BRIDGE NEAR KNAPPTON, PACIFIC COUNTY, WASHINGTON, 26 August 1969, T. Briggs.

Isolachus Briggs, new genus

Scute with areas weakly delineated. Rounded eye tubercle deeply recessed from anterior margin. Sternum with acute apex. Labial processes absent. Spiracles exposed.

Chelicerae with elongate basal segment and anterior spines.

First tarsi with five or six segments, second with more than ten. Distitarsi of first legs with two or three segments, of second with about six segments.

Femur of first legs with small ventral spines. Claws on hind legs with two pairs of equal branches on central prong, posterior pair reduced.

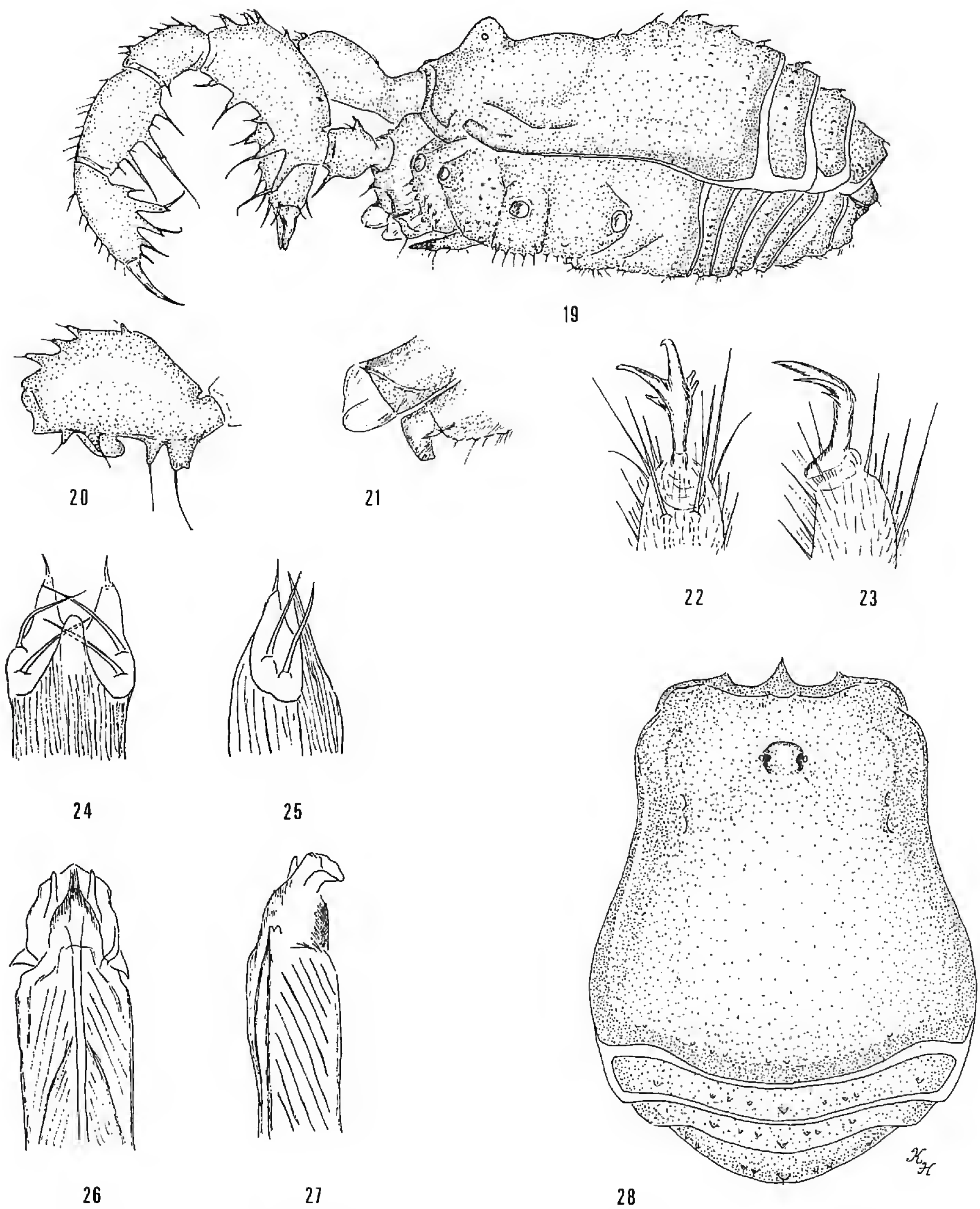
Ovipositor with elongate distal lobes and lateral setae.

TYPE SPECIES.—*Isolachus spinosus* Briggs, new species.

Isolachus spinosus Briggs, new species

(Figs. 5, 21–35)

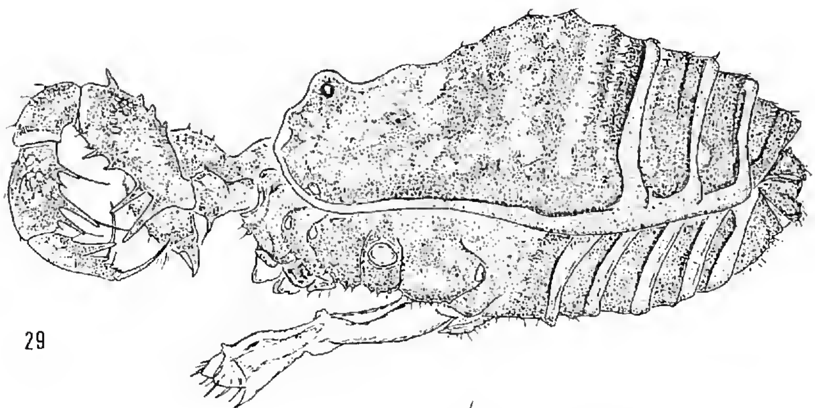
FEMALE.—Total body length, 28.0 mm. Scute length, 2.26 mm. Length of eye tubercle, 0.28 mm. Scute width, 2.14 mm. Length of second leg, 7.39 mm. Width of eye tubercle, 0.31 mm.



Figs. 19–28. *Pentanychus flavescens* Briggs, new species. Fig. 19. Lateral view of female. Fig. 20. Ectal view of male palpal femur. Fig. 21. Lateral view of labial process of male. Figs. 22–23. Dorsal and lateral views of right hind claw. Figs. 24–25. Ventral and lateral views of ovipositor. Figs. 26–27. Ventral and lateral views of penis. Fig. 28. Dorsum of sighted specimen.

Anterior margin of scute with rounded shoulders. Scute mottled throughout with black pigment, region posterior to eye tubercle lightest. Areas with rows of small tubercles. Tergites smooth, each with band of dark pigment. Sternum broad, rod-shaped. Venter, excluding sternum, dusky. Lateral sclerites free.

Maxillary processes dark, acute lobes bearing coarse setae. Second coxae with small tubercles on ectoposterior.



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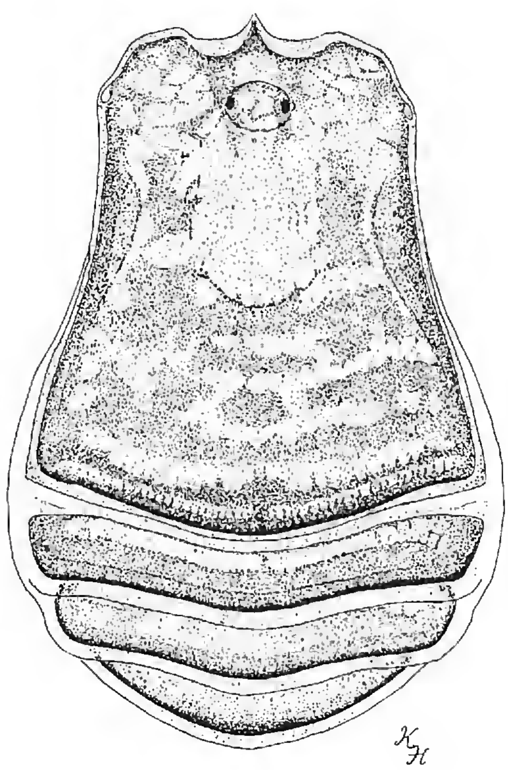

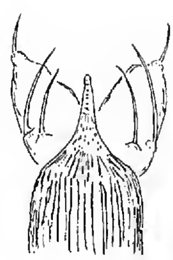

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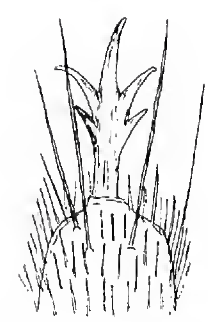

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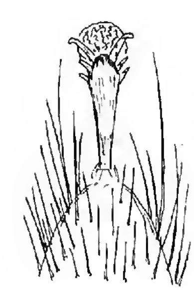

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FIGS. 29–35. *Isolachus spinosus* Briggs, new species. FIGS. 29–30. Lateral and dorsal views of female. FIG. 31. Ventral view of ovipositor. FIGS. 32–33. Lateral and dorsal views of hind claws. FIGS. 34–35. Lateral and dorsal views of juvenile hind claw.

Chelicerae without prominent tooth on fixed fingers. Palpi with robust spines, palpal femora each with prominent anterodorsal spine.

Tarsal formula 5 to 6-13 to 15-4-4. Legs, including tarsi, darker than body. Tarsal claw of hind legs with nearly equal distal branches.

Ovipositor with narrow ventral lobe.

MALE.—Unknown, may not exist.

JUVENILES.—Integument without dark pigment.

Holotype female, 1 MILE SOUTH SADDLE MOUNTAIN STATE PARK, CLATSOP COUNTY, OREGON, 7 August 1967, T. Briggs and A. Jung.

OTHER LOCALITIES.—Oregon. Clatsop County: 1 mile south Saddle Mountain Park, 5 September 1970, T. Briggs, K. Hom, R. Lem, and W. Lum. Columbia County: 5.5 miles south Clatskanie, 8 August 1967, T. Briggs. Washington. Grays Harbor County: 6.8 miles south Neilton, 22 June 1966, T. Briggs, V. F. Lee, A. Jung, and K. Hom. Lewis County: Rainbow Falls State Park, 25 August 1969, T. Briggs.

ACKNOWLEDGMENTS

I wish to thank the members of the Galileo Science Club who helped conduct the field investigations. Art work and curation was performed by Kevin Hom and Robert Lem drew the map.

FIRST INTERNATIONAL CONGRESS OF SYSTEMATIC AND EVOLUTIONARY BIOLOGY

The Society of Systematic Zoology and the International Association for Plant Taxonomy have joined forces to develop this first opportunity for botanical/zoological interaction at the international level. The University of Colorado (Boulder, Colorado) has extended a gracious invitation to meet on that campus 4–11 August *1973*. The diversity of ecological situations in the surrounding countryside makes this one of the most attractive sites in North America, both aesthetically and scientifically. The presence of experienced, enthusiastic biologists on that campus also provides an indispensable ingredient for the success of this Congress.

To begin the planning phase, two committees have been appointed by the sponsoring organizations, a Steering Committee and an International Advisory Committee. The Steering Committee will be the principal organizing group. The International Committee will provide valuable advice and guidance in the development of the Congress and it is recognized by the International Union of Biological Sciences as the special working group responsible for this event.

Program plans at this point encompass interdisciplinary symposia and contributed paper sessions. The botanists will not convene a nomenclatural section but a zoological one on this subject is anticipated. In the next few months the outline of the program and other activities will begin to take form. All suggestions will be gratefully received, carefully considered, and as many adopted as practical or feasible. Correspondence may be addressed to any member of the Steering Committee (e.g., Dr. Paul D. Hurd, Jr. (Co-Chairman, Program Committee) Department of Entomology, Smithsonian Institution, Washington, D. C. 20560) but preferably to the Secretary: Dr. James L. Reveal, Department of Botany, University of Maryland, College Park, Maryland 20740.

New and Little Known Micropezidae from the Western United States[1]
(Diptera)

RICHARD W. MERRITT[2]
Washington State University, Pullman

Two new species and the previously unknown male of the third are being described here in order to include them in a paper to be submitted for publication in the California Insect Survey Series.

Compsobata (Trilophyrobata) jamesi Merritt, new species
(Fig. 1)

MALE.—Head mainly black; frontale yellow immediately above bases of antennae; narrow parafrontal, whitish yellow posterior to base of antenna, gradually darkening to black on posterior half; face and bucca pale yellow; posterior oral margin brownish; parencephalon and occiput black with narrow oral margin brownish; proboscis brownish; palpus yellow; antenna yellow, arista black, sparsely pubescent basally. Entire head covered with cinereous pollen; mesofrons appearing velvety black with ocelli standing out against dark background; silvery reflection on epicephalon adjacent to eye; yellowish pile on face, proboscis and occipital region. Thorax wholly black; largely cinereous pollinose, most of pteropleuron, and mesonotum except broad anterior and lateral and narrower prescutellar margins, polished and shining; pile on thorax yellowish, bristles black. Halter yellowish white. Wing yellowish hyaline; veins pale yellow. Posterior cell open. Legs chiefly yellow; middle and hind coxae brownish black; tarsal claws black at tip. Coxae cinereous-pollinose, legs otherwise subshining. Abdomen black except fulcrum and apical three-fourths of claspers, which are yellow; genital structures pale brown. First abdominal tergum cinereous pollinose, second only basally, sixth, seventh, and ninth sparsely cinereous. Hairs on terga yellowish. Claspers of male (Fig. 1) arising from fourth and fifth abdominal sterna; terminal lobe partially flattened and somewhat reniform with caudal lobe; fulcrum distinctly bilobed, distance between lobes subequal to width of lobe. Hairs on claspers yellow. Length 6.3–6.6 mm (Holotype—6.5 mm).

FEMALE.—Antenna tawny; ovipositor cylindrical and broad, flattened apically, not auriculated at base. All terga including ovipositor shiny. Otherwise, except sexually, like male. Length 5.7 mm excluding ovipositor, ovipositor 1.4 mm.

Holotype male, NAHCOTTA, PACIFIC COUNTY, WASHINGTON, 14 June 1953 (Trevor Kincaid). Allotype, same data but collected on 31 May 1953. (Type and allotype deposited in the Maurice T. James Entomological Collection at Washington State University.) Paratypes: three

[1] Scientific Paper No. 3544, College of Agriculture, Washington State University, Pullman, Washington. Work conducted under Project 9043.

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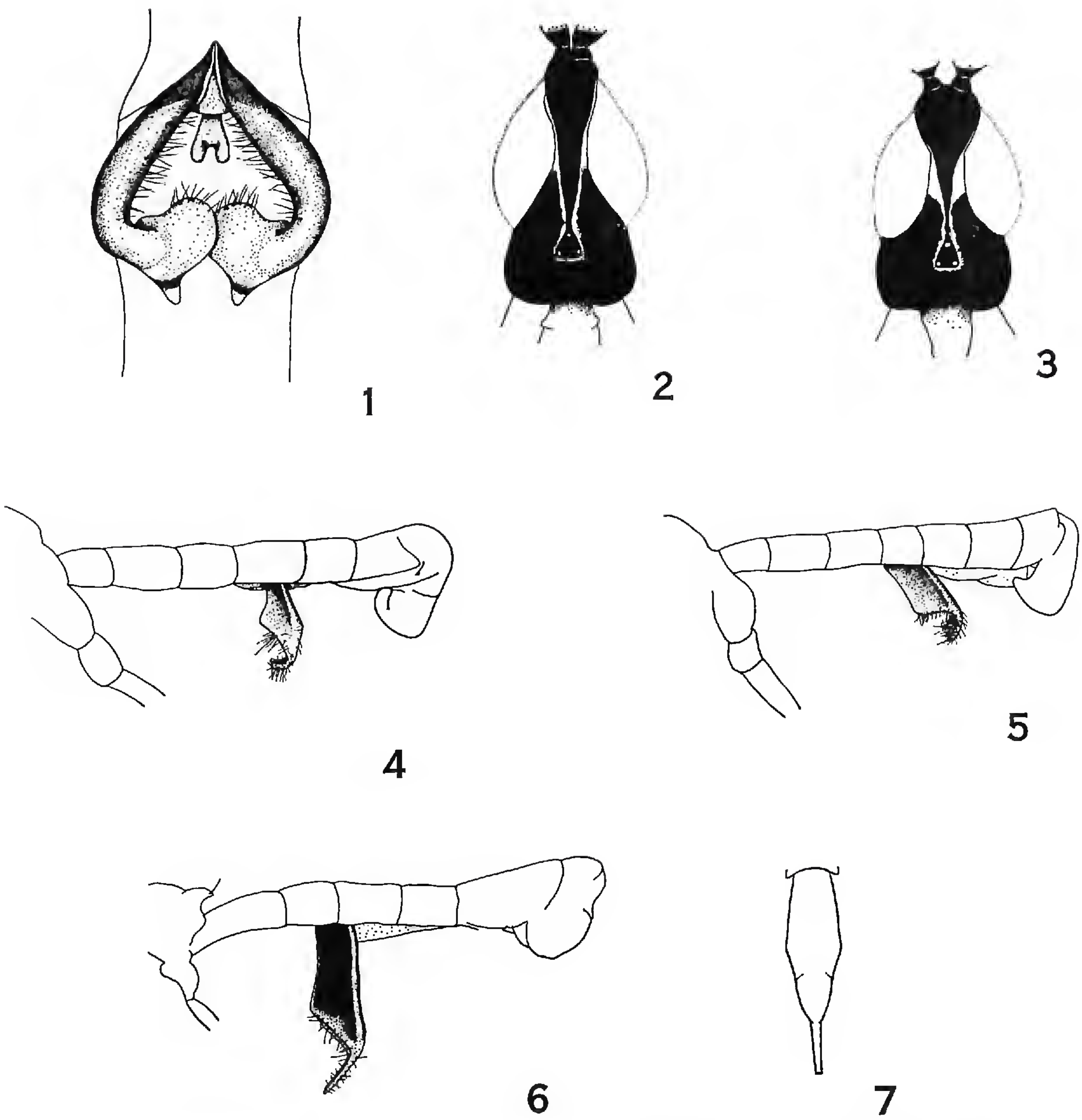

FIG. 1.—*Compsobata* (*Trilophyrobata*) *jamesi* Merritt, n. sp., ventral view of claspers. FIG. 2.—*Micropeza* (*Micropeza*) *unca* Merritt, n. sp., dorsal view of head, showing color pattern. FIG. 3.—*Micropeza* (*Micropeza*) *setaventris* Cresson, dorsal view of head, showing color pattern. FIG. 4.—*Micropeza* (*Micropeza*) *unca* Merritt, n. sp., lateral view of male abdomen, showing claspers. FIG. 5.—*Micropeza* (*Micropeza*) *setaventris* Cresson, lateral view of male abdomen, showing claspers. FIG. 6.—*Micropeza* (*Micropeza*) *atra* Cresson, lateral view of male abdomen, showing claspers. FIG. 7.—Subfamily Micropezinae, dorsal view of generalized ovipositor.

males, same data as holotype except 10 May 1953, 20 May 1954, and 23 May 1954; one male, Marietta, Whatcom Co., 18 June 1944 (R. D. Shenefelt). One in California Academy of Sciences, one in United States National Museum, and two in M. T. James Entomological Collection at Washington State University. Two additional males and one female from the type locality were not included in the paratype series because of imperfections.

DISTRIBUTION.—This species has been found only in the coastal areas of Washington.

DISCUSSION.—The males of *C. jamesi* can be separated from other males by a U-shaped fulcrum with two distinct lobes (Fig. 1). I examined only one female, the allotype. In this specimen the ovipositor was deformed. It appears to be of the type of *Compsobata mima* (Hennig), subcylindrical and not auriculate basally. The pollinose mesopleura ($AEPS_2$) will distinguish both sexes of *C. jamesi* from those of *C. mima.*

Micropeza (Micropeza) unca Merritt, new species

(Figs. 2–5)

MALE.—Head black and yellow; narrow parafrontal yellow, becoming black upon reaching epicephalon; latter black with dark inner margins gently bowed toward eye (Fig. 2); frontale not differentiated; mesofrons black; ocellar spot black except adjacent narrow margins which are yellow; face and bucca pale yellow to almost white; parencephalon and occiput black with oral margin pale yellow; proboscis pale yellow; palpus dark brown; antenna black, arista white, brownish at extreme base, sparsely pubescent. Head shining and polished; mouth and occipital region with some black and yellow hairs; inner and outer vertical bristles black. Thorax black and yellow with some variation in the pleura; mesonotum black except for large orange to yellow notopleural stripe and supraalar margin which varies from dark to pale; propleuron pale to dark; humerus pale; sternopleuron either pale on dorsal three-fourths of surface and black ventrally or brownish black on dorsal one-third, then pale sternopleural stripe and black ventrally. Mesopleuron generally brownish with some pale markings ventrally; pteropleuron dark with pale markings; prosternum whitish, meso- and metasternum black; all other areas of thorax brown to black. Sclerites of thorax dull and cinereous-pollinose; ventral margin of sternopleuron with bristles or bristle-like setae in about three irregular rows; bristles of thorax black. Halter yellow. Wing brownish hyaline, veins brown. Posterior cell open. Coxae and femora yellow; tibiae very pale brown; tarsi brown; apical flexor spot on each femur and apices of tibiae dark. Legs subshining with black hairs. Abdomen chiefly black; terga pale at posterior and lateral margins; seventh and ninth terga pale with few dark markings; sterna blackish except pale lateral margins. Genital structures brownish. Claspers yellowish white, arising from fourth and fifth abdominal sterna and extending slightly basad of apex of tergum II; narrower at base than toward middle, consisting of elevated ridge on posterior margin, terminating in curved digitate process (Fig. 4). Abdomen cinereous pollinose with ninth tergum shining; lateral margins of sterna bearing black setae. Length 6.0–6.6 mm (Holotype 6.2 mm).

FEMALE.—Similar to male in most respects except for the following: bristles and setae on ventral margin of sternopleuron reduced in size and number; front femur usually with dark markings on apical two-fifths. Abdominal sterna brownish with long marginal setae present; ovipositor black and slender tapering towards apex. Length 6.0–7.0 mm including ovipositor. (Allotype 5 mm excluding ovipositor, ovipositor 1.2 mm.)

Holotype male and allotype, DAVIS, YOLO COUNTY, CALIFORNIA, 23 April 1953 (J. C. Hall). (Type and allotype deposited in collection at

University of California at Davis.) Paratypes: three females, same data as holotype; one female, Mt. Diablo, Contra Costa Co., July 1937 (M. A. Cazier); one female, Sespe Cyn., Ventura Co., 10 July 1959 (F. D. Parker); one male, Stanford University, Santa Clara Co., 20 June 1910 (R. W. Doane). Two deposited in the University of California at Davis, two in the M. T. James Entomological Collection at Washington State University, one in the American Museum of Natural History, and one in California Academy of Sciences. Additional specimens were not included in paratype series because of imperfections.

DISTRIBUTION.—This species is known only from California.

VARIATION.—The maxillary palpi vary from pale to dark brown.

DISCUSSION.—Cresson (1938) apparently failed to note the difference in male claspers in specimens of *Micropeza setaventris* Cresson from California. There is a similarity but upon close examination one can see that the claspers of *M. unca* (Fig. 4) are remarkably different from those of *M. setaventris* (Fig. 5). Also, the inner margin of the dark area on the epicephalon is only gently bowed in *M. unca* (Fig. 2) as opposed to being bent anteriorly at a distinct acute angle in *M. setaventris* (Fig. 3). The sternites of the female do not possess strong black marginal setae. For these reasons I am referring those specimens to a new species, *Micropeza unca.*

MICROPEZA (MICROPEZA) ATRA Cresson

(Figs. 6, 7)

Micropeza atra Cresson, 1938, Entomol. News, 49: 74. Type ♀, Flagstaff, Coconino County, Arizona (U. S. Nat. Mus., no. 27059).

The males of this species have not been previously described. I examined four male specimens from Bear Valley, Iron County, Utah, which could not be referred to any species I had studied to date. After checking the range and description of *M. atra* females I am considering the Bear Valley specimens to be the males of *M. atra.*

MALE.—Head entirely black except for whitish to pale yellow on anterior part of epicephalon between eyes, narrow oral margin, face, and bucca. Proboscis with fleshy labella white and haustellum brown; palpus yellowish brown; antenna black; arista black at base, otherwise yellowish, sparsely pubescent. Head shining and polished, except small cinereous postocellar area appearing as silvery reflection; proboscis with black and yellow hairs; occipital region sparsely pubescent; bristles of head black. Thorax wholly black except for whitish conjunctival area of prosternum; prosternal plate off-white to gray; sclerites mostly cinereous pollinose and subshining; area of humeri shining. Halter yellowish white. Wing brownish hyaline, veins brown. Posterior cell open. Front coxa pale yellow to almost white, mid and hind coxae tawny; fore femur largely brownish black, pale basally; mid and hind femora orange-yellow and dark at apices; tibiae and tarsi blackish. Legs subshining with black hairs. Abdomen completely black except for brown genital structures, and pale margins of claspers and digitate processes at terminal end of claspers. Abdomen chiefly cinereous pollinose and dull, postabdominal area may be subshining. Claspers (Fig. 6) large and broad, easily attaining base of abdomen. Digitate processes long and bent anteriorly. Length 5.5–5.8 mm.

DISTRIBUTION.—This species has been recorded from Arizona, Utah, and New Mexico. Specimens examined: NEW MEXICO: Jemez Mts., Sandoval County, 29 May 1914, 1 female; UTAH: Bear Valley, Iron County, 9 June 1966 (G. F. Knowlton) (three males in Utah State University collection, one male in M. T. James Entomological Collection at Washington State University).

Cresson (1938) speculated that the claspers of the male of *M. atra* would probably be short, of the type of *Micropeza lineata* Van Duzee, but they are large and of the type found in the *Micropeza compar* Cresson complex (Fig. 6). The open first posterior cell, large dark claspers, and the tapering ovipositor which is pointed at the tip (Fig. 7) will differentiate *M. atra* from any other species. Cresson (1938) keys *M. atra* out in two separate places on the basis that an indistinct notopleural stripe is sometimes present. After examining all specimens available I do not think this is a valid observation and therefore conclude that the thorax is black without a pale notopleural stripe.

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CRESSON, E. T., JR. 1938. The Neriidae and Micropezidae of America north of Mexico (Diptera). Trans. Amer. Entomol. Soc., 64: 293–366.

BOOK NOTICE

ECOLOGY, BEHAVIOR, AND ADULT ANATOMY OF THE ALBIDA GROUP OF THE GENUS EPICAUTA (COLEOPTERA, MELOIDAE). By Richard B. Selander and Juan M. Mathieu. University of Illinois Press, Urbana, Chicago and London. Illinois Biological Monographs, No. 41. Pp. [6+] 168, 60 figs., 27 tables. 7 July 1969. $5.95 paperbound.

This is another of the well illustrated, finely written and fully documented papers resulting from Richard Selander's life-long fascination by meloid beetles, and the interest engendered in his students. The title is explanatory, but does not indicate the tremendous amount of field and laboratory work involved, in this case supported in part by grants from the National Science Foundation (Selander) and the Rockefeller Foundation (Mathieu). There is a key to the species on pp. 106–107, followed by a concise Synonymy and Locality Records.—HUGH B. LEECH, *California Academy of Sciences, San Francisco 94118.*

Notes and New Species of Limnephilid Caddisflies from Idaho

(Trichoptera: Limnephilidae)

STAMFORD D. SMITH

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While re-examining several collections in preparation for an annotated list of Idaho Trichoptera, some previously undescribed species were found. Also, a nomenclatorial change is necessary for a species that I recently described. This paper presents descriptions and figures of the new species of Limnephilidae and makes the appropriate name change. I wish to express my appreciation to Dr. W. F. Barr, University of Idaho, for reading the manuscript, and to Dr. R. J. Boles, Central Washington State College, for his assistance with the illustrations.

ARCTOPORA SALMON (Smith) new combination

Lenarchulus salmon Smith, 1969, J. Kansas Entomol. Soc., 42: 50.

Since I described this species it has been brought to my attention that Schmid (1952) was in error in erecting the genus *Lenarchulus* for *Phryganea trimaculata* Zett. My species (*salmon*) should have been described in the genus *Arctopora* because of generic synonymy.

Limnephilus loloensis Smith, new species

(Figs. 1–6)

This species is a member of the *harrimani* complex, most closely related to *L. gioia* Denning. Adult males can be separated from other members of this complex by the nearly straight mesal margin of the cerci when viewed dorsally, the shortened tenth abdominal tergite, and the recurved apices of the lateral arms of the aedeagus.

MALE.—Length 18 mm. Dorsum of body mottled with light and dark; head and thorax dark brown to black, abdomen and wings light brown, legs with coxae and femora dark, paling to light brown distally; front wings with hind margins with dark irregular markings, somewhat irrorate, veins with dark spots most distinct on posterior veins, but costa, subcosta, and radius 1 without any such maculations; individuals appear darker dorsally, fading ventrally when wings folded at rest; first basitarsus distinctly longer than second tarsal segment; antennae light brown; major setae of frontal area dark brown, remaining major setae of head and thorax light brown to pale yellow; wings with small, sparse setae.

Genitalia as in Figs. 1–4. Eighth abdominal segment with medium-sized distinct pale setae on posterior half, bases of setae giving posterior portion of tergum

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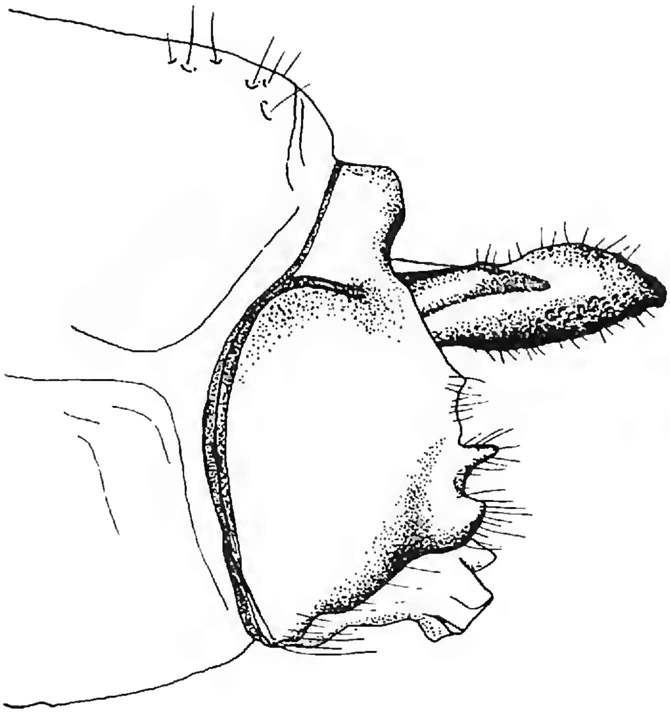

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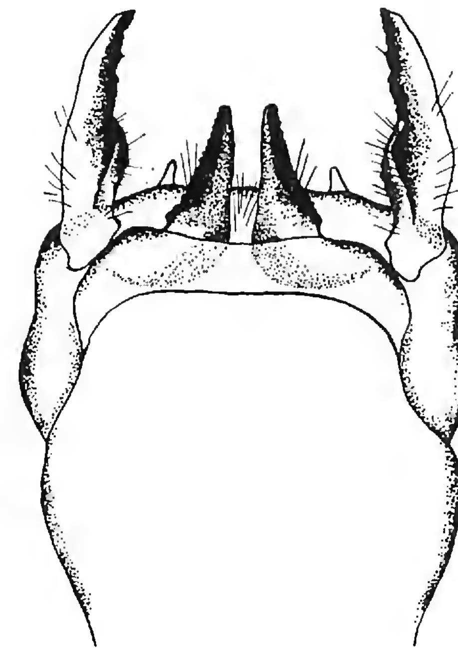

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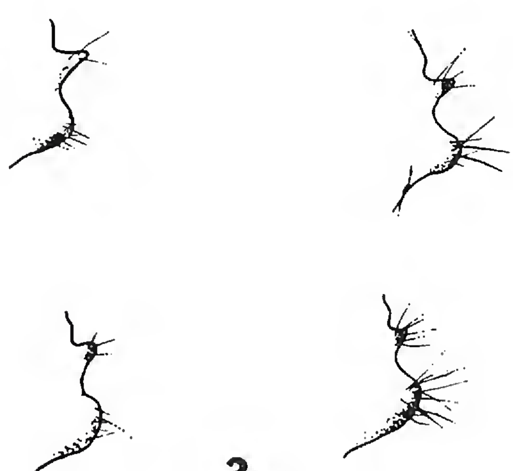

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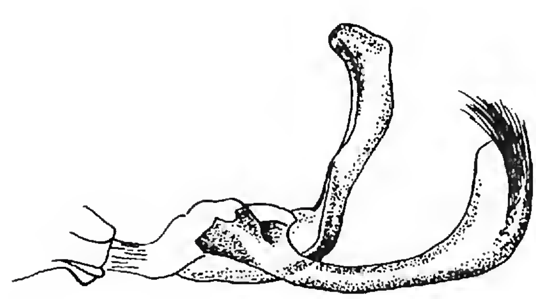

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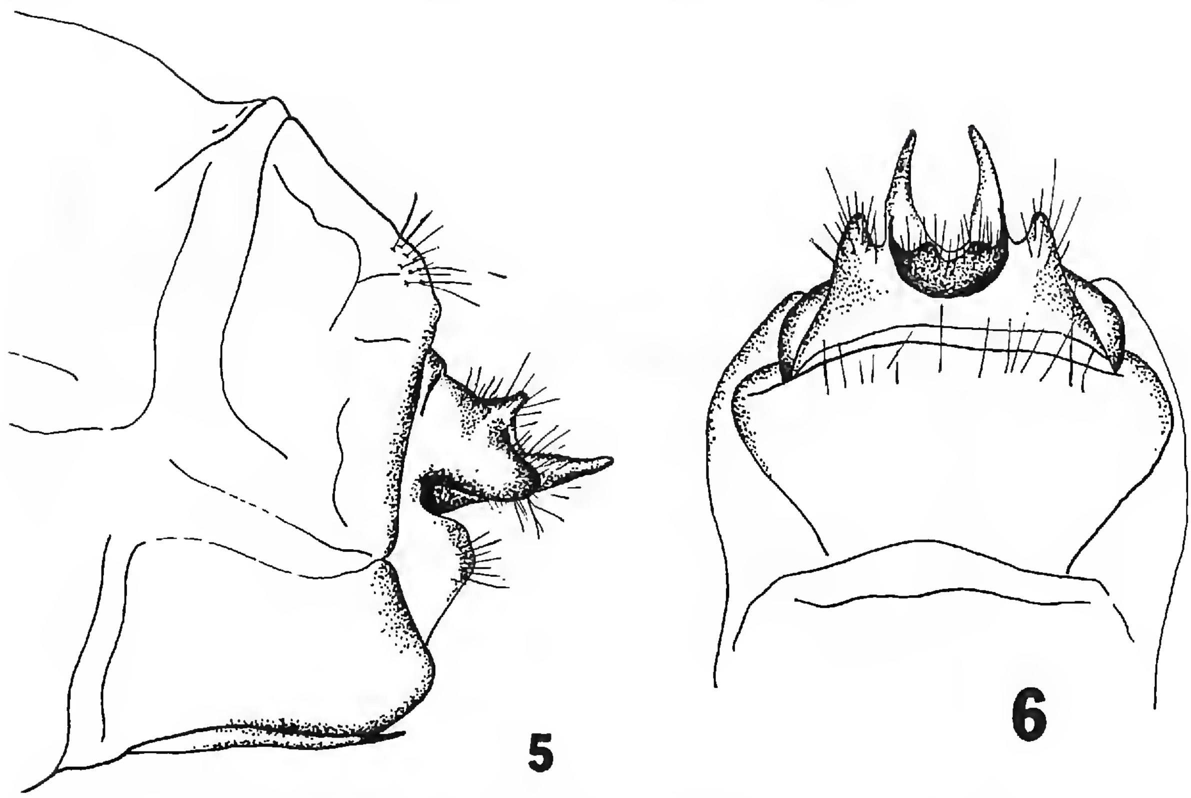
FIGS. 1–4. *Limnephilus loloensis* male genitalia. FIG. 1. Lateral view; FIG. 2. Dorsal view; FIG. 3. Variation of claspers; FIG. 4. Aedeagus, lateral view.

and sternum a slightly warty appearance; eighth tergum without dense patch of short setae. Ninth abdominal segment robust, somewhat expanded laterally giving it more or less bulbous appearance, widest near lateral line; ninth tergum relatively broad, but distinctly narrowed strap with dorsal midline sunken giving posterior margin a slightly emarginate appearance in dorsal view. Cerci elongate, somewhat lanceolate; apical half slightly expanded dorsally; mesal surface roughly spatulate, dish-shaped surface with dense, small, dark irregular tubercles; dorsal and ventral margins of apical half of cerci irregular, dorsomesal margins nearly straight, parallel, slightly irregular in dorsal view. Tenth abdominal tergite short, approximately one half as long as cerci; triangulate in lateral view, apices acute; covered with many small, dark tubercles, black along ventral margin and at apex. Claspers



FIGS. 5–6. *Limnephilus loloensis* female genitalia. FIG. 5. Lateral view; FIG. 6. Dorsal view.

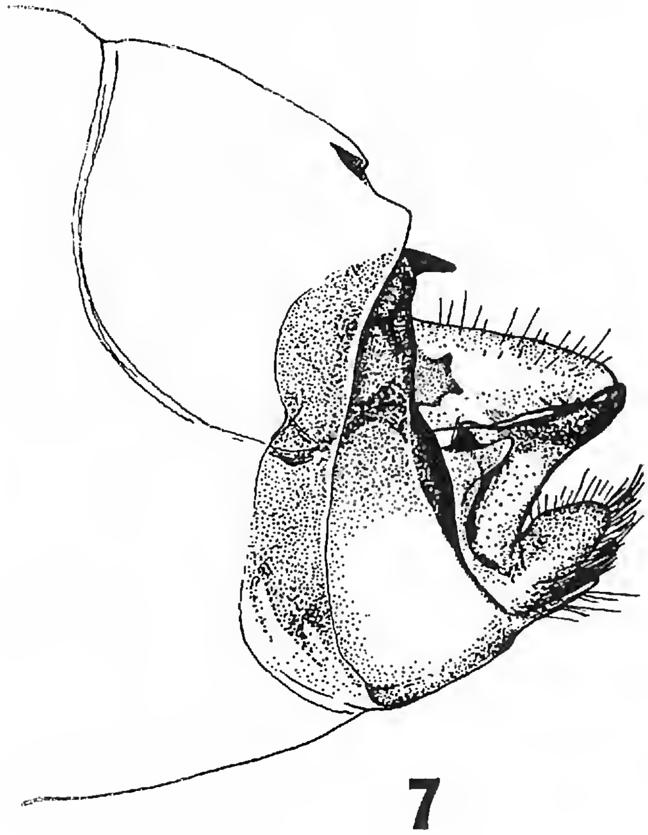
fused with ninth segment, projecting portion hirsute with posterior margin roundly emarginate forming dorsal and ventral lobes, dorsal lobe narrow and acute, ventral lobe slightly shorter and broadly rounded; clasper shape variable (Fig. 3). Aedeagus sclerotized, tubular, expanded at apex, apical portion recurved; lateral arms of aedeagus sclerotized, apical portions recurved, widest at curve; apices hispid, surmounted by many heavy spines.

FEMALE.—Length 12 mm. Smaller than holotype but similar in general appearance. Head, thorax, and abdomen uniform golden brown color, somewhat paler than male; spines on tibia and tarsi dark brown to black; wing coloration same as in male. Genitalia as in Figs. 5–6.

Holotype male, LOLO PASS, IDAHO COUNTY, IDAHO (at Idaho-Montana state line) elev. 5,187 feet, 14 August 1964, Richard Roberts. Deposited in California Academy of Sciences collection.

Allotype, same data as for holotype. The holotype and the allotype were a mating pair. Deposited in California Academy of Sciences collection. Paratypes: 3 males, 12 females, Lolo Pass, Idaho County, Idaho (at Idaho-Montana state line) elev. 5,187 feet, 28 July 1964, S. D. Smith (046); 1 male, 15 mi. w. Lolo Pass, Idaho County, Idaho, 16 July 1966, Donald S. Horning, Jr., attracted to white light. Deposited at University of Idaho and author's collection.

There is considerable size variation in this species. Males in the type series ranged from 12 mm to 16.5 mm; females ranged from 10.5 mm to 15 mm in length from head to wing tip.



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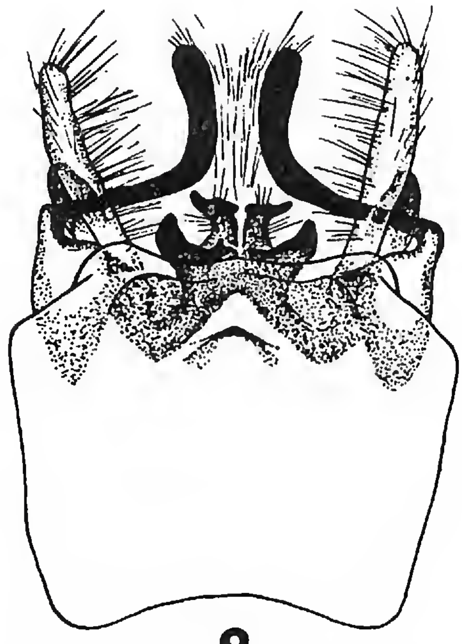

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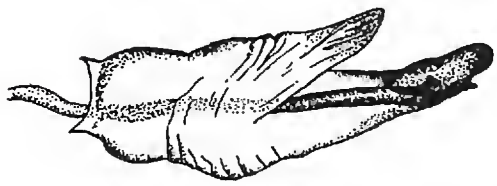

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FIGS. 7–9. *Homophylax auricularis* male genitalia. FIG. 7. Lateral view; FIG. 8. Dorsal view; FIG. 9. Aedeagus, lateral view.

Homophylax auricularis Smith, new species

(Figs. 7–9)

This species belongs to the *flavipennis-acutus* complex and is most closely related to *H. flavipennis* Banks. It can be distinguished from other species in the genus by the shape of the tenth abdominal tergum with its short, broad ventral arms, by the cerci that extend posteriorly approximately as far as the aedeagus shield, and by the large aedeagus shield with its evenly narrowed apex, and by other features of the male genitalia. *Homophylax auricularis* belongs to Group II of Denning (1964) and would key out in Couplet 3 of his key to species.

MALE.—Head, thorax, and abdomen uniformly light brown to straw color, no distinct markings. Spurs 1-3-4. Forewing light brown, no distinct markings, basal portion of radial vein somewhat darkened; distinct narrow, semicircular flap present, arising as base of medial vein; radius large and distinct; subcosta and radius covered by semicircular flap, with single row of 5 to 10 stout black spines; underside of flap and scent pocket densely lined with scales, many short scales at base of costa and subcosta; anal area reflexed; underside of wing below flap with dense scales, long scales between costa and subcosta at base (oval scent pocket).

Hind wing with long, distinct furrow between subcosta and radius without scales; medial-cubital furrow deep, lined with small scales, many small spines which are very dense in the basal one-quarter of the wing, no spines in apical half of wing furrow. Transverse carina of sixth and seventh abdominal sterna with few spines. Eighth tergum with moderately sclerotized median carina, carina small but distinct; eighth tergum brown, slightly darker and more heavily sclerotized than eighth sternum, eighth tergum only slightly sclerotized on posterior lateral margins.

Genitalia as in Figs. 7–9. Ninth abdominal segment with sparsely scattered fine setae; dorsal strap of ninth tergum well sclerotized; in lateral view segment widest ventrally with short rounded projection of posterior margin starting near ventral margin of cerci as a continuation of margin of ninth sternite; ninth sternite wider than widest part of ninth tergum. Cerci large, extending caudally about as far as aedeagus shield; subtriangular; dorsal margin in lateral view slightly convex, apices narrowly rounded, ventral margin nearly straight; cerci with long fine setae on lateral and mesal surfaces, the most prominent hairs on dorsal margin and on dorsal one-third of mesal surface. Basal sclerite directed dorsocaudally, heavily sclerotized; in lateral view subtriangular, dorsal margin slightly concave, ventral margin convex; dorsal surface produced mesally to form a shelf-like structure; in dorsal view tooth-shaped, outer margin convex, mesal margin concave, apices rounded. Clasper in lateral view thumb-like, apical half with long fine setae; claspers fused on meson into narrowly rounded emargination; mesal portion of clasper forming flange around base of aedeagus. Aedeagus shield large, directed dorsocaudally, dorsal and ventral margins nearly parallel, dorsal margin slightly longer than ventral margin, apex evenly narrowed; long fine setae on mesal surface; dorsal margin and apex black. Tenth tergite with lateral plates closely appressed, appearing partially fused; dorsal and ventral prongs black, heavily sclerotized; dorsal prongs single, short, acutangulate in lateral view, broader in dorsal aspect; in dorsal view prongs divergently arcuate, apices directed caudad; ventral arms small, divergent, directed laterocaudad, with very small knob dorsally at base. Aedeagus typical for group, simple, very similar to that of *H. acutus*.

FEMALE.—Unknown.

Holotype male, BEAR, ADAMS COUNTY, IDAHO, 15 August 1951, A. J. Walz. Deposited in California Academy of Sciences collection.

Paratype: male, same data as holotype. Deposited in author's collection.

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Some Alaskan Stoneflies

(Plecoptera)

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Portland, Oregon 97202

Kenneth Goeden of the Oregon State Department of Agriculture and I spent a week in Alaska during 1968 collecting insects at several locations along highways between Anchorage and the vicinity of Eagle on the Steese Highway east of Fairbanks. We collected 18 species of stoneflies, including an undescribed species of *Nemoura* and several others of special interest. Since few stoneflies have been recorded from this section of Alaska, I am presenting all of the records in this paper.

I am indebted to Dr. William E. Ricker for confirming my identifications for *Chloroperla ovibovis* and the new *Nemoura* and to Alan V. Nebeker for the drawings. Financial assistance for carrying on some of the research upon which this paper is based was provided by the National Science Foundation (Grant NSF-GB-3726).

PTERONARCELLA BADIA Hagen

Mendeltna Creek, Glenn Highway, 30 June 1968, 5 males, 3 females, Goeden and Jewett.

Two of the males are brachypterous, the wings extending about half the length of the abdomen.

CAPNIA COLUMBIANA Claassen

Moose Creek, 8 miles east of Palmer, Glenn Highway, 29 June 1968, female, S. G. Jewett, Jr.

CAPNIA CONFUSA Claassen

Mendeltna Creek, Glenn Highway, 30 June 1968, 2 females, Goeden and Jewett; One Mile Creek, Paxson, Richardson Highway, 1 July 1968, female, Goeden and Jewett.

EUCAPNOPSIS BREVICAUDA (Claassen)

Phelan Creek, McCallum, Richardson Highway, 1 July 1968, female, S. G. Jewett, Jr.; One Mile Creek, Paxson, Richardson Highway, 1 July 1968, female, Goeden and Jewett; Creek about 7 miles east of Eureka, Glenn Highway, 30 June 1968, female, S. G. Jewett, Jr.

LEUCTRA FORCIPATA Frison

One Mile Creek, Paxson, Richardson Highway, 1 July 1968, male, 2 females, Goeden and Jewett.

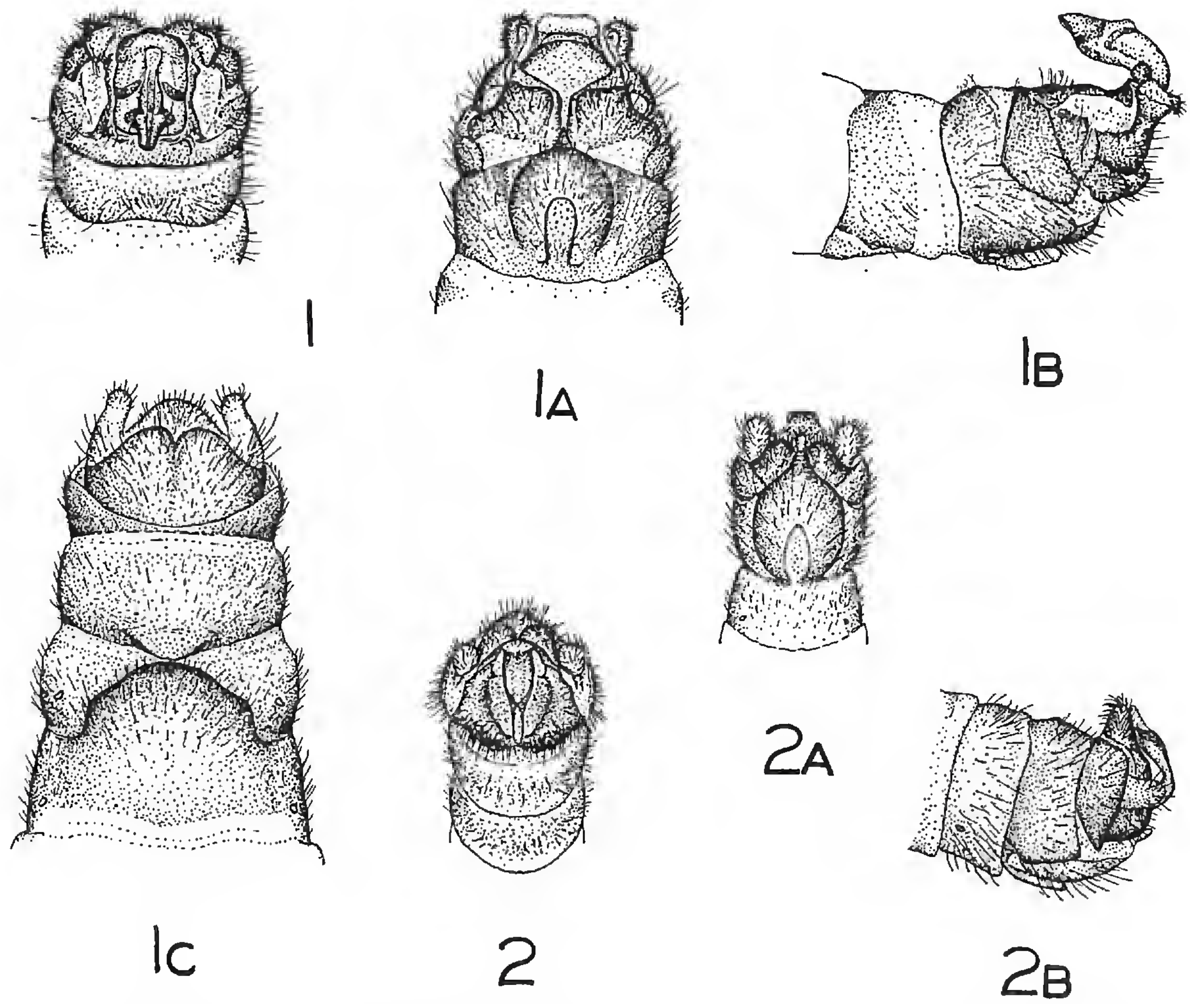

FIG. 1, *Nemoura rickeri* Jewett, male genitalia of holotype, dorsal view; 1A, ventral view; 1B, lateral view; 1C, female genitalia of allotype, ventral view. FIG. 2, *Podmosta weberi* (Ricker), male genitalia, dorsal view; 2A, ventral view; 2B, lateral view.

These specimens are smaller than material from Clatsop County, Oregon.

NEMOURA ARCTICA Ebsen-Peterson

Creek about 7 miles east of Eureka, Glenn Highway, 30 June 1968, 2 males, 6 females, Goeden and Jewett.

Nemoura rickeri Jewett, new species

Color of body and appendages dark brown, abdomen lighter than head and thorax. Wings clear. Length of body 5.5 mm for male, 6 mm for female; length to tip of wings 7.5 mm for male, 9 mm for female.

MALE.—Ninth and 10th segments heavily sclerotized. Cerci strongly sclerotized on outer surface, directed upward to lie on either side of epiproct, tips bearing an outwardly directed, sharply pointed, hairy tooth (Figs. 1 and 1A). Tenth tergite deeply incised medially; epiproct recurved, massive, rectangular, in dorsal view the blunt tip twice as long as wide, tip bluntly pointed in lateral view (Figs. 1 and 1B). Paraprocts simple, broad. Tip of ninth sternite sharply pointed; basal lobe about twice as long as wide, nearly straight-sided, tip broadly rounded (Fig. 1A).

FEMALE.—Seventh sternite produced over most of 8th by broad, rounded median plate, hairy and heavily sclerotized along its distal border (Fig. 1C); 9th sternite with small median plate extending anteriorly to margin of extended seventh sternite; eighth sternite less heavily sclerotized than seventh and ninth.

Holotype male, Cache Creek, 19 miles east of Eureka, Glenn Highway, Alaska, 30 June 1968, Goeden and Jewett. Allotype and paratype male, same data as holotype. Paratype male, creek about 7 miles east of Eureka, Glenn Highway, Alaska, 30 June 1968, S. G. Jewett, Jr. Holo- and allotype deposited in the collection of the California Academy of Sciences.

This species is similar to the rare northern European *Nemoura sahlbergi* Morton.

This species is named for Dr. William E. Ricker, eminent fishery scientist and stonefly authority.

PODMOSTA WEBERI (Ricker)

Nemoura (*Podmosta*) *weberi* Ricker, 1952, Indiana Univ. Publ., Sci. Ser., No. 18, pp. 46–47.

To Ricker's original description of this species based on females, I can now add a description of the male.

Length of body 5 mm, to tip of wings 7 mm. Color straw to brown with back of head and prothorax darkest; legs and antennae straw; wings almost clear, very lightly infuscated. Cerci short, narrow at base, globular, membranous, heavily sclerotized and beset with hairs (Fig. 2A). Tenth tergite deeply recessed medially, in lateral view, its anterior margin raised well above other abdominal segments (Figs. 2 and 2B); in dorsal view, epiproct recurved, elongated, distal half narrowed and finger-like, tip rounded (Fig. 2). Paraprocts simple, triangular, distally broadly rounded. Tip of ninth sternite bluntly pointed; basal lobe about twice as long as wide (Fig. 2A).

Plesiotype male, creek about 7 miles east of Eureka, Glenn Highway, Alaska, 30 June 1968, S. G. Jewett, Jr. Taken with 18 additional males and 3 females. Plesiotype deposited in the collection of the California Academy of Sciences.

Two additional female specimens were taken at a creek at Richardson, Alaska Highway, 2 July 1968, Goeden and Jewett.

ZAPADA HAYSI (Ricker)

Creek about 7 miles east of Eureka, Glenn Highway, 30 June 1968, female, S. G. Jewett, Jr.

Isogenus colubrinus Hagen

Tanana River at bridge north of Delta Junction, Alaska Highway, 1 July 1968, 4 males, 3 females, S. G. Jewett, Jr.

Paraperla frontalis (Banks)

Moose Creek, 8 miles east of Palmer, Glenn Highway, 29 June 1968, female, S. G. Jewett, Jr.

Utaperla sopladura Ricker

Chatanika River, Steese Highway, 4 July 1968, male, 8 females, S. G. Jewett, Jr.; same except 6 July 1968, male, female, S. G. Jewett, Jr.

Alloperla serrata Needham and Claassen

One Mile Creek, Paxson, Richardson Highway, 1 July 1968, male, female, Goeden and Jewett.

Alloperla severa (Hagen)

Chatanika River, Steese Highway, 4 July 1968, male, Goeden and Jewett; tributary of Chatanika River, Steese Highway, 4 July 1968, male, female, Goeden and Jewett; same except 6 July 1968, male, Goeden and Jewett; Mendeltna Creek, Glenn Highway, 30 June 1968, 36 males, 46 females, Goeden and Jewett.

Chloroperla ovibovis Ricker

Moose Creek, Glennallen, Glenn Highway, 30 June 1968, 7 males, 9 females, Goeden and Jewett.

This record extends the known range of this species westward from the Back River drainage in McKenzie, Canada, where the types were collected.

Suwallia pallidula (Banks)

Moose Creek, Glennallen, Glenn Highway, 30 June 1968, 2 males, female, Goeden and Jewett; Chatanika River, Steese Highway, 4 July 1968, 10 females, Goeden and Jewett.

Sweltsa fraterna (Frison)

Creek 5 miles south of Paxson, Richardson Highway, 1 July 1968, 3 females, K. Goeden.

Triznaka signata (Banks)

Mendeltna Creek, Glenn Highway, 30 June 1968, 12 males, 12 females, Goeden and Jewett; Tanana River bridge north of Delta Junction, Alaska Highway, 1 July 1968, male, S. G. Jewett, Jr.

A New *Pleocoma* from Southern California with Notes on Additional Species

(Coleoptera; Scarabaeidae)

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Although much has been written concerning the distribution and habits of the beetles of the genus *Pleocoma*, few new species have been described in recent years. Many anomalous specimens from previously unrecorded localities exist in collections, but the extreme variability of phenotypes exhibited by some species already described makes the naming of new forms from but a few specimens seem unwise. Series of both sexes are necessary from each locality to properly understand intraspecific variations in the *Pleocoma*.

In the past few winters it has been the author's good fortune to collect a large series of *Pleocoma* from Southern California which represents a new species, and to also be able to clarify somewhat the previously published status, distribution, and habits of several other local species of *Pleocoma*.

Pleocoma linsleyi Hovore, new species

(Figs. 1–3, 5)

MALE.—Form robust, broadly oblong-oval, only moderately convex, dorsum slightly flattened (Fig. 1); integument reddish brown; pubescence rich golden yellow. *Head* reddish brown, narrowly margined with piceous, clothed with long golden hairs; dorsal surface coarsely, irregularly punctate, with broad smooth area extending from lateral base of vertical horn anteriorly to apex of ocular canthus; clypeal process small, only moderately reflexed, apex with shallow, broadly obtuse notch, apical angles of notch acute, rounded; vertical horn short, sides gradually narrowed toward apex, apex with shallow, obtuse notch, apical angles of notch rounded, anterior face of horn concave medially, surface coarsely punctate, densely clothed with very long golden hairs; ocular canthi projecting forward slightly from a right angle, anterior edge sinuate, dorsal surface slightly concave, smooth, punctation light, scattered, punctures small, irregular, often setose; palpi and antennae light reddish brown, lamellae of antennae darker, scape stout, subconical, slightly produced anteriorly at apex, second segment moniliform, strongly oblate, third segment elongate, subequal or equal to scape in length, slightly reflexed, with conspicuous flattened process projecting anteroventrally and extending from near base almost to apex of segment, process most pronounced apically, fourth segment transverse with acute process, segments five to eleven distinctly lamellate, fifth segment with lamella about three-fifths as long as that of sixth segment, lamella of sixth segment more than four-fifths as long as that of seventh segment, that of

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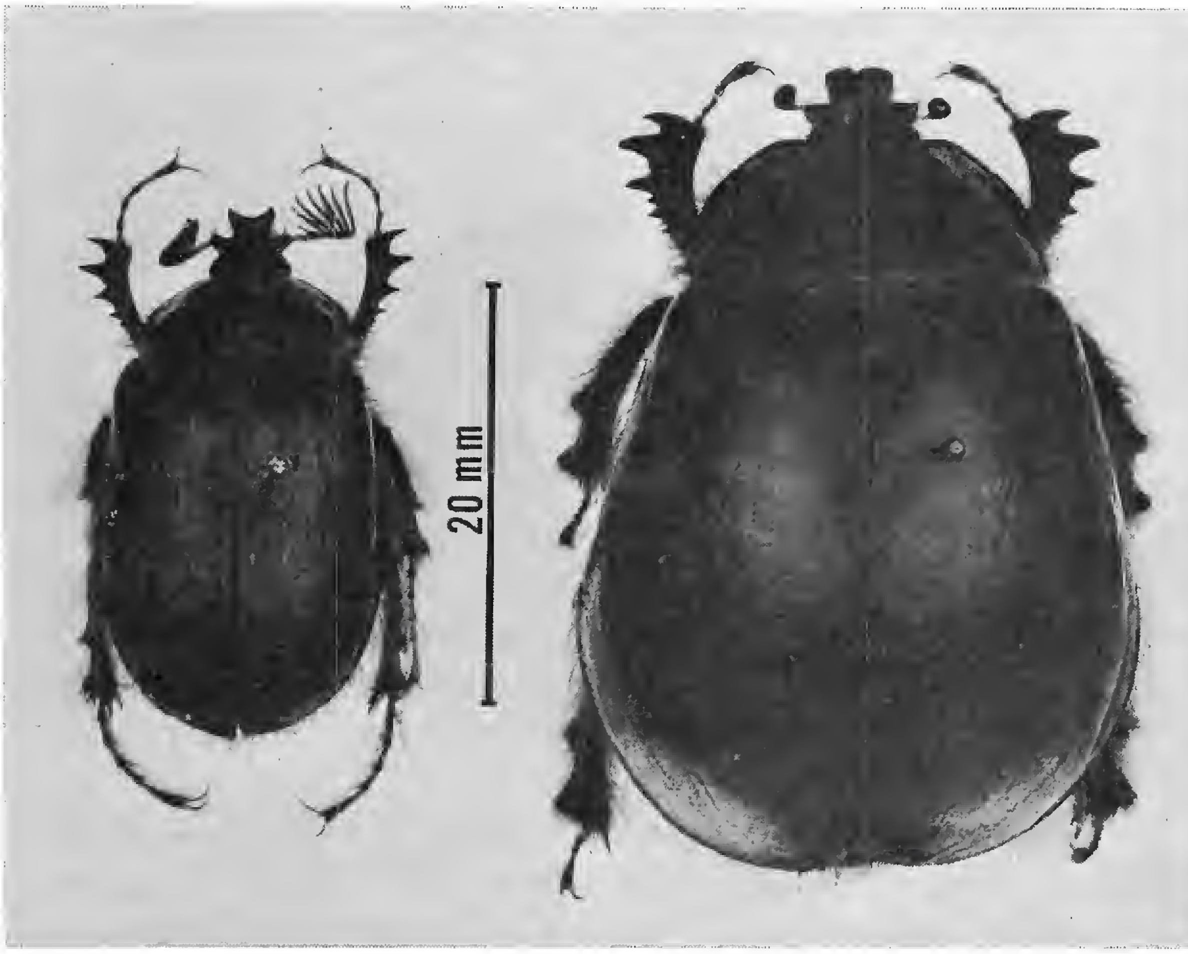

FIG. 1. *Pleocoma linsleyi* Hovore. Dorsal view, holotype male, left; allotype, right.

seventh subequal to that of eighth, that of eighth only slightly shorter than that of ninth, lamella of ninth segment longest, those of tenth and eleventh only slightly shorter than ninth, and of decreasing length, ratios of segments five to eleven in holotype male 24:40:45:46:47:45:44 (Fig. 2). *Pronotum* approximately twice as wide as long, barely widest at posterior angles, posterior angles broadly rounded, lateral discal impressions distinct, maculate with piceous; disc convex with feeble transverse median ridge, anterior median impression lacking, indicated only by slight flattening of discal surface and indistinct impunctate median line at anterior margin, pubescence entirely absent, surface shining, finely, moderately densely punctate, punctures coalescing anteriorly, and becoming less distinct and more widely spaced laterally. Legs dark reddish brown, densely clothed with long golden hairs. *Scutellum* finely, sparsely punctate centrally, thinly clothed with long recumbent hairs. *Elytra* rich reddish brown, transparent, shining, fairly uniformly punctate, punctures irregular in size, denser in striae, sutural striae deep, coarsely punctate, geminate striae at margins of costae distinct, deeply coarsely punctate, costae elevated, impunctate, nearly attaining elytral apices. *Abdomen* light reddish brown, sternites finely, sparsely punctate, most punctures setose. Length 23–28 mm.

FEMALE.—Form ovate, robust; color dark reddish brown; pubescence light reddish with golden reflections (Fig. 1). *Head* with clypeus coarsely, densely punctate, expanded apically, apical angles obtuse, rounded, anterior margin convex, median notch small, shallow, rounded; vertical horn very short, stout, apical notch broadly obtuse, apices rounded; antennae pale reddish brown, scape and lamellae darker,

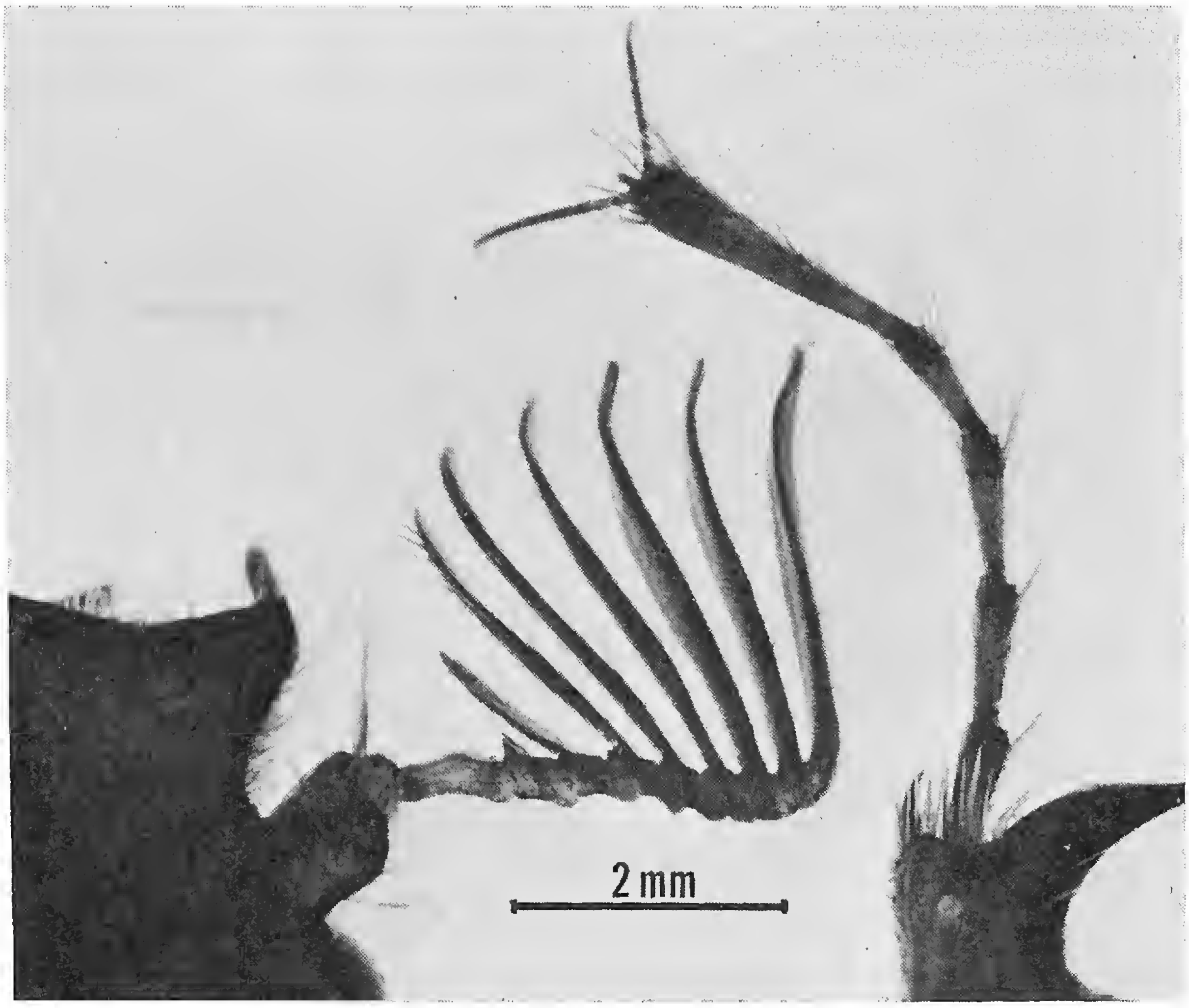

FIG. 2. *Pleocoma linsleyi* Hovore. Dorsal view, right antenna, holotype male.

third segment near apex slightly produced anteroventrally, fourth segment angulate with short, acute projection, fifth segment with short lamella, segments six to eleven lamellate, forming club. *Pronotum* convex, shining, dark reddish brown, lighter laterally, narrowly margined with piceous, slightly more than twice as wide as long, barely widest at posterior angles, posterior angles rounded, disc coarsely, irregularly punctate, punctures forming indistinct transverse rows, denser and larger anteriorly, interrupted medially by longitudinal impunctate line. *Scutellum* sparsely punctate anteriorly, few punctures with short recumbent hairs. *Elytra* widest behind middle, transparent, surface shining, finely, irregularly punctate, costae slightly elevated, with occasional minute scattered punctures, attaining apical third of elytra, sutural striae distinct, coarsely punctate, deeply impressed, geminate striae at costae, feebly impressed, finely, irregularly punctate. Length 35–40 mm.

Holotype male, OLD RIDGE ROUTE, N-2, 1.5 MI. N. SANDBERG, LOS ANGELES COUNTY, CALIFORNIA, 25 October 1969 (dug out of soil), F. Hovore, collector; (deposited in the collection of the Los Angeles County Museum of Natural History). Additional paratype males: 89, same locality as holotype, dates and collectors as follows: 14 December 1968 (F. Hovore, dug out of soil, 1; J. A. Robertson, dug out of soil, 1); 19 December 1968 (F. Hovore, dug out of soil, 1); 25 October 1969

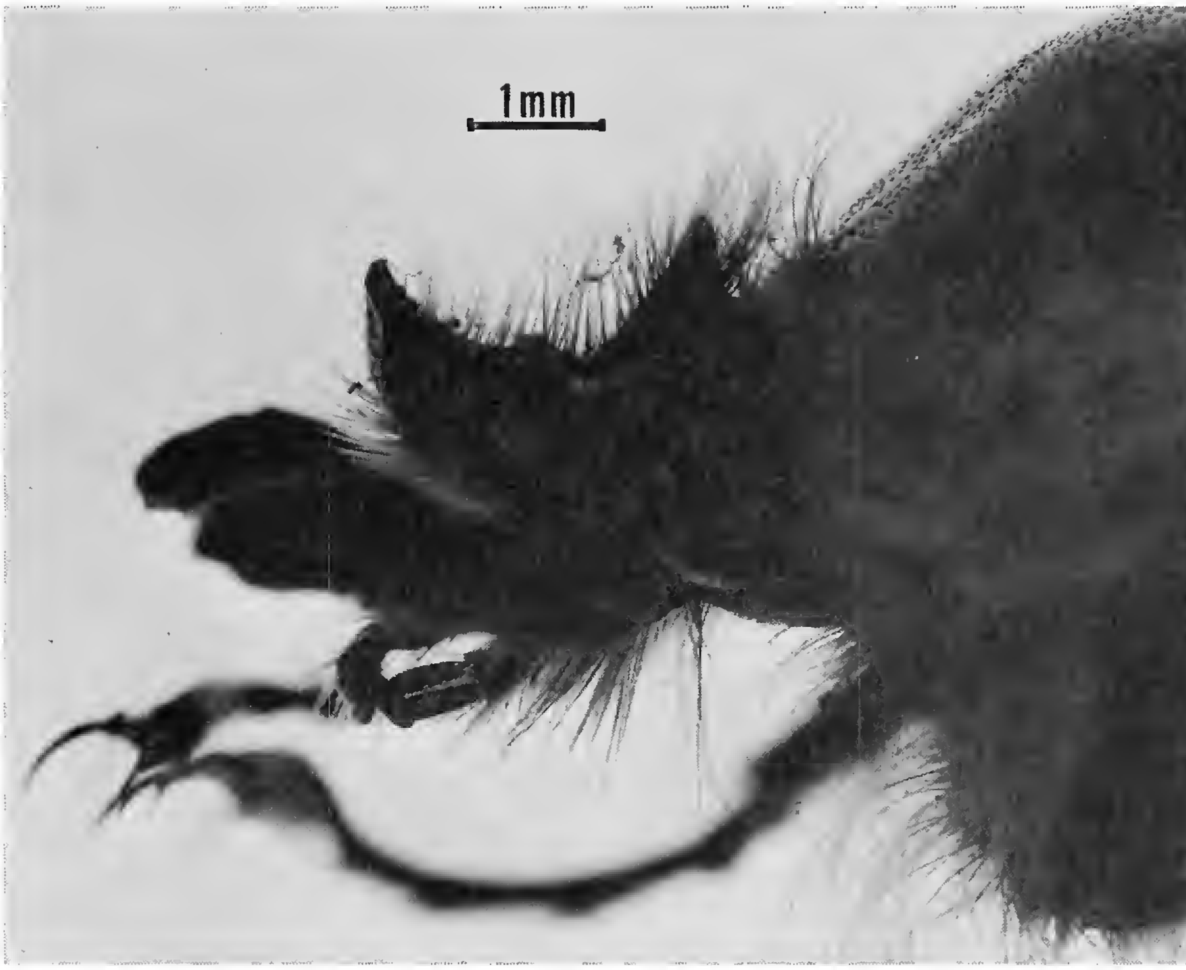

FIG. 3. *Pleocoma linsleyi* Hovore. Left lateral view of head and pronotum, male.

(F. Hovore, dug out of soil, 3) ; 31 October 1969 (F. Hovore, dug out of soil, 1) ; 15 November 1970 (F. Hovore, dug out of soil, 2) ; 1 December 1970 (F. Hovore, at blacklight, 14) ; 2 December 1970 (F. Hovore, at blacklight, 66). Allotype, same locality as holotype, 14 December 1968 (dug out of soil), F. Hovore, collector. Additional paratype females: same locality as holotype and allotype, 22 October 1970 (F. Hovore, dug out of soil, 1) ; 15 November 1970 (F. Hovore, dug out of soil, 1). Paratypes are on deposit in the author's collection; California Academy of Sciences; California Insect Survey Collection, Berkeley; Los Angeles County Museum; U. S. National Museum; J. A. Robertson collection.

Of the presently known species, *Pleocoma linsleyi* seems most closely related to *P. badia* Fall and *P. conjungens* Horn. The male differs from *P. conjungens* by the reddish brown color of the dorsal surface, less prominent basal angles of the pronotum, and larger average size (average size about 25 mm for *P. linsleyi*, 22 mm for *P. conjungens*). It is distinguished from *P. badia* by the more evenly convex, shining, less densely punctate pronotal surface, the absence of a hairy anterior pronotal impression, the greatly reduced structures of the clypeal and

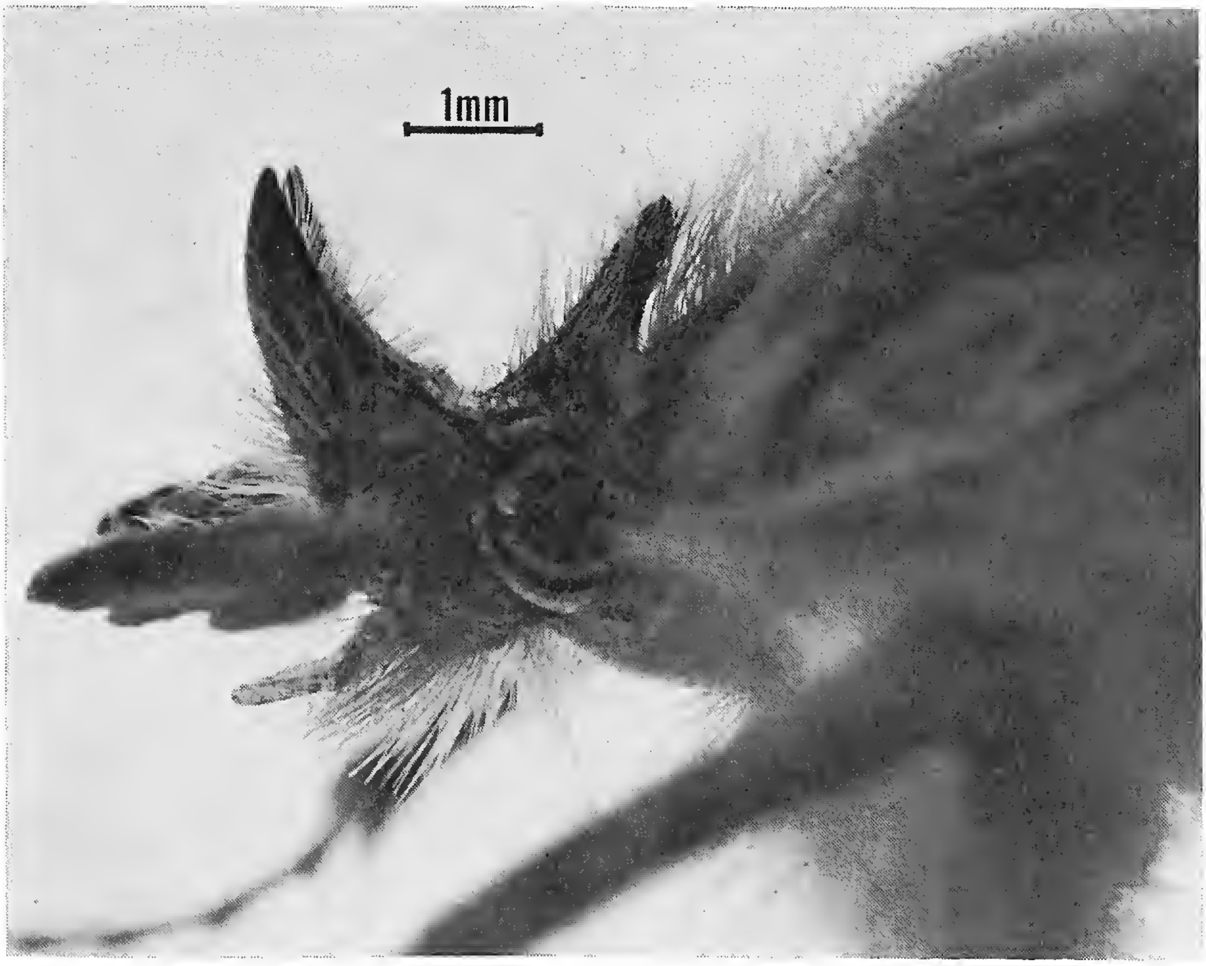

FIG. 4. *Pleocoma badia* Fall. Left lateral view of head and pronotum, male.

vertical horns (Figs. 3 & 4), the elevated elytral costae, and the flattened anteroventral process of the third antennal segment. *Pleocoma linsleyi* is the third species to have this latter character specifically noted in the literature, the others being *P. hoppingi* Fall (in Davis, 1935), and *P. octopagina* Robertson (1970). Females of *P. linsleyi* differ from those of *P. badia* by the broadly, obtusely rounded clypeal emargination, the more elevated elytral costae, the less angulate pronotal angles, the distribution and density of the pronotal punctation, and the previously discussed configuration of the third antennal segment (Figs. 5 & 6).

Within the series of males of *P. linsleyi* before the author there is a great amount of color and structural variation between individuals. The elytra range from very pale reddish brown to deep chestnut, and five examples have the pronotum clouded medially with piceous. The form of the clypeal emargination, the extent of the smooth areas on the dorsal surface of the head, the shape of the ocular canthi, and the relative lengths of the lamellae on the fifth and sixth antennal segments also exhibit a wide range of variation within the material at hand. However, the diagnostic specific characters are consistent for all the specimens.

FIG. 5. *Pleocoma linsleyi* Hovore. Dorsal view of head and pronotum, allotype female.

An additional series of thirty-nine male *Pleocoma* from Tehachapi Mountain Park, Kern County, Calif., has been made available to the author for study through the generosity of T. W. Taylor, G. Walters, and B. Streit. These specimens are clearly *Pleocoma linsleyi,* and although the sample has a slightly higher percentage of individuals with dark elytra than does the paratype series, and in all but one specimen the fifth antennal lamella is two-thirds or more as long as that of the sixth, it is the opinion of the author that separate taxonomic status for this population is not warranted. The percentage of character intergradation between the two samples is very high, as is the individual variation within each series, and on this basis it would seem inadvisable to give subspecific recognition to the Tehachapi population. Furthermore, the distance between the type locality and Tehachapi Mountain Park is only about twenty miles of relatively unbroken mountain range, and future collecting of the intervening areas may show *P. linsleyi* as having one continuous range between the two localities.

BIOLOGY.—The larvae of *P. linsleyi* feed on rootlets of *Quercus chrysolepis* Liebm., and have been taken at depths of between two and eight

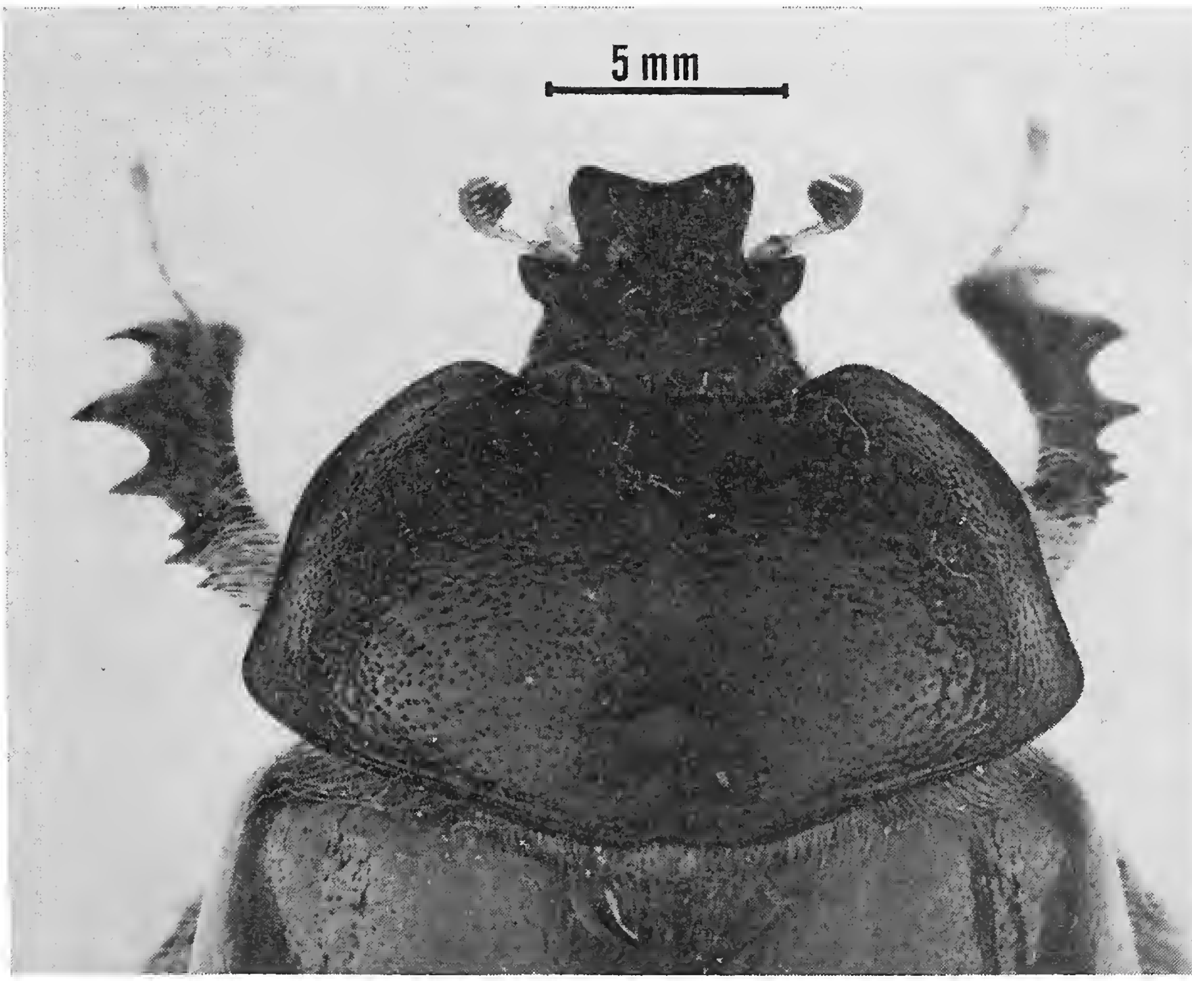

FIG. 6. *Pleocoma badia* Fall. Dorsal view of head and pronotum, female.

feet from the ground surface. Unlike most scarab larvae, some *Pleocoma* grubs are sedentary feeders, enlarging their smooth, hard-walled burrows as their body size increases. The author has taken grubs ranging in length from 13 to 60 mm; the former size probably that of first or second instars, the latter size that of nearly mature female grubs. The rootlet forms an enlarged tissue nodule at the point of larval feeding, assuring the larva of a constant food supply at the burrow. The author has also observed this type of rootlet feeding and nodule development in *P. badia* (in *Quercus*), *P. puncticollis* (in *Ceanothus*), and *P. venturae* (in *Quercus*).

Pupation probably occurs in late summer or early fall, the author having taken adults in their pupal cells as early as 22 October. Adult activity of *P. linsleyi* at the type locality appears to begin only after the area has received over three inches of rain, with the heaviest flights taking place at dawn during or shortly after a light drizzle.

Pleocoma linsleyi is preyed upon in the larval and pupal stages by a large dipteran larva, tentatively identified at the time of this writing as belonging to the family Asilidae. The author has collected these larvae from grubs and pupae of both sexes of *P. linsleyi* at the type locality, and has taken similar dipteran larvae from the immature stages of *P. badia* and *P. venturae*. The larvae usually attack the immature *Pleocoma* through the abdomen, and in severe cases the host may be totally drained of body fluid. A single larva is apparently able to parasitize more than one grub or pupa, travelling through the soil along roots and in rock fissures from one host burrow to another.

Pleocoma puncticollis Rivers

Larvae and adults of both sexes of this large black species were taken from their burrows beneath *Ceanothus* plants in Sepulveda Pass, Los Angeles Co., California, by the author in December 1969. The only previous published speculation as to the host plant of *P. puncticollis* (Hazeltine, 1952) was for the colony at Del Mar, San Diego Co., Calif., and that record was also for *Ceanothus*.

Pleocoma venturae Linsley

Pleocoma material in the Los Angeles County Museum of Natural History collection from Bee Rock, Griffith Park, Los Angeles, California (one male, one female), which once seemed referable only to *P. hirsuta* Davis of the known species (Linsley, 1941), now proves to represent *P. venturae* Linsley. This latter species was not yet known to Linsley at the time of his examination of the Bee Rock specimen (the female was apparently not in the collection at that date), and the range of *P. hirsuta* was therefore incorrectly extended. It appears that *P. hirsuta* is still known only from the type specimen from the Old Ridge Route area, and that *P. venturae*, described originally from Squaw Flat, Ventura County, has a much more extensive distribution than was previously assumed. Additional examples in the Los Angeles Museum from Glenoaks Canyon, Glendale, Los Angeles County, and specimens collected by the author and M. Gannon in La Crescenta and Tujunga, Los Angeles County, give further range extension to *P. venturae*. The author has also collected *P. venturae* from the area of the type locality, and from Glenoaks Canyon, and the samples are virtually identical within the limits of their variation, as well as agreeing with the original description and paratype material of *P. venturae*.

Pleocoma nitida Linsley

Hazeltine (1952) speculated that this species seems to require precipitation to initiate flight, and that males are not attracted to light. A series of 39 males collected at blacklights and automobile headlights by the author and D. G. Marqua 5 miles N.E. of Santa Margarita, San Luis Obispo Co., Calif., proves that *P. nitida* does indeed come to lights (the type specimen was also collected as light) (Linsley, 1941), and that it does not require immediate precipitation for flight activity since our specimens were collected approximately four hours after rain had ceased and under clearing sky conditions.

Acknowledgments

The author wishes to extend his gratitude to Dr. Charles Hogue of the Los Angeles County Museum of Natural History for advice concerning the text of the manuscript; to Mr. Lawrence Reynolds of that institution for the excellent photographs which appear in this article; and to T. W. Taylor, G. Walters, and B. Streit for their loan of specimens of *Pleocoma* to the author.

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ZOOLOGICAL NOMENCLATURE: Announcement A.(n.s.) 87

Required six-month's notice is given of the possible use of plenary powers by the International Commission on Zoological Nomenclature in connection with the following names listed by case number:

(see *Bull. Zool. Nomencl.* 27, pts. 3/4, 23 December 1970):

1733. Validation of TRYPETID—as stem of *Trypetes* (Coleoptera)

1798. Emendation to *Argiope* of *Argyope* Audouin 1826 (Aranaea)

(see *Bull. Zool. Nomencl.* 27, pts. 5/6, 29 March 1971):

195. Type-species for *Siphona* Meigen, 1803 (Diptera)

Comments should be sent in duplicate, citing case number, to the Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London SW7, England. Those received early enough will be published in the Bulletin of Zoological Nomenclature.—W. E. China, *Assistant Secretary to the International Commission on Zoological Nomenclature.*

A New Genus and New Species of Trichoptera

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Moraga, California 94556

Recent collections of Trichoptera from Montana, Oregon, and California have contained several undescribed species of unusual interest. New species of *Rhyacophila*, *Lepidostoma*, *Polycentropus*, and *Chimarra* are described. A new *Goeridae* genus and species have also been included in this paper. The new goerid genus is represented by a primitive species remarkably different from other described species. In addition, new distributional records of considerable interest are discussed. Unless otherwise designated, types are in the author's collection.

Rhyacophila cerita Denning, new species

This new species is closely related to *R. vedra* Milne. Distinguishing characters are its smaller size and the absence of a prominent medial carina on the sixth and seventh sterna. The basal segment of the male clasper is shorter and the apical segment is larger and more truncate than in *vedra*. The aedeagal structure is very different, especially the ventral structure which lacks the three setal tufts of *R. vedra*.

MALE.—Length 12–13.5 mm. Wings luteus with dark markings, pterostigma distinct, body, legs, antennae yellowish. Spurs 3-4-4. Sterna 6 and 7 bearing minute conical carina. Genitalia (Fig. 1). Ninth segment massive and greatly elongated, similar in shape to *R. vedra*, but not curved dorsad, dorsolateral angle acute; sternum very small. Tenth tergum short, appears as flattened disc from lateral view; narrow and semicircular from dorsal aspect (Fig. 1A), or ventral aspect (Fig. 1B). Aedeagal structure hinged to anal sclerite by strongly sclerotized ribbon-like strap. Basal segment of clasper short, expanded distally; apical segment slightly shorter, parallelogram-shaped, apex truncate; fairly dense spinous pad on mesal surface. Aedeagal structure, ventral aspect (Fig. 1C), with dorsal process (dp) distally acute, carinate process (p) truncate and tubular, ventral portion (1) terminating in expanded apex bearing ventral row of dense spines and four apical spines, considerably different from the characteristic three apical tufts of *R. vedra*.

Holotype male, BUCKTHORN CAMPGROUNDS, LITTLE ROCK CREEK, ANGELES NATIONAL FOREST, 6,800 FT., SAN GABRIEL MTS., LOS ANGELES COUNTY, CALIFORNIA, 18 July 1969, J. A. Honey. Paratypes, 4 males, two with same data as holotype except one, Matilija Hot Springs, Ventura County, California, 2 May 1970, and one, Cortelyou Springs, San Gabriel Mts., Los Angeles County, California, 24 June 1970 all by J. A. Honey. Holotype and one paratype deposited in the Los Angeles County

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Museum, Los Angeles, California. Little Rock Creek is a spring-fed creek on the north side of the mountains.

The discovery of this species of *Rhyacophila* in southern California is of considerable interest since very few are known from that area or adjoining Baja California. This new species was collected in association with *R. angelita* Banks and *rotunda* Banks, both common western species. *Rhyacophila vedra*, the sister species of *R. cerita*, has not been collected in southern California, northern Mexico, or Arizona. It is fairly common in the cool humid coastal areas of northern California and Oregon.

Rhyacophila newelli Denning, new species

This species is a member of the *angelita* group. Three species compose this closely allied group, *R. angelita* Banks, *R. perplana* Ross, and *R. vuzana* Milne. These species are similar in several respects: the ninth and tenth tergum, the anal sclerite, the claspers, and the aedeagal structure. *Rhyacophila newelli*, however, differs radically from the three species by a different clasper and aedeagal structure; but it is very similar to them in the ninth and tenth tergite and anal sclerite. It is probably the most primitive member of the *angelita* group.

MALE.—Length 7 mm. Wings fuscus, mottled with dark brown markings, appendages and body luteus. Seventh sternum with small medial conical. Genitalia (Fig. 2). Ninth tergum about twice as wide as sternum. Tenth tergum with dorsal process prominent and directed dorsocaudad; from dorsal aspect, with wide mesal incision extending almost half the distance to base, and with characteristic pair of black spots along mesal margin near base of emargination; ventral process directed caudad, practically same width throughout, distal margin with wide, shallow black emargination. Anal sclerite closely opposed to ventral process, from lateral aspect gradually narrowed distally and directed ventrocaudad, from ventral (or dorsal) aspect process divided into pair of wide lateral lobes, also black along margin. Clasper basal segment wide and irregular in outline, directed dorsocaudad, its apical segment very small and narrow; apicomesal surface covered with dense brownish spinules. Aedeagal structure with dorsal process (dp) from ventral aspect gradually expanded distally, margin with small mesal notch (Fig. 2A); phalicata with dorsal process (p) trilobed, with central, tubular lobe shorter than the two lateral lobes (Fig. 2B); ventral process (vp) fairly massive from lateral aspect, distally truncate; from ventral aspect (Fig. 2C) apex subacute; aedeagus (l) long, tubular, membranous process curved dorsad and reaching above height of claspers, apex bearing elongate brownish structure internally.

Holotype male, RATTLESNAKE CREEK, HUNGRY HORSE RESERVOIR, MISSOULA COUNTY, MONTANA, 17 October 1969, R. A. Newell.

I take pleasure in naming this species in honor of Robert A. Newell,

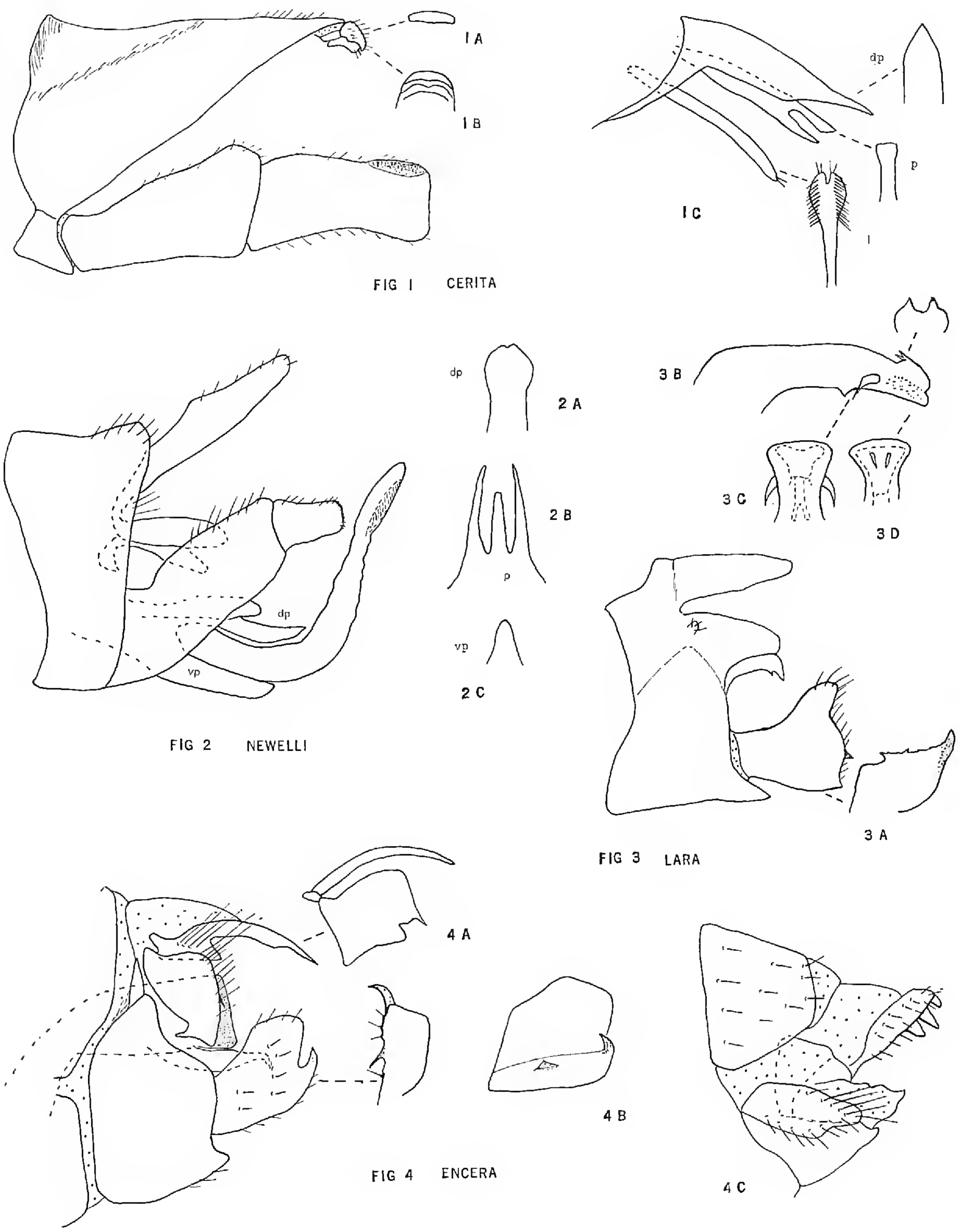

FIG. 1. *Rhyacophila cerita* Denning, male genitalia, lateral view. 1A, dorsal aspect, tenth tergite. 1B, ventral aspect, tenth tergite and anal sclerite. 1C, lateral aspect, aedeagal structure; dp, ventral aspect; p, ventral aspect; l, ventral aspect. FIG. 2. *Rhyacophila newelli* Denning, male genitalia, lateral view. 2A, aedeagal dorsal process, ventral aspect. 2B, phalicata, ventral aspect. 2C, ventral process, ventral aspect. FIG. 3. *Chimarra lara* Denning, male genitalia, lateral aspect. 3A, clasper, ventral aspect. 3B, aedeagus, lateral aspect. 3C, apex aedeagus, ventral aspect. 3D, apex aedeagus, dorsal aspect. FIG. 4. *Polycentropus encera* Denning and Sykora, male genitalia, lateral aspect. 4A, cercus, dorso-lateral aspect. 4B, clasper, ventro-dorsal aspect. 4C, female genitalia, lateral aspect.

University of Montana, who has collected many interesting Trichoptera in the Flathead Lake area of Montana.

Chimarra lara Denning, new species

This species is related to *C. elia* Ross and *C. barranca* Denning, which are known from localities in northern Mexico and Texas. *Chimarra lara*, from southern California, differs from *C. elia* or *C. barranca* in the shape of the ninth and tenth tergite, the ventrad directed, crescent-shaped sclerite associated with the tenth tergite, and the apex of the aedeagus which is radically different from either. The paired, lateral spines and the short, dorsal pair of spines at the apex of the aedeagus easily distinguish *C. lara.*

MALE.—Length 4.5 mm. Wings dark brown, appendages luteus, antennae brownish. Genitalia (Fig. 3). Ninth sternum with ventral portion wide, ventral lamina triangular, acute; division between ninth and tenth terga imperceptible. From lateral aspect, tenth tergite divided into narrow, elongate, dorsal portion becoming subacute distally, and short obtuse ventral portion; from dorsal aspect mesal portion semi-membranous, distal margin with short, circular emargination. Heavily sclerotized, crescent-shaped process arises from ventral lobe of tenth tergite, apex abruptly turned ventrad and bearing two sharp prongs. Cerci small, orbiculate. Claspers, with dorsal lobe narrow and rounded, convex outer surface bearing scattered setae; near ventral corner short, black, mesad directed spine present, easily discernible from ventral aspect (Fig. 3A). Aedeagus tubular from lateral aspect (Fig. 3B), ventral margin near apex developed into a triangular protrusion, lateral pair of black, heavily sclerotized acute spines near apex, directed ventrolaterad, best seen from ventral aspect (Fig. 3C), apicodorsal portion bearing pair of short black spines directed dorsocephalad, best seen from dorsal view (Fig. 3D) ; internal structure best seen from ventral aspect (Fig. 3C).

Holotype male, FURNACE CREEK RANCH, DEATH VALLEY, INYO COUNTY, CALIFORNIA, 8 March 1966, T. W. Fisher and R. E. Orth. Paratypes four males, same data as for holotype; one male, Cow Creek, Death Valley National Monument, California, 25 April 1955; one male, Riverside County, California, San Timoteo Canyon, 19 September 1964, M. E. Irwin. Holotype and two paratypes deposited in the Entomology Collection, University of California, Riverside, California.

Polycentropus encera Denning and Sykora, new species

This species, bearing some resemblance to *P. remotus* Banks, is separated from it and other described species by the acute hook of the clasper and cercus and by the acuminate, ventrad, curved tenth tergal rods.

MALE.—Length 6.5 mm. General color of head, thorax, and appendages light brown; wings darker due to considerable blackish pubescence. Spurs large, setose, 3-4-4. Genitalia (Fig. 4). Ninth sternum, lateral aspect, deltoid, arcuate caudal margin partially covers base of clasper; dorsum abruptly narrowed to slender lightly sclerotized projection. Tenth tergum consists of a short, obtuse, membranous mesal lobe, flanked on each side by declivous tergal rods, acute distally, from dorsal aspect about twice as long as membranous mesal lobe. Cerci laminate, irregular in outline, ventral margin narrowed, truncate; from dorsolateral aspect (Fig. 4A), lateral margin developed into prominent acute spur. Ventral margin of clasper curved dorsad to become a large, acute, dorsad-curved spur; dorsal lobe wide, truncate; from ventromesal aspect (Fig. 4B), margin developed into wide ridge contiguous to lateral spur and bearing acute darkened protuberance about midway. Aedeagus tubular, expanded distally, apex obliquely truncate; ventral margin produced caudad as slender, sinuate lobe, acute and curved ventrad, internally one pair of black rods near dorsal margin and single ventrad black rod.

FEMALE.—Length 8 mm. Color brownish; wings dark due to considerable pilosity, faintly irrorate; appendages lighter colored than wings. Seventh sternum sclerotized, abundantly setose. Genitalia (Fig. 4C). Eighth sternum bearing slender, elongate, lateral lobes, narrowed and obtuse distally, hirsute. Ninth sternum with distal margin heavily sclerotized, somewhat quadrate, partially covered by lateral lobe.

Holotype male, EL ENCERO, VERACRUZ, MEXICO, 22 July 1965, 1,336 meters, Alberto Ortiz. Collected by sweeping along small stream. Allotype female, Cordoba, Veracruz, 2 September 1966, Alfred B. Lau. Paratypes, five males, one female, same data as for holotype. Paratypes deposited in the Entomology Collection, University of California, Davis, California.

GOERIDAE

The family is represented in North America by five genera and nine species. Described species occur from the Atlantic to the Pacific coastal areas in the United States, with the majority of species being known from the eastern area.

The new genus, *Goereilla,* is radically different from others in its possession of ocelli, a character not occurring in other genera. The thin pilosity of the legs, wings, and body is also unusual. These and other characters suggest that the genus may be considered one of the more primitive genera in the Goeridae.

The general distribution of the genera and species in North America are:

Goera archaon Ross	Northwest United States
Goera calcarata Ross	Eastern United States
Goera fuscula Banks	Eastern United States
Goera stylata Ross	Michigan and Ontario to Eastern United States

Goerita semata Ross	Eastern United States
Pseudogoera singularis Carpenter	Eastern United States
Goeracea genota Ross	Northwest United States
Goeracea oregona Denning	Northwest United States
Goereilla baumanni Denning	Montana

Goereilla Denning, new genus

Characters that distinguish *Goereilla* from other genera are the prominent ocelli; the first and second maxillary palpal segment about the same length; the thin pilosity of the wings, legs and body; the abdomen without ornamentation except for a small somewhat elongate aperture on the fifth sternum; and spurs 1-2-2.

Goereilla, related to *Goerita* Ross, differs from it in complete separation of the anal veins of the forewings (Fig. 5), no modification of the palpi, the short first antennal segment, and in the number of spurs. *Goereilla* differs from *Goeracea* Denning by the absence of scales on the wings, in not holding the maxillary palpi in the front of the face, and in the number of spurs. The wing veination is generalized with the branching of M_{1+2} before rm in the forewing, which is similar to that in *Goeracea oregona* Denning.

TYPE OF THE GENUS: *Goereilla baumanni* Denning.

Goereilla baumanni Denning, new species

MALE.—Length 9.5 mm. Wings and legs dark brown; body, antennae, and palpi blackish. Antennae shorter than wings; first segment short, shorter than diameter of eyes. Maxillary palpi three segmented, no modifications; second segment only slightly longer than first; third segment one and a half times longer. Forewing veination generalized (Fig. 5), M_{1+2} branched before rm, 1A, 2A, 3A separated. Pilosity of wings, body, appendages sparse; legs quite spinous. Ocelli very prominent; no raised crown between antennae. Eighth segment not sclerotized heavier than other segments. Genitalia (Fig. 5A). Ninth tergum abruptly narrowed to sclerotized strap; sternum narrowed ventrad, dorsolateral margin expanded and arcuate. Cerci large, ventroapical corner incised, forming distinct digitate dorsal lobe from lateral aspect (Fig. 5A); from dorsal aspect cerci bivaricate. Tenth tergum, lateral aspect, projected caudad beyond remainder, wide basal portion constricted distally, apex widened, with distal margin truncate; from dorsal aspect (Fig. 5B), mesal incision wide and deep, mesal lobes with apex expanded laterally then narrowed to acute apex, apices convergent. Basal segment of clasper robust, short, wider than long; distal segment about same length but narrow, ventral margin widely arcuate, apex obtuse; basal segment with scattering of long slender yellowish setae. Aedeagus short, cylindrical, basal portion tubular and curved ventrad; from ventral aspect, apex with cluster of short brownish spines.

Holotype male, RIVERSIDE CREEK, NEAR HUNGRY HORSE RESERVOIR, FLATHEAD COUNTY, MONTANA, 2 May 1969, R. W. Baumann. Paratype male, Butler Creek, Snow Bowl, Missoula County, Montana, 14 May 1970, D. A. Potter.

It is with pleasure that I name this species in honor of R. W. Baumann, an outstanding Plecoptera student.

Lepidostoma goedeni Denning, new species

A member of the *unicolor* group, this species is closely related to *L. recina* Denning. It may be distinguished from *L. recina* and other described species by the truncate caudal margin of the tenth tergite and its narrow ventral lobe, by the short, flattened spine of the clasper and several other characters.

MALE.—Length 6.5 mm. Wings and appendages luteus. Forewings with narrow, reflexed coastal cell lined with long, slender, brown scales. Maxillary palpi one segmented, short, apex bearing dense brush of flattened black scales. First antennal segment long, unmodified. Spurs large, 2-4-4. Genitalia (Fig. 6). Tenth tergite, lateral aspect, with ventral corner produced caudad as elongate, narrow, distally truncate lobe, and acute apex directed dorsad; distal margin of dorsal portion straight, several short spines present along dorsal margin. Tenth tergum, dorsal aspect (Fig. 6A), with short mesal incision, resultant dorsal lobes short, spinous; apices of ventral lobe project caudad beyond remainder, apex truncate. Clasper, lateral aspect, with apex subacute, curved dorsad, basodorsal lobe short and digitate, lateral lobe slender and acute. Clasper from ventral aspect (Fig. 6B), with an inconspicuous mesal lobe, short, flattened, lightly sclerotized, does not reach apex. Aedeagus short, arcuate, no ornamentation.

Holotype male, BEVERLY BEACH, LINCOLN COUNTY, OREGON, 2 August 1969, blacklight trap, Kenneth Goeden.

I take pleasure in naming this new species in honor of Kenneth Goeden, outstanding collector of many interesting Trichoptera.

Recent collections of Trichoptera have resulted in some interesting new distributional records. Several of these records, some of which were completely unexpected, are recorded here.

POLYCENTROPUS LAMINATUS Yamamoto

The type locality of this species is El Oro, Ecuador. It is recorded here from Musawas, Nicaragua, Waspuc River, 23 September 1955, Borys Malkin.

POLYCENTROPUS PICANA Ross

Described from Neuvo Leon and Tamaulipas, Mexico, it is here recorded from Veracruz, Mexico, 4 December 1966, A. B. Lau and 2 July 1966, J. S. Buckett.

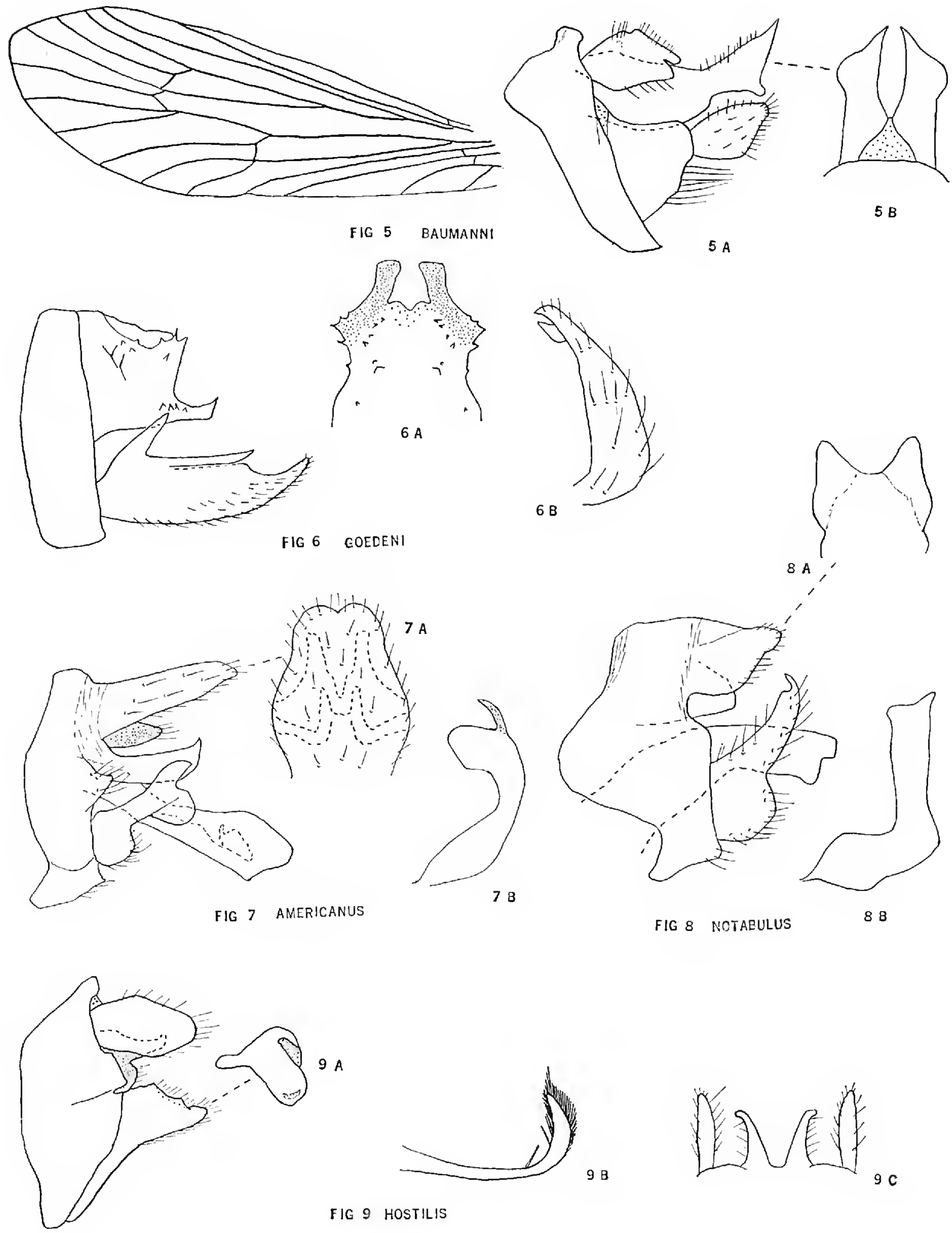

FIG. 5. Forewing, *Goereilla baumanni* Denning. 5A, male genitalia, lateral aspect. 5B, tenth tergum, dorsal aspect. FIG. 6. *Lepidostoma goedeni*, male genitalia, lateral aspect. 6A, tenth tergum, dorsal aspect. 6B, clasper, ventral aspect. FIG. 7. *Brachycentrus americanus* (Banks), male genitalia, lateral aspect. 7A, dorsal aspect, cercus and tenth tergum. 7B, clasper, caudal aspect. FIG. 8. *Brachycentrus notabulus* Milne, male genitalia, lateral aspect. 8A, cercus, dorsal aspect. 8B, caudal aspect, clasper. FIG. 9. *Nemotaulius hostilis* Hagen, male genitalia, lateral aspect. 9A, tenth tergal plate, caudal aspect. 9B, lateral arm of aedeagus. 9C, tenth tergite and cerci; dorsal aspect.

I would like to thank Dr. John Unzicker, Illinois History Survey, Urbana, Illinois, who compared the type specimens of *P. laminatus* and *P. picana* to these specimens. There are some differences in the *P. laminatus* from Nicaragua but at this time I consider these to be intraspecific variations.

BRACHYCENTRUS AMERICANUS (Banks)

A widely distributed species, but not previously recorded from southern United States. Here recorded from Gadsen County, Florida, Hurricane Creek, 7 miles east of Quincy, 12 April 1967, W. L. and J. Peters. To avoid confusion with the eastern species *Brachycentrus notabulus* Milne, figures of both species are given (Figs. 7 and 8). The figure of *B. notabulus* was drawn from a male paratype collected at Glencarlyn, Virginia, 25 April, collection of N. Banks, kindly loaned the writer by Dr. John Unzicker, Illinois Natural History Survey.

NEMOTAULIUS HOSTILLIS Hagen

In the literature this species is recorded from the northeastern states westward to Minnesota and Alberta. Recently collected in Oregon, the species should now be considered transcontinental. There are minor, but consistent, differences between the eastern males and females studied and the Oregon coastal population. Until the immature stages have been collected and compared to eastern larvae I consider these differences to be species variations. However, at a later date it is possible this population may be considered as undescribed. A typical Oregon male is presented (Fig. 9 A–C). Specimens studied, all from Oregon: 1 ♂, Astoria, 31 July 1968, blacklight trap, Kenneth Goeden; 1 ♂, Astoria, 29 August 1969, blacklight trap, Robert Brown; 1 ♀, Astoria, 14 August 1968, Robert Brown; 1 ♂, 1 ♀, Astoria, 16 September 1968, blacklight trap, Kenneth Goeden; 2 ♂, Astoria, 1 September 1967, blacklight trap, Kenneth Goeden; 9 ♂, Warrenton, Clatsop County, 23 August 1968, blacklight trap, Robert Brown.

AGRYPNIA VESTITA (Walker)

The species is generally considered a typically eastern species. The collection of it at Astoria, Oregon established *A. vestita* as transcontinental in distribution. Several collections are available, one on 29 August 1969, Robert Brown, and another on 16 September 1968, blacklight trap, Kenneth Goeden. These western *A. vestita* were compared to eastern populations by Dr. Glenn Wiggins, Royal Ontario Museum, Toronto and found to be essentially similar.

A Sex Association in the Genus *Brachycistis*

(Hymenoptera: Tiphiidae)

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It seems surprising that in a group of wasps as conspicuous and abundant over the western half of the United States as Brachycisitidinae, the sexes have not been associated or even placed in the same subfamily until quite recently (Mickel and Krombein, 1942). Sexual dimorphism is so pronounced in the subfamily that a dual system of nomenclature has evolved with the males in one series of genera and species and the females in another. Of the 60 species currently recognized in America north of Mexico, the sexes have been definitely associated for only two (Wasbauer, 1968).

The purpose of this paper is to present a third sex association in the genus *Brachycistis* and to provide a description of the previously unknown female.

I recently had the opportunity to examine a collection made at Winchester, Riverside County, California, by Mr. W. R. Icenogle. Mr. Icenogle has deployed pit traps at various times on his property and in conjunction with these has operated a fluorescent blacklight. The Winchester locality is in a coastal sage scrub association and is depauperate in brachycistidines. Over a three-year period, the fluorescent blacklight attracted a total of two species of males, *Brachycistis agama* Dalla Torre and *Brachycistis carinata* Fox. The pit traps collected two species of females, *Brachycistis agama* and a new species referable to the genus *Astigmometopa* Mickel and Krombein. It seems certain that the Winchester *Astigmometopa* is the female of *Brachycistis carinata*. The rationale for this association is as follows:

1. Over a three-year period, two species based on males and two based on females have been taken at the Winchester locality.
2. In one of the species, *Brachycistis agama*, the sexes have already been associated.
3. The *Astigmometopa* is of the same integumental color as *Brachycistis carinata* from Winchester and bears the same size relationship to it as previously associated females to their males.

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4. *Brachycistis carinata* is very restricted in its distribution, occurring only in the Southern California Coastal Mountains. In collections of brachycistidine females I have examined from numerous California localities, I have not seen this species previously.

Admittedly, point four above is weak, since female brachycistidines are still uncommon in collections, and it might be argued that the Winchester female referable to *Astigmometopa* could occur elsewhere but simply has not been taken previously. However, it seems more likely that if it were the female of a more widely distributed species, representatives would have appeared in some of the collections examined.

On the basis of these considerations, I propose the following nomenclatorial action:

Brachycistis Fox, 1893: 7, male.
Astigmometopa Mickel and Krombein, 1942: 668, female (new synonymy).

The type species of *Astigmometopa* is *A. emarginata* Mickel and Krombein 1942: 668 [= *Brachycistis emarginata* (Mickel and Krombein)] (new combination) described from Valentine, Texas. Mickel and Krombein state that males referable to *Brachycistis alcanor* (Blake) (cited as *B. cremastogaster* Melander) were taken at the same time and place as the unique female type of *B. emarginata* and speculate that this species may be the male of *B. emarginata.* Of the males, the species morphologically most similar to *Brachycistis carinata* is *B. ioachinensis* Bradley. The range of the latter overlaps that of *B. alcanor* throughout Arizona, New Mexico, and western Texas, so it is at least equally likely that *B. ioachinensis* will prove to be the male of *B. emarginata.* In view of this uncertainty, I am retaining the name *Brachycistis emarginata* until a definite sex correlation can be demonstrated.

A plesiotype selected from the Winchester, California series of females is described below:

BRACHYCISTIS CARINATA FOX

PLESIALLOTYPE FEMALE.—Shining medium brown, moderately heavily punctate, punctures rather large and deep, scattered third degree density on head except for close set row along inner margin of compound eye extending posteriorly to intersect curved setose sulcus of vertex; scattered third degree density on disc of thoracic nota and sides of pronotum; first degree density on dorsolateral surfaces of pronotum, dorsolateral surfaces of propodeum, edge of expanded portion of mesepisternum and posterolateral surfaces of propodeum; single row of large, close set punctures on posterodorsal edge of propodeum; very small, first to second degree density on declivous posterior face of propodeum; larger second degree density on proepisterna, each puncture giving rise to a long, straight, straw-colored hair; declivous anterior portion of first metasomal tergum shagreened with minute, close set punctures, posterior dorsal portion shining with scattered larger punctures; succeeding metasomal terga very sparsely punctate except for curved row of closely spaced punctures before apex of each.

Head.—Subquadrate, broader than long, width at widest point 1.2 times length (measured from vertex to apex of clypeus) ; vertexal impressions deep, noticeably curved, divergent posteriorly; curved setose genovertical sulci present, becoming series of disconnected punctures anteriorly, nearly straight row of contiguous to subcontiguous punctures posterior to each sulcus; compound eye removed from posterior margin of vertex by 1.9 times its length; mandibles slender dorsally, widest about middle at distinct mesal tooth, then gradually narrowed to acute apex; laterally with low ventral carina margined by lateral setose sulcus which extends apicad slightly beyond middle of mandible; antennae not flattened, scape densely setose dorsally and ventrally for its entire length, hairs at apex, dorsally forming loose tuft directed posteriorly; first four antennal segments in a ratio of 3.3:1.0: 1.3:1.4; clypeus in dorsal view a narrow transverse rectangle, lateral margins abruptly truncate, median portion slightly produced, medioapical margin feebly concave. Underside of head with occipital carina transverse anteriorly, forming nearly straight line across midline of head, integument transversely angled just anterior to it; maxillary palpi six segmented, labial palpi four segmented; gular orifice relatively short, 0.3 times as wide as head at level of mandibular insertions.

Mesosoma.—Width ratios of thoracic nota: pronotum 1.00; mesonotum 1.09; propodeum 0.88; propodeum trapezoidal, 0.66 times as wide at base as at apex; prothoracic leg short, tibia without spines on anterior surface, posterior surface glabrous with oblique row of three spines toward apex; basitarsus ventrally with two spines directed anteroventrally, basal spine nearly twice length of apical spine, posteriorly with two comb spines of equal length before apex and three at apex, the longest slightly shorter than basitarsus and longer than second tarsal segment, second segment with short spatulate spine on anterior edge basad of middle, pair of long comb spines on posterior edge at apex and pair of shorter spines dorsad and ventrad of comb spines; third segment with very small spine on anterior margin near base and pair of much shorter comb spines; penultimate segment with single very slender comb spine; mesotibia with four rows of stout spines on anterior surface, spines of dorsal row spatulate, six or seven in number; metatibia with three ill-defined spine rows.

Metasoma.—First metasomal segment without distinct petiole; pygidium shining, gently convex with small, shallow, paired sulci laterally before apex.

Length.—8.8 mm.

The plesiallotype bears a small printed label with the following data: "Winchester, Riverside Co. Cal. 8-June-68, W. Icenogle" and a small hand-printed label: "in pit trap." It has been placed in the collection of the California Academy of Sciences.

Through the kindness of Dr. G. W. Byers, Snow Entomological Museum, Lawrence, Kansas, the holotype of *Brachycistis emarginata* (Mickel and Krombein) has been made available to me for study. It differs from the plesiallotype and other specimens from Winchester of *B. cari-*

nata (Fox) in the configuration of the occipital carina; in *B. emarginata* the anterior ventral portion is somewhat angled at the midline of the head; in *B. carinata* the two sides form a nearly straight transverse line; in *B. emarginata* the integument of the head is not angled just anterior to the closure of the occipital carina anteriorly; in *B. carinata* there is a distinct angulation; in *B. emarginata* there is a curved row of large, well-separated punctures dorsolaterally on the vertex; in *B. carinata* there is a distinct, curved, setose genovertical sulcus; in *B. emarginata* vertexal impressions are absent; in *B. carinata* they are well-developed, elongate, and diverging posteriorly. This character is no doubt somewhat variable, however; I have seen a specimen from Walnut Canyon, near Flagstaff, Arizona, which fits *B. emarginata* in most respects but has small, dot-like vertexal impressions.

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Wasbauer, M. S. 1968. Some sex associations in the Brachycistidinae. Pan-Pac. Entomol., 44: 297–299.

BOOK NOTICE

The Natural History of Mendocino. By Jacques R. Helfer. Published by the author. Frontispiece, [4+] 159 pp., about 400 un-numbered figs., 1 color pl. Spring, 1970. $15.00, postpaid from J. R. Helfer, Mendocino, Calif. 95460.

This is an attractively produced book for the nature lover, which definitely belongs in research and taxonomic libraries as well. Basically it is a series of illustrated descriptions of interesting natural history items to be found near Mendocino, on the coast of northern California, but many of the subjects occur widely throughout the state and beyond. It includes a key to the genera of California buprestid beetles with all genera figured, and illustrated notes on three exotic buprestids. For the entomologist there are drawings and descriptive comments (habits and habitats, life histories, etc.) on termites, earwigs, grasshoppers and allies, bugs, moths, wasps, flies, millipeds, spiders, and a pseudoscorpion. All drawings are by the author, and many are the first published illustrations of these California species. There are many figures of Coleoptera; some, with accompanying text, have appeared in the finely produced but little known (and now unfortunately defunct) local magazine, *The Mendocino Robin*. The book is written to interest and intrigue the inquiring mind, and makes a fine gift.—Hugh B. Leech, *California Academy of Sciences, San Francisco 94118.*

Parasites of the Western Hemlock Looper, *Lambdina fiscellaria lugubrosa* (Hulst), in Southeast Alaska

(Lepidoptera: Geometridae)

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The western hemlock looper, *Lambdina fiscellaria lugubrosa* (Hulst), was collected in Alaska for the first time in 1965. Field collections and laboratory rearings were conducted during 1966 to obtain life history data and to determine parasitization. Shortly after the completion of the 1966 field season, a salvage logging operation was carried out within and adjacent to the looper infestation. This permitted only a single season of fieldwork. Results of the preliminary studies dealing with the biology of the looper were reported by Torgersen and Baker (1967). The pupal parasites named below are probably only a partial list as the records are based on a single season's work.

PARASITES OF THE HEMLOCK LOOPER

Field collections and rearings contained looper eggs, larvae, and pupae. No parasites emerged from eggs or larvae. However, dissections of late-instar larvae revealed that 1.4 percent ($n = 350$) contained parasite larvae of unidentified species. Eight species of parasites (Ichneumonidae) were obtained from looper pupae: *Pimpla pedalis* Cresson, *P. aquilonia* Cresson, *P. hesperus* (Townes), *Apechthis ontario* (Cresson), *Itoplectis quadricingulatus* (Provancher), *Mastrus laplantei* Mason, *Cratichneumon ashmeadi* (Schulz) or species near it, and *Aoplus velox occidentalis* (Harrington).[1] *Pimpla hesperus* and *Cratichneumon ashmeadi* are new parasite records for *L. f. lugubrosa.* Table 1 lists the parasites according to their abundance. The range of parasitization within individual pupal collections for all parasite species combined was from 7 to 27 percent; mean parasitization was 10 percent.

The following key is designed to identify the ichneumonid parasite adults obtained from hemlock looper pupae in Alaska. Terminology follows that of Townes (1969). Characters used in separating several species are, in part, after Townes et al. (1960, 1965).

[1] Determinations were made by Insect Identification and Parasite Introduction Branch, ARS, Beltsville, Md. 20705.

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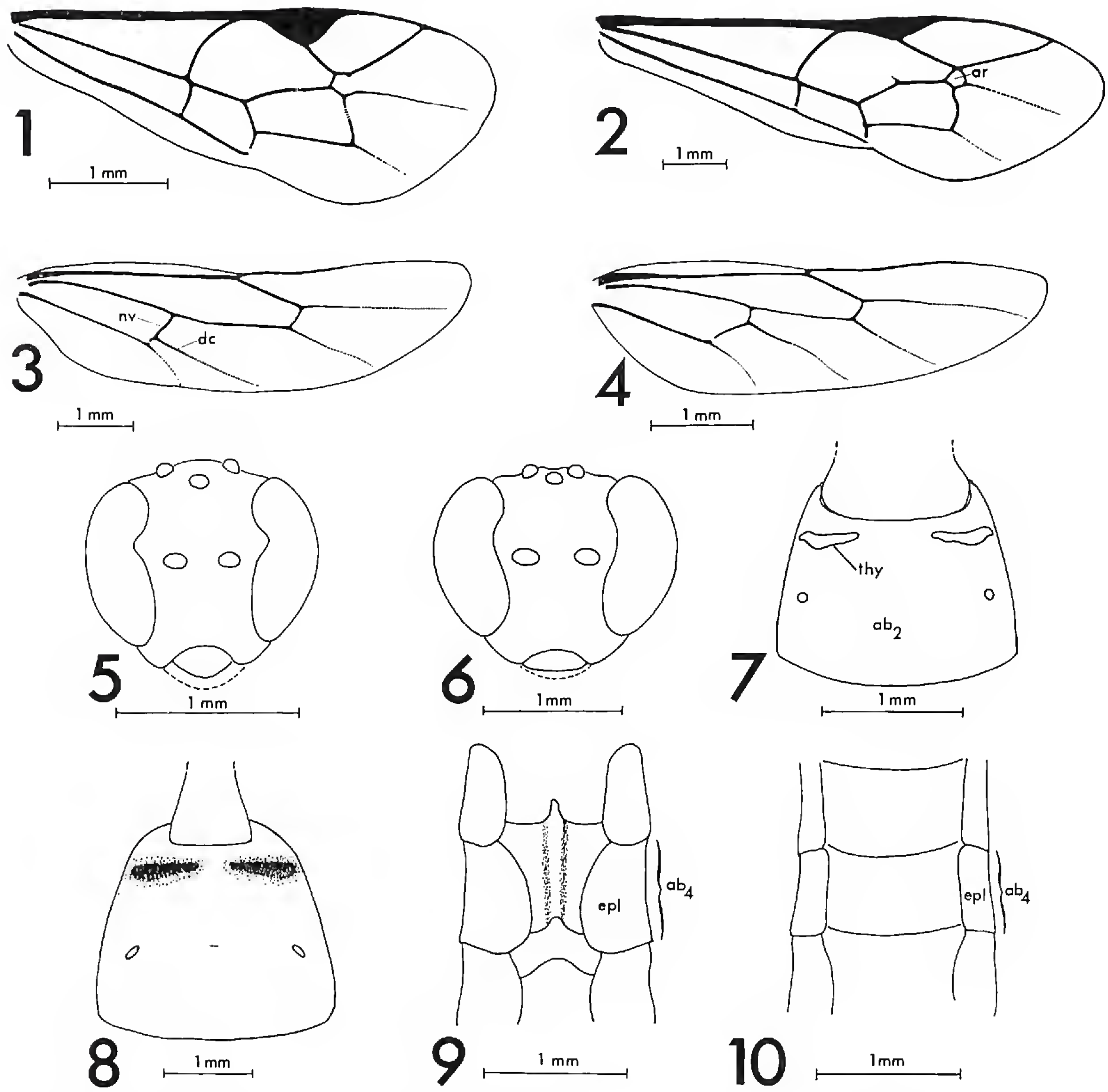

FIGS. 1–10. Right forewings and hindwings, anterior view of heads, 2nd abdominal terga, and venter of 4th abdominal segments of looper parasites. FIGS. 1–2. Forewings. (1) *Mastrus laplantei.* (2) *Aoplus velox occidentalis.* FIGS. 3–4. Hindwings. (3) *Aoplus velox occidentalis.* (4) *Pimpla hesperus.* FIGS. 5–6. Anterior view of heads. (5) *Itoplectis quadricingulatus.* (6) *Pimpla pedalis.* FIGS. 7–8. Second abdominal terga. (7) *Cratichneumon ashmeadi.* (8) *Aoplus velox occidentalis* (♀). FIGS. 9–10. Venter of 4th abdominal segments (♀). (9) *Pimpla aquilonia.* (10) *Pimpla hesperus.* Legend: ab_2, 2nd abdominal tergite; ab_4, 4th abdominal segment; ar, areolet; dc, discoidella; epl, epipleurum; nv, nervellus; thy, thyridium.

KEY TO LOOPER PARASITES

1. Areolet absent (Fig. 1) .... *Mastrus laplantei* Mason
   Areolet (ar) present (Fig. 2) 2

2(1). Discoidella (dc) intersects nervellus (nv) below middle (Fig. 3) 3
   Discoidella intersects nervellus above middle (Fig. 4) 4

3(2). Thyridia (thy) separated medially by space greater than width of each (Fig. 7); head, thorax, and abdomen of both sexes black or fuscous .... *Cratichneumon ashmeadi* (Schulz)

Thyridia separated medially by space less than width of each (Fig. 8); head, thorax, and abdomen of females ferruginous; males black, with clypeus and all, or part of face white .... *Aoplus velox occidentalis* (Harrington)

4(2). Inner margin of compound eye markedly concave opposite antennal base (Fig. 5) 5

Inner margin of compound eye not markedly concave opposite antennal base (Fig. 6) 6

5(4). Face black .... *Itoplectis quadricingulatus* (Provancher)

Face pale yellow (♂), or mostly black with yellow lateral margins (♀) .... *Apechthis ontario* (Cresson)

6(4). Hind tibia entirely black .... *Pimpla pedalis* Cresson

Hind tibia not entirely black; unicolorous amber or fulvous; or dark with pale band near proximal end 7

7(6). Males 8

Females 9

8(7). Antennal scape entirely black .... *Pimpla hesperus* (Townes)

Antennal scape white or yellow in front .... *Pimpla aquilonia* Cresson

9(7). Epipleurum (epl) of 4th abdominal tergite (ab_4) only slightly longer than wide (Fig. 9); propodeal spiracle long oval; hind tibia unicolorous amber or fulvous .... *Pimpla hesperus* (Townes)

Epipleurum of 4th abdominal tergite more than twice as long as wide (Fig. 10); propodeal spiracle round or nearly so; hind tibia dark with a pale band near proximal end .... *Pimpla aquilonia* Cresson

NOTES ON PARASITE BIOLOGY

Aoplus velox occidentalis comprised nearly 86 percent of all the parasites reared (Table 1). This species emerged from a collection made on 7 August containing newly formed pupae. Adults emerged from 23 August to 22 September, but heaviest emergence occurred from 29 August to 6 September. According to Heinrich (1960), species in the genus *Aoplus* overwinter as adult females; males die in the fall after mating. This species has been reared from both the eastern and western forms of *L. fiscellaria* in Canada and the United States; it was recorded by De Gryse and Schedl (1934) as *Amblyteles velox* in Ontario, and by Carroll (1956) in Newfoundland, Canada. Carolin[2] reared *A. velox* from the looper in Washington.

Three *Pimpla* species, *P. pedalis*, *P. aquilonia*, and *P. hesperus* comprised about 10 percent of the parasites reared (Table 1). The pupae from which these three species emerged were collected from 8 August throughout the month. Adult parasite emergence occurred throughout September. *P. pedalis* and *P. hesperus* emerged during the first half of the month; *P. aquilonia* emerged 2 through 26 September.

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[2] V. M. Carolin. Studies on the western hemlock looper in southwest Washington in 1962. October, 1964. 26 pp., illus. Unpublished progress report on file, Pacific Northwest Forest and Range Experiment Station, Portland, Oreg.

TABLE 1. Parasites of the looper arranged according to abundance.

Parasite species	Number emerged	% Total emergence
Aoplus velox occidentalis (Harrington)	369	85.8
Pimpla pedalis Cresson	22	5.1
Pimpla aquilonia Cresson	14	3.3
Apechthis ontario (Cresson)	13	3.0
Itoplectis quadricingulatus (Provancher)	5	1.2
Pimpla hesperus (Townes)	5	1.2
Mastrus laplantei Mason	1	.2
Cratichneumon ashmeadi (Schulz)	1	.2
	430	

Apechthis ontario was unique in that it was the only parasite that emerged from late-collected pupae. This species emerged during the third week in November from a collection made on 28 October. It appears that, under field conditions, at least some *A. ontario* overwinter in the host pupa and emerge in the spring. Carolin[2] made the same observation for this parasite of the looper in Washington. Parasitized pupae collected during the period from 11–30 August in Alaska produced *A. ontario* from 6 through 22 September. This represents the nonoverwintering segment of the population.

Several specimens of *Itoplectis quadricingulatus* were reared. Collections made during the last 2 weeks in August produced adults by mid-September. This species was also reported as a parasite of the looper by Carolin[2] in Washington as well as by Hopping (1934), as *Ephialtes* (*I.*) *obesus*, in British Columbia. *Itoplectis quadricingulatus* is a common parasite of the black-headed budworm, *Acleris gloverana* (Walsingham), and the hemlock sawfly, *Neodiprion tsugae* Middleton, both of which are sometimes important defoliators in southern coastal Alaska (Torgersen, 1968, 1970). Both the budworm and sawfly are attacked in the fall. It is likely that these two insects serve as alternate hosts for *I. quadricingulatus* emerging from the looper in the fall.

A single specimen of *Mastrus laplantei* was reared from a looper pupa collected on 30 August; emergence was on 18 September.

A single specimen, tentatively identified as *Cratichneumon ashmeadi* or a species near it, was also obtained. Heinrich (1960) indicates that members in this genus overwinter as larvae within the host. However, in the laboratory, this specimen emerged on 7 September from a pupa collected on 9 August.

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BOOK NOTICE

THE NEW FIELD BOOK OF FRESHWATER LIFE. By Elsie B. Klots, drawings by Suzan Noquchi Swain. G. P. Putnam's Sons, 200 Madison Ave., New York, N. Y. 10016. 398 pp., 92 figs., 22 pls., 8 in color. 29 July, 1966. $4.95.

A most useful handbook, with emphasis on the aquatic communities. Plants, invertebrates, fishes, amphibians and reptiles are included, but not birds and mammals. The Insecta comprise Chapter 12 (pp. 169–263, figs. 47–71, pls. 15–18), and pp. 357–372. The latter section contains keys to the genera of ". . . a few frequently collected and popular groups of insects," which prove to be the nymphs of Plecoptera, Ephemeroptera and Odonata. In Chapter 12 there are modified keys, called "groupings," to the families of the orders of aquatic insects; some are to adults, some to immatures, and an extra one to Hemiptera is by habitats. There is much information on typical life histories. The book is, in a sense, dedicated to Dr. Ann H. Morgan, whose 1930 Putnam's Sons *Field Book of Ponds and Streams* has had wide recognition and use; she died two months before Dr. Klots' book appeared.—HUGH B. LEECH, *California Academy of Sciences, San Francisco 94118.*

A New Subspecies of *Papilio indra* from Central Nevada[1]
(Lepidoptera: Papilionidae)

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The state of Nevada has remained nearly virgin collecting territory for the lepidopterist until the last decade. Since then, a rising tide of interest has been shown in this region of isolated mountain ranges, deserts, and high valleys.

During the summer of 1967, one of us (J.F.E.) spent nearly two weeks collecting insects in Nevada in the company of Oakley Shields of Davis, California, and Scott Ellis of Hotchkiss, Colorado. In the course of this expedition numerous new distribution records of Great Basin species were gathered as well as specimens of an atypical representative of *Papilio indra* Reakirt. Subsequent expeditions in 1968 and 1969 by J. Emmel and Shields produced additional adult material of this *Papilio* as well as immatures.

The present paper describes the new subspecies of *Papilio indra*; future papers will describe the biology of this butterfly and evolutionary relationships of this and other populations within the *P. indra* complex.

Papilio indra nevadensis Emmel & Emmel, new subspecies
(Fig. 1)

MALE.—*Forewing radius*: 35.7–45.0 mm. *Tail length*: 4.8–6.6 mm. *Primaries, superior surface*: Wing more elongate than typical *P. indra*; ground color jet black; pale yellow submarginal spots less prominent, while postmedian row of pale yellow arrow-shaped markings more prominent than in typical *P. indra*; yellow bar at distal end of cell absent or obsolescent, whereas usually present in typical *P. indra*. *Secondaries, superior surface*: Wing more elongate than in typical *P. indra*; ground color jet black; pale yellow submarginal spots slightly less prominent and pale yellow postmedian band more prominent than in typical *P. indra*; character of blue scaling and anal eyespot similar to typical *P. indra*. *Primaries, inferior surface*: Similar to superior surface, although light markings cream rather than light yellow and slightly more extensive. *Secondaries, inferior surface*: Similar to superior surface, although light markings cream and slightly more extensive; some pale orange scaling along outer edge of postmedian band and in anterior two submarginal spots. *Head, thorax, abdomen*: Coloration as in typical *P. indra*.

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FEMALE.—*Forewing radius*: 40.9–48.1 mm. *Tail length*: 5.4–7.5 mm. Head, thorax, abdomen, wing shape, range of color pattern variation similar to male.

Holotype male, JETT CANYON, 6,600 FEET ELEVATION, EAST SIDE; TOIYABE RANGE, NYE COUNTY, NEVADA, 3 August 1967, John F. Emmel.

PARATYPES.—11 males and 9 females. Data as follows (all localities east side Toiyabe Range, Nye County, Nevada): 9 males, 5 females, Jett Canyon, 6,500–6,800 feet elevation, 3 August 1967. John F. Emmel, Oakley Shields, and Scott Ellis, 2 males, 2 females, Summit Canyon, 7,000–7,200 feet elevation, on 30 June 1968. Reared by Chris Henne on *Tauschia parishii* C. & R. at Pearblossom, California; emerged 29 and 30 May 1969.

The holotype and eight paratypes will be deposited in the collection of the Los Angeles County Museum, Los Angeles, California. Two paratypes are deposited in the collection of the Allyn Foundation, Sarasota, Florida, two paratypes in the Florida State Collection at Gainesville, one paratype in the collection of Chris Henne, Pearblossom, California, four paratypes in the collection of John F. Emmel and Thomas C. Emmel, Idyllwild, California, and one paratype in the collection of Thomas C. Emmel at the University of Florida.

The August specimens of the type series represent a summer brood; those taken in late June represent the end of the spring brood which probably emerges in May. The spring brood specimens appear to average smaller in size than the summer brood individuals. The summer brood does not appear to be a yearly phenomenon; no individuals were taken in August 1968, and only one was taken in August 1969 (although spring broods in these two years were apparently small). Larvae of the new subspecies were found on *Pteryxia petraea* (Jones) C. & R. in Jett Canyon in 1967, and in Summit Canyon, Nye Co., and Kingston Canyon, Lander Co., in 1968 and 1969, and show additional character differences which will be described in detail in a separate paper on the biology of *P. i. nevadensis*.

The new subspecies superficially appears closest to *P. i. pergamus* Hy. Edwards from southern California; however, *P. i. pergamus* has more angular wings, is smaller, and is always single-brooded in contrast to *P. i. nevadensis* which may have a second brood if the conditions are favorable. There are also major differences in the immature stages of *P. i. pergamus* and *P. i. nevadensis*.

The full range of *P. i. nevadensis* has not been determined. It probably will be found in most of the ranges adjacent to the Toiyabe Range wherever the foodplant *Pteryxia petraea* grows. One *P. indra* larva was

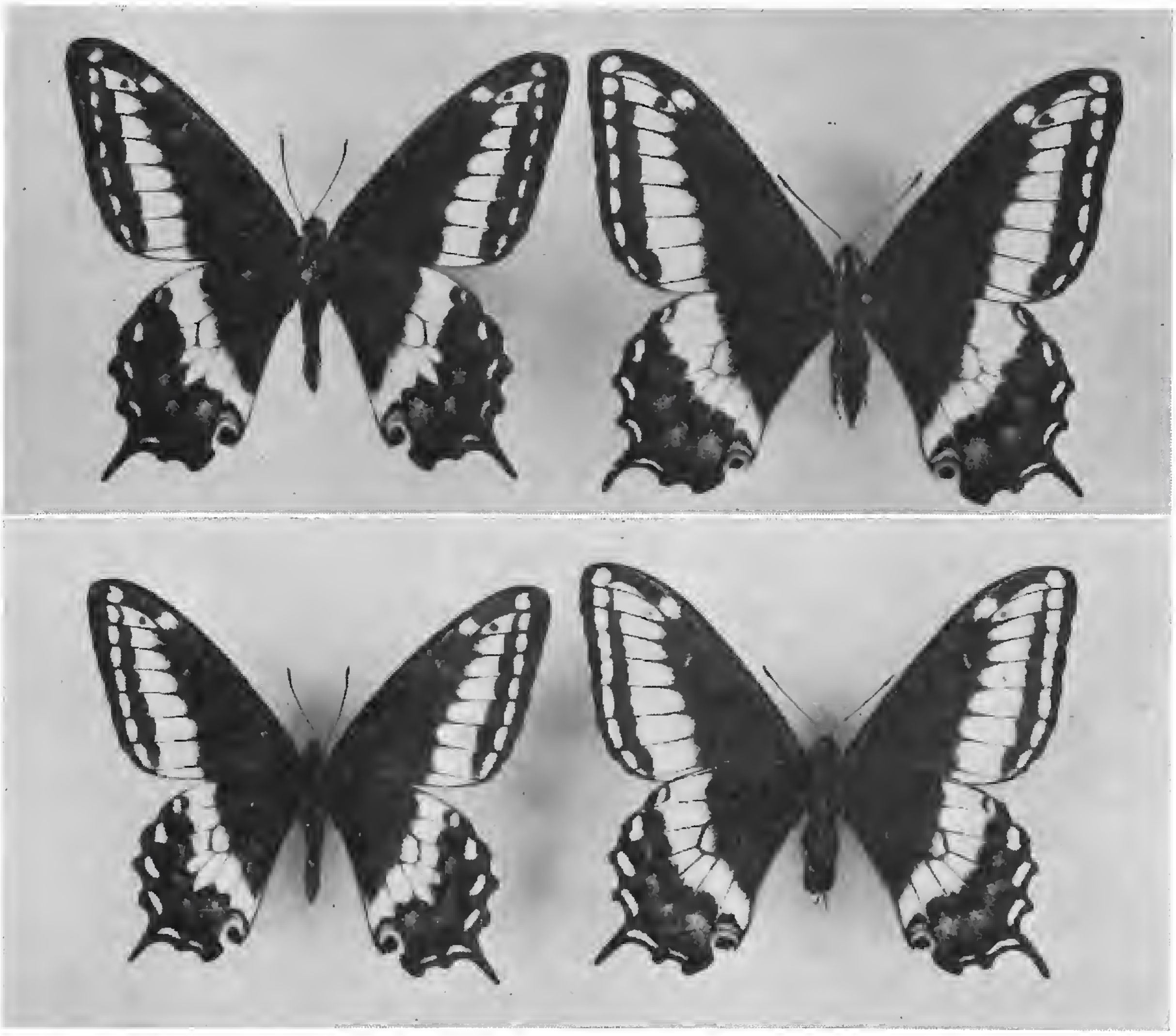

FIG. 1. *Papilio indra nevadensis* Emmel and Emmel, new subspecies. Holotype (male) on left and paratype female on right; dorsal surfaces above, ventral surfaces below. Male from Jett Canyon, 6,600 ft. elevation, and female from Summit Canyon, 7,000 ft. elevation, both localities in Toiyabe Range, Nye County, Nevada.

collected on *Pteryxia petraea* at six road miles east of Manhattan in the Toquima Range, Nye County, Nevada, on 9 July 1969; this larva failed to pupate, but was indistinguishable from larvae of *P. i. nevadensis* from the Toiyabe Range about 15 airline miles from this locality, and probably represents this subspecies. Mr. Peter J. Herlan of the Nevada State Museum, Carson City, Nevada, has taken two specimens of *P. indra* in the Humboldt Range, Pershing County, Nevada, which appear to represent spring brood specimens of *P. i. nevadensis*. *P. indra* populations in the Spring Mountains, Clark County, Nevada, about 200 airline miles south of the type locality of *P. i. nevadensis*, appear to be intermediate between *P. i. nevadensis* and *P. i. martini* (Emmel & Emmel, 1966, 1968). It is obvious that a considerable amount of field work will be necessary to determine the full distribution and variation of *P. indra* populations in the western Great Basin.

Acknowledgments

The authors are especially grateful to the Allyn Foundation, Sarasota, Florida, for providing summer research grants in 1968 and 1969, and the Los Angeles County Museum of Natural History kindly provided travel funds from 1967 through 1969. Peter J. Herlan of the Nevada State Museum and his wife Barbara provided maps and much helpful information during our stays in Nevada.

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SCIENTIFIC NOTE

Mass movement of *Tarnetrum corruptum* (Odonata : Libellulidae).—The observation of a unidirectional mass movement of the dragonfly *Tarnetrum corruptum* (Hagen) (Libellulidae) was particularly notable since it was an almost exact repetition of a movement observed by B. Furman and reported by Turner (1965, Pan-Pac. Entomol., 41: 66–67).

On 25 September 1970 between 17:30 and 18:00 PDT in University Village, Albany, Alameda County, California, individuals of *Tarnetrum corruptum* were flying due east across a 50-foot front at a rate of four per minute. Most individuals flew about four feet above the ground, but some flew as high as 20 feet. At the time there was a light easterly wind of about five miles per hour. During the period the dragonflies were moving across a front which extended at least from Albany to University Avenue in Berkeley.

No individuals were noted on the days before or after the event, although all were unseasonably hot.

The first observation alluded to above, the only other recorded mass movement of this species, took place on 24–26 September 1963 at nearby Kensington (two air miles distant). Then, the individuals were noted flying in the same direction at the same time of day.

Taken together these two observations reflect an event of at least periodic recurrence or are highly coincidental.—Paul A. Opler, *University of California, Berkeley 94720.*

Behavior and Ecology of *Acanthoscelides prosopoides*[1]
(Coleoptera: Bruchidae)

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The attacks of the larvae of the seed beetles or Bruchidae on plant seeds are of importance because commercial peas and beans are commonly destroyed. Since many non-economic Leguminosae are attacked as well as the seeds of some 27 other plant families, bruchids may be utilized in the future to destroy the seeds of weeds. The destruction of seeds is initiated when adult females oviposit into or on the seeds or pods and the larvae then hatch and burrow into the seeds. In most species, the larvae feed, moult several times, and then pupate inside seeds but some are known to construct silken pupal chambers inside pods or in the ground. The adult then emerges from its pupal chamber through a typical circular bruchid exit hole. The adults may or may not feed prior to mating and oviposition.

When Schaeffer described *Bruchus prosopoides* in 1907 he mentioned its close resemblance to *Bruchus prosopis* LeConte, hence the name. Knowledge gathered in the last 60 years indicates these two species resemble one another only superficially and consequently *B. prosopoides* is now placed in the genus *Acanthoscelides* and *B. prosopis* in the genus *Algarobius*. Host plant preferences are criteria also used to separate the two. *Algarobius prosopis* is known to breed only in the seeds of species of *Prosopis*. *Acanthoscelides prosopoides* larvae feed in the seeds of *Ziziphus obtusifolia* (Hooker) A. Gray, family Rhamnaceae.

The affinities and nomenclature of the spiny shrub called lotebush or *Z. obtusifolia*, have been confused for many years. The name *Condalia lycioides* (A. Gray) Weberbauer has frequently been used for this species but Johnston (1962, 1963) removed it from the genus *Condalia* and adopted the senior synonym *Z. obtusifolia*. We will follow Johnston's usage in this paper.

The first rearing of *A. prosopoides* was reported by Johnson (1970) from information on a specimen borrowed from the U. S. National Museum of Natural History. The specimen was reared from seeds of *Z. obtusifolia* collected on 18 May 1954 at Brownsville, Texas by an unknown collector. Johnson also reported a rearing from seeds he col-

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lected at Quitobaquito, Organ Pipe National Monument, Pima County, Arizona on 14 April 1968. The distribution of the insect (Johnson, 1970) and plant (Johnston, 1963) is from southeastern California to southern Oklahoma and south into Mexico.

Since over 80% of the bruchid species whose host plants are known attack seeds of the Leguminosae and most species of *Acanthoscelides* attack papilionaceous legumes, the ecology and behavior of the unique *A. prosopoides* were studied and are reported upon here. It is hoped that this knowledge will aid in understanding the phylogeny of this species and therefore other species in the genus.

The mature fruit of *Z. obtusifolia* is a drupe 7–10 mm in diameter with a thin exocarp, a fleshy mesocarp, and a woody endocarp. Although the endocarp contains two seed chambers, usually only one seed and one seed chamber are enlarged.

During the study mature fruits were collected once weekly from 5 May 1969 to 30 June 1969 from about 5 miles south of Camp Verde, Yavapai County, Arizona. Collecting was discontinued after 30 June because only occasional fruits were encountered.

Most of the fruits had turned to the dark blue color of maturity by 6 June. The only apparent difference between these and the fruits collected to 30 June was a slow desiccation of the flesh surrounding the stones although in the last sample the flesh was moist and reasonably soft. Large numbers of fruits were found on the plants until 18 June when a decrease was noted. The numbers declined rapidly so that after 30 June hardly any fruits were to be found on the plants. Therefore, during June the bruchids had an abundant supply of acceptable fruits for oviposition.

Mature fruits were brought to the laboratory and treated according to the methods of Bottimer (1961) and Johnson (1968, 1970). The results of our studies are presented and discussed below.

Mating Behavior

There were two types of responses exhibited by the male in the presence of a female. Frequently the male approached a female from the rear and quickly climbed onto her back. When the female raised her abdomen, the male backed up slightly and copulation occurred immediately.

Also a male approached a female from the rear and stimulated her pygidium with a short series of quick nudges produced by the up and down movement of the male's head with the mouthparts touching the female. He then stimulated the apex of her elytra and sometimes up to the distal one-fourth of the elytra. As the male progressed up the female's elytra, his anterior legs grasped the sides of the pygidium, abdomen or elytra, depending on the height and relative size of the two insects. This usually continued for about three to five minutes. On some occasions the female was observed to walk away, although she remained in the immediate area. The male either followed or stayed in place nudging at the substrate. When the male was apparently ready for copulation he quickly attempted to find and mount a female as described earlier.

Apparently this stimulation affects only the male's readiness for copulation. During the mating ritual, if other females were near, an-

During copulation the male's lateral lobes became extended as the median lobe entered the female. When the median lobe was fully inserted the lateral lobes were at their maximum ventral extension. Dur-
other female sometimes appeared to offer herself in place of the original.
ing each thrust the lateral lobes appeared to grasp the exposed sides of the pygidium and then relax.

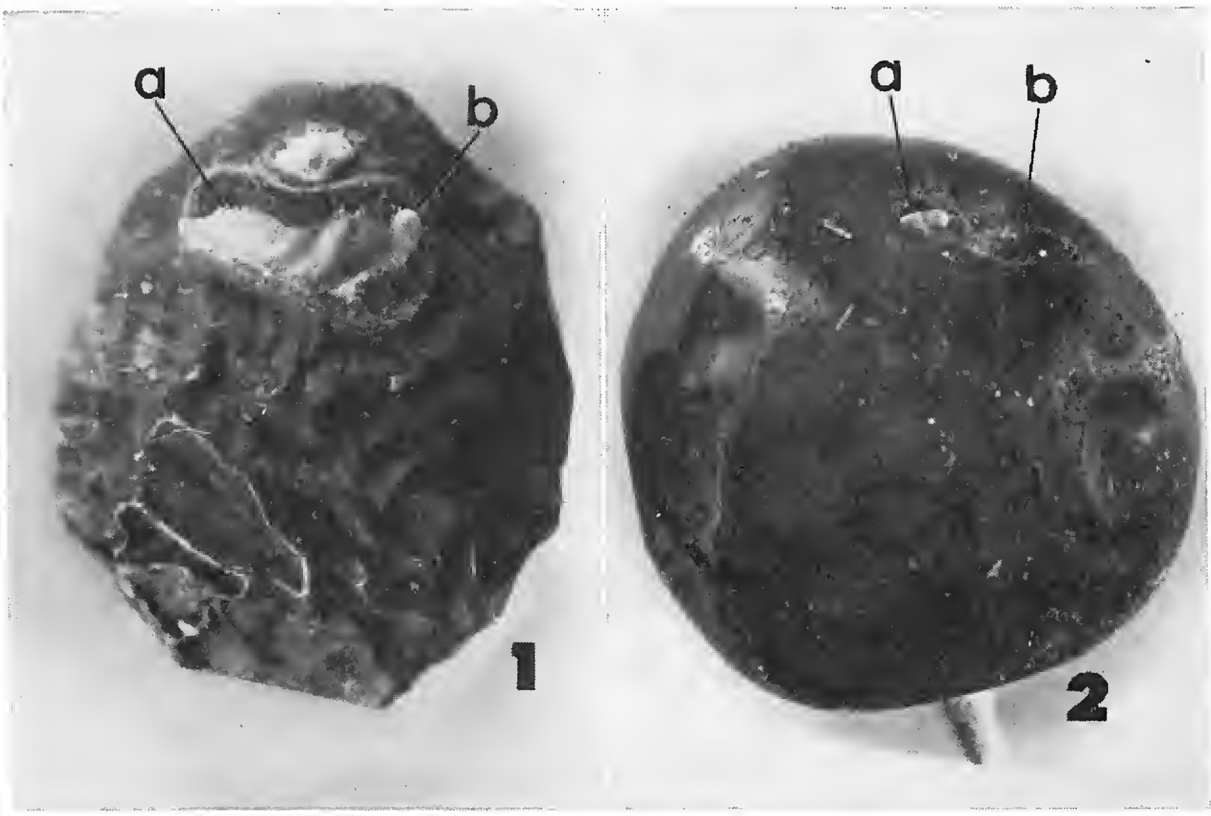
During copulation the male cleaned his legs and antennae with his free legs while perpendicular to the substrate with his hind legs balancing him. The female also appeared to preen herself. Unless disturbed, it seemed that the male was the one to discontinue copulation.

Food is not a necessary prerequisite for copulation or for production of viable eggs. Although adults were observed to feed on the flesh of the host fruit in the laboratory, the teneral adults taken from isolated fruits copulated within minutes after being placed in a petri dish without ever being exposed to food or water. The females then laid viable eggs.

Oviposition

Eggs of *A. prosopoides* were observed to be deposited on two different areas of the fruits collected and isolated in May and June. When holes were present in the flesh of the fruits (Fig. 1 a), eggs (Fig. 1 b) were laid and cemented into them. The holes were probably the result of the fruits being struck by spiny branches. The most common area selected was next to the atrophied style (Fig. 2 a). This type of egg deposition was most common in the field collected material because the exocarp of the fruits in the field rarely exhibited cracks and holes while on the plant.

In the laboratory both of the above methods were observed in cul-



FIGS. 1–2. *Ziziphus obtusifolia* fruit. FIG. 1. a. Hole in flesh. b. Egg of *Acanthoscelides prosopoides* laid in hole. FIG. 2. a. Egg of *Acanthoscelides prosopoides* laid near remnants of the style. Note larval exit hole on the right, ventral surface of the egg. b. Exit hole of an adult *A. prosopoides.*

tures. When recently emerged *A. prosopoides* adults were allowed to remain with the fruits in the jars, eggs were found laid in cracks and holes in the fruit. Most often the holes utilized were those remaining when the pedicel separated from the fruit. Also eggs were sometimes laid on any part of the surface of the fruit and even on twigs. We believe this behavior to be due to the crowded conditions of the laboratory since eggs were not observed to be deposited in this manner in the field.

Eggs and first instar larvae of *A. prosopoides* were easily obtained by allowing the females to oviposit into open-celled styrofoam. They seemed to prefer these holes to holes in the flesh of the fruit or to the surface of the fruit. The presence of a fruit suitable for oviposition does not seem to be the primary stimulus for egg deposition. Rather, it would appear that *A. prosopoides,* like many other bruchids, will oviposit when given the correct physical stimuli. It appears an appropriate hole triggers oviposition regardless of the surrounding material.

Further observations of this species are necessary to discover if eggs are laid on other seeds or surfaces in the field and to reveal the other stimuli for oviposition.

TABLE 1. Emergence of *A. prosopoides* from isolated fruits of *Z. obtusifolia* in 1969.

Culture #	1	2	3	4	5	6
Date Coll.	29 May	6 June	10 June	18 June	24 June	30 June
# of fruits	42	374	376	241	118	122
# infested	3	28	20	9	6	20
% infested	7.2%	7.5%	5.3%	3.8%	5.1%	16.4%

IMMATURE STAGES

EGG CHARACTERISTICS.—Unlike bruchids which infest the seeds of some other large plants in the area, *A. prosopoides* eggs are not cemented with one side flat against the surface of the seed coat or pod. Rather the middle of the egg is cemented and the ends protrude from the substrate. The egg of *A. prosopoides* has a smooth chorion, is about 0.75 mm long, and is 0.31 mm at its widest.

FIRST INSTAR LARVA.—The first instar larva exits near one end of the egg adjacent to the fruit surface and does not burrow directly from the egg into the fruit as many bruchids do. Usually eggs are laid next to the atrophied style in the field (Fig. 2 a). The exit hole is in the anterior end of the egg and the hole produced by the entering larva is near the egg. The adult emergence hole (Fig. 2 b) is also usually near the style.

Although it would seem more advantageous for the larvae if the eggs were laid in protected cracks, the majority of infested field-collected fruits had eggs laid on their exterior. This could be a result of collecting fruits only from the plant. As fruits were rarely found on the ground, we suspect that they were probably removed by other animals such as rodents or birds.

DEVELOPMENTAL TIME

Observations in the laboratory indicated that the average time between copulation and egg deposition was two days for teneral females. An average of five days was required for the development of first instar larvae from the time of oviposition to eclosion.

The maximum developmental time from first instar larva to adult was 82 days. In the isolated cultures about 4% emerged after 60 to 80 days. This delayed development of a small percentage may be normal, creating overlap between summer generations.

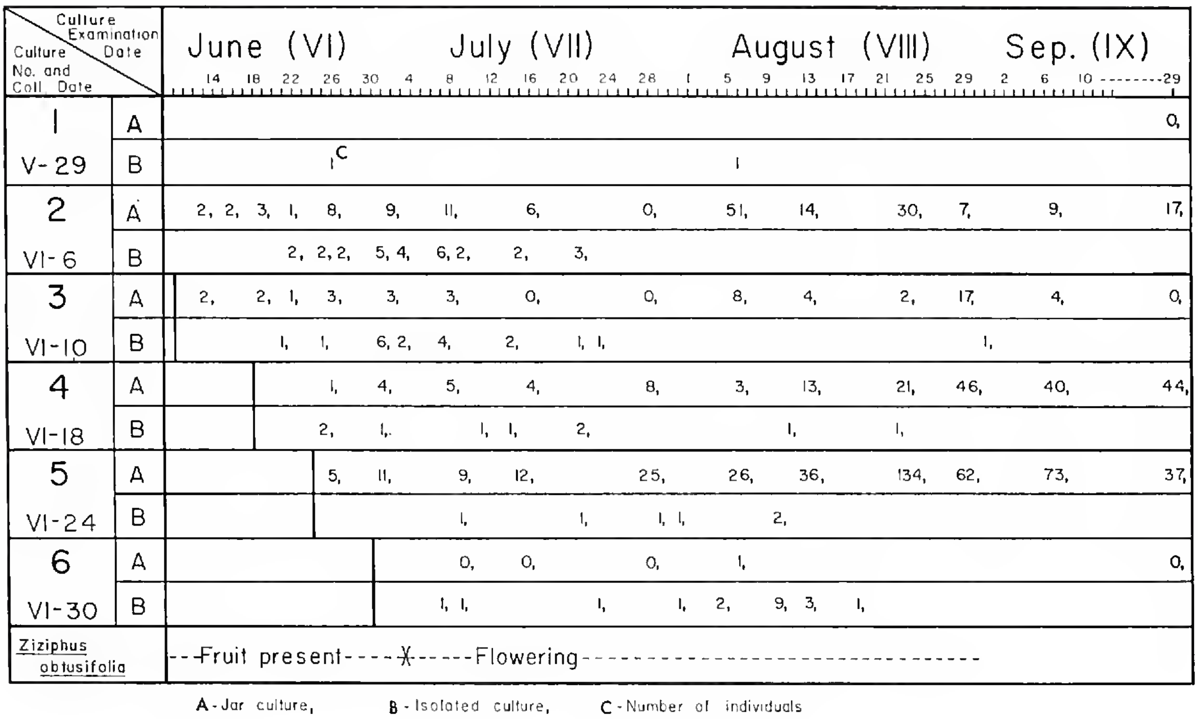


FIG. 3. Emergence data of *Acanthoscelides prosopoides* reared from jar and isolated cultures of *Ziziphus obtusifolia.*

PERCENT OF SEEDS INFESTED

After the insects had ceased to emerge from the seeds, the percent of the fruits destroyed was calculated (Table 1). Although an unknown number of fruits contained two seeds, the fruit was treated as a unit because in only one instance (culture 6) did two adults emerge from one fruit. However, only one seed was used by an *A. prosopoides* larva in the course of its development.

There was a dynamic increase in percent infestation in the 30 June collection (Table 1). Possible causes for this sudden increase is that fewer fruits were available and more insects may have been present than earlier in the season. Both could lead to oviposition of more eggs on the available fruits.

LIFE CYCLE AND GENERATIONS PER YEAR

On 14 April 1968, some fruits of *Z. obtusifolia* were collected at Quitobaquito, Organ Pipe National Monument, Pima County, Arizona. Some of these were isolated in gelatin capsules and the rest were stored in a pint fruit jar. Both the isolated and jar cultures were examined periodically for emerged adults. During March 1969 some of these fruits were dissected and overwintering *A. prosopoides* larvae were found in them. No adults had emerged from seeds in the culture since they were last examined on 17 December 1968. All of the larvae were

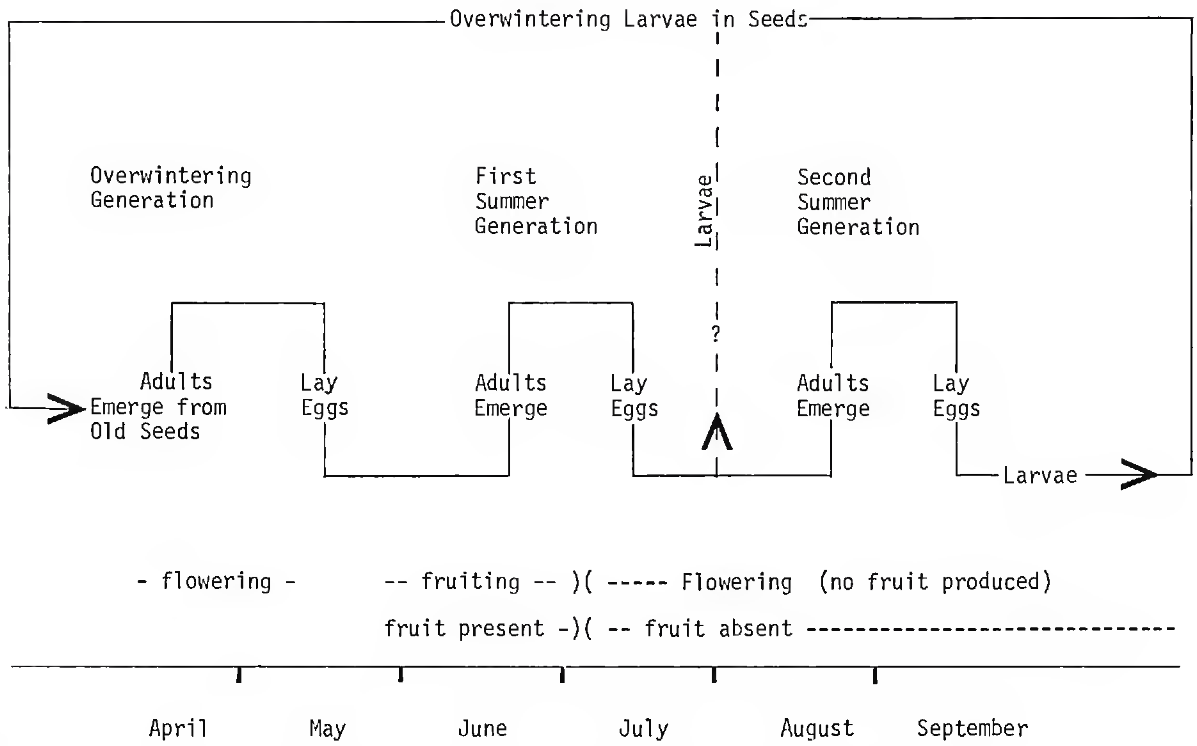


FIG. 4. Proposed life cycle of *Acanthoscelides prosopoides*.

of equal size and appeared ready to pupate. The adults started to emerge by 21 May 1969. As adults have been collected on these plants in nature as early as 14 April in some areas, the development of these insects may have been slowed because the culture was kept under laboratory conditions at room temperatures. However, it appears that the developmental time of the bruchids had not been altered significantly. In isolated seeds of this culture no adults emerged in the summer of 1969.

In Fig. 3 the number of *A. prosopoides* that emerged from the jar cultures and the isolated cultures are listed. The date that each culture was collected is indicated under its number and with cultures 3–6 is also indicated by a solid vertical line.

Culture 1 consisted of immature fruits. However, *A. prosopoides* were able to complete their development within the small seeds. Small fruits collected one week earlier did not yet have fully developed seeds inside them and the only insects which emerged from the latter seeds are in the wasp family Pteromalidae, probably parasites of lepidopterous larvae.

The last adult emerged from the isolated fruits of culture 2 on 21 July 1969, yet *A. prosopoides* continued to emerge from fruits in the jars for approximately another two months. The end of emergence from the isolated fruits coincides with the emergence of adults from fruits in the jar cultures. This is strong support for a theory that there are at least two generations of adults produced during the summer months

(Fig. 4). If there are indeed two generations plus the generation that overwinters and emerges in May, then there are three generations per year. It would seem reasonable that the second summer generation lays the eggs of the overwintering generation (Fig. 4).

However, the adults of the first generation possibly lay two types of eggs; one that gives rise to the second generation plus one that produces the overwintering larvae (Fig. 4, dashed line).

Culture 3 has the same general characteristics as those explained for culture 2, except the period of time between the two generations is longer. The one late emergence recorded from the isolated culture is an example of the variation in larval developmental time discussed earlier. This variation could cause an overlap between the two generations.

Cultures 4 and 5 apparently were collected late enough so that variation may have eliminated any diphasic emergence pattern that was present in cultures 2 and 3 or they were collected late enough so that eggs laid by both the overwintering generation and the first summer generation were present.

Culture 6 is important for two reasons. 16.4% of the fruits were infested which is 2 to 4 times greater than infestations in cultures 1–5 (Table 1), and it was the last culture to be collected. Almost all of the fruits were isolated and few adults emerged from the jar cultures. The higher infestation rate in this culture may be a direct result of a combination of an increased number of adults in the field and a reduction in the number of fruits tending to concentrate eggs on the fruits remaining on the plant.

Most plants had fruits remaining on them probably no later than one or two weeks after the last collection. Thereafter, some started flowering and continued to flower for the rest of the summer but without fruiting again. Consequently, several problems arise while trying to interpret the emergence data (Fig. 3).

Since three generations per year are apparent in the laboratory, we can only assume the same occurs in the field. We believe this assumption is valid because there is no evidence that emergence continues throughout the year as it does with some species which breed continuously as do *Stator limbatus* (Horn) and *Acanthoscelides obtectus* (Say). Also the time of emergence in the laboratory of the overwintering generation roughly corresponds with the time fruit is available in the field.

If developmental times are not significantly influenced by laboratory conditions and temperatures, as suggested earlier, then the majority of the first and all of the second generation emerge when there are no more fruits available on the plant for oviposition for the second and/or overwintering generation. If eggs were laid for the second summer generation before the fruits disappeared from the plants, where were the fruits when *A. prosopoides* emerged? They were not on the plant, nor were any discovered on the ground. It is possible that rodents collected the fruits and stored them where *A. prosopoides* of the second generation could emerge and lay eggs for the overwintering generation. If this is not the case, then the first generation adults would have had to have laid two different types of eggs, one kind for the second generation and another for the overwintering generation.

Effect of A. prosopoides on the Reproductive Biology of Ziziphus obtusifolia

Although the maximum percentage of seeds destroyed in any culture in this study was 16.4 (Table 1), it appears that a second generation and other seed-eating animals in the area would have a significant effect on the number of viable seeds that survive in any one year. Apparently some protective mechanism yet to be discovered is possessed by this plant species to prevent attacks of bruchids on its seeds. Or, as this bruchid species appears to have only recently adapted to this plant, it has not yet evolved the ability to fully exploit the seeds of *Z. obtusifolia*. Many crops of legume seeds are almost completely destroyed by bruchids.

Associated Hymenoptera

The eggs, larvae, and pupae of many bruchids which feed in the seeds of the Leguminosae are attacked by hymenopterous parasites, sometimes to the extent that almost all the beetles are destroyed. However, in our cultures containing *A. prosopoides*, only occasional bruchids were parasitized.

Eupelmus cushmani (Crawford) and an unidentified species of *Eupelmus* were reared from fruits of *Z. obtusifolia* from 5 miles south of Camp Verde. Although Peck (1963) reported *E. cushmani* as a parasite of the bruchids *Acanthoscelides ochraceicolor* (Pic) and *Mimosestes sallaei* (Sharp) as well as one species of Platystomidae and six species of Curculionidae, dissections of these fruits revealed only an empty, undamaged, pupal exoskeleton of *A. prosopoides*.

Several specimens of two as yet unidentified species in the family Pteromalidae were also reared from fruits collected 5 miles south of Camp Verde. Dissections of fruits from which they emerged revealed the remains of both *A. prosopoides* larvae and pupae. The other pteromalid, *Pseudocatolaccus americanus* Gahan, was reared from seeds from Quitobaquito and is probably not a bruchid parasite as Peck (1963) listed it as attacking species of Cecidomyiidae.

Several specimens of *Urosigalphus bruchi* Crawford (Braconidae), a parasite of the immature stages of the bruchids *Amblycerus robiniae* (Fabricius) and *Algarobius* sp. (Muesebeck et al., 1951), were reared from seed cultures from both localities, but we have no direct evidence that it is also a parasite of *A. prosopoides.*

The lack of appreciable numbers of parasites in our cultures indicates that *A. prosopoides* probably evolved the habit of attacking the seeds of *Z. obtusifolia* not only because of their nutritional value but also because of the few parasites which prey upon them when in the seeds of *Z. obtusifolia.* The small number of parasites also suggests a rather recent adaptation to these seeds by *A. prosopoides.*

The other Hymenoptera reared from our cultures are not known to be bruchid parasites. *Galeopsomopsis transcarinata* Gahan, a species which we reared from seeds collected at Quitobaquito, is listed by Peck (1963) as attacking the Cecidomyiidae. *Paragaleopsomyia eja* Girault, reared from both localities, has no known hosts but its relative, *P. gallicola* Gahan, is listed by Peck as attacking the Cecidomyiidae. We reared an unidentified species of *Torymus* from seeds collected at Quitobaquito. Peck lists species of *Torymus* as attacking a variety of hosts.

Eurytoma squamosa Bugbee was reported by Bugbee (1967) to attack the seeds of five species of *Ceanothus.* We reared this species only from seeds collected at Quitobaquito. This is the first known record of it attacking a species of *Ziziphus.*

Acknowledgments

The Hymenoptera reared during this study were identified by Dr. P. M. Marsh and Dr. B. D. Burks of the Entomology Research Division, Agricultural Research Service, U. S. Department of Agriculture. Their assistance is gratefully acknowledged.

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SCIENTIFIC NOTE

Discovery of an error in the 1890 description of *Pulverro columbianus* (Kohl) (Hymenoptera : Sphecidae).—A study of the genus *Pulverro* over the past several years has revealed an error in the description of the species *P. columbianus* as published by Kohl in 1890 (K. K. Naturhist. Hofmus. Ann., 5: 61). The 17 specimens of this species available for study are all males and according to the catalog no females have been collected, but yet Kohl's description referred to the holotype as a female. Otherwise his description matches the male specimens in our collections. Kohl's holotype specimen is in Vienna and through the kind assistance of Dr. Max Fischer of the Naturhistorisches Museum it was loaned to me for study. The specimen is in rather poor condition with the head detached and glued to a separate point. The antennae are missing, but the terminal abdominal segments are intact and the specimen is indeed a male, so the 1890 publication is in error and the species *P. columbianus* is known only as males. I have established two homotypes for future reference. Collection data of the specimens studied indicates that the species *P. colorado* Pate is probably synonymous with *P. columbianus* and *P. colorado* has been found to be only females. The species *P. monticola*, which I described in 1968 (Pan-Pac. Entomol., 44: 263), is closely related to *P. columbianus* and the females of *P. monticola* show a definite resemblance to *P. colorado* even though there are specific differences.—LLOYD E. EIGHME, *Pacific Union College, Angwin, California 94508.*

The North American Areodina with a Description of a New Genus from California

(Coleoptera: Scarabaeidae)

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The subtribe Areodina (of the tribe Rutelini) has been defined by Ohaus (1918, 1934) to include six genera; two occur north of Panama, and one reaches the United States. North American authors have generally considered *Cotalpa* (sensu Ohaus) to comprise four genera (subgenera, Ohaus), three of which occur in the United States. These four genera (*Cotalpa*, *Byrsopolis*, *Paracotalpa*, and *Parabyrsopolis*) have been the objects of much recent confusion.

Cotalpa was named by Burmeister (1844: 423) with *Scarabaeus lanigera* Linnaeus 1758 as the type species. In the same paper he (Burmeister, 1844: 425) named *Byrsopolis* for *Byrsopolis castanea* n. sp., from South America. Various species were named in the two genera until 1915, when both Ohaus (1915) and Casey (1915) published new names for the same taxa. Casey described the genera *Pocalta* (1915: 92) for the species of *Cotalpa* with dorsal hair, and *Parareoda* (1915: 99) for the Central American and Mexican *Byrsopolis*. Ohaus published the names *Paracotalpa* (1915: 256) for the dorsally haired species, and *Parabyrsopolis* (1915: 256) for the Central American and Mexican forms, and, with *Byrsopolis*, placed these as subgenera of *Cotalpa*. Casey's names, published in English and more widely read in North America, were used by the majority of systematists in the United States. Ohaus (1925: 75) pointed out that his work, which appeared on 1 July 1915, had priority over Casey's (27 November 1915), and his (Ohaus') names were the valid ones. Subsequent authors have generally used Ohaus' nomenclature, while following Casey's generic concept. Recently however, things have become confused by the unexplained placement of *Parabyrsopolis* as a synonym of *Paracotalpa* (Arnett, 1963: 424), without indicating placement for the species formerly included in *Parabyrsopolis*. Saylor (1940: 191) added to the generic nomenclature of this group by naming *Ciocotalpa* as a new subgenus of *Cotalpa* (sensu stricto) for *Cotalpa consobrina* Horn.

The species placed in these genera have also been subjected to varying amounts of confusion. Following is a brief treatment of each genus, as recognized by this author.

BYRSOPOLIS Burmeister

Byrsopolis Burmeister 1844:425; Lacordaire 1856:364; H. Bates 1888:290; Ohaus 1912:312, 1915:256, 1918:10, 1934:37. Type = *Byrsopolis castanea* Burm. 1844:425.

This genus consists of approximately six species, restricted to South America. Ohaus (1912: 314) named a new species "*Byrs. nigroaenea*," which, since his later treatment of *Byrsopolis* as a subgenus of *Cotalpa*, became a junior homonym of *Byrsopolis nigroaenea* Bates (1888: 289). He later evidently intended the name *fuscoaenea* as a new name for this taxon. Both of the lists prepared by him, in the Coleopterorum Catalogus (1918) and in the Genera Insectorum (1934) cite *Byrsopolis fuscoaenea* as described on the page where "*Byrs. nigroaenea* n. sp." is named (this taxon is presently placed in *Parabyrsopolis*, where the name is still a junior homonym with *Parabyrsopolis nigroaenea* (Bates) 1888: 289). If in fact Ohaus intended the name *fuscoaenea* to replace his *B. nigroaenea*, as seems likely, he did not completely cite the change. The complete, correct citation should be as follows:

Parabyrsopolis fuscoaenea (Ohaus) 1918:11 (for *Byrsopolis nigroaenea* Ohaus 1912: 314 *nec*. Bates 1888:289).

PARABYRSOPOLIS Ohaus

Parabyrsopolis Ohaus 1915:256, 1918:11, 1934:39.
Parabysopolis, Arnett 1963:424 (misspelling of *Parabyrsopolis*).
Parareoda Casey 1915:99.

This genus has been generally ignored by recent American workers. These beetles are quite distinctive, as outlined in the key, and should be given valid generic status. At present there are two names in the literature for taxa known in the United States, both from Arizona. A generic revision is needed, and until that time I will consider both names as representing distinct species although further material may show that this is not the case.

COTALPA Burmeister

Cotalpa Burmeister 1844:423; Lacordaire 1856:366; Horn 1867:168, 1871:338; H. Bates 1888:289; Wickham 1905:1; Ohaus 1915:256, 1918:9, 1925:75, 1934:35; Casey 1915:88; Saylor 1940:190; Arnett 1963:423. Type = *Scarabaeus lanigera* Linnaeus 1758:350.
Ciocotalpa Saylor 1940:191. Type = *Cotalpa consobrina* Horn 1871:377.

I follow Saylor's treatment of this genus, although he seems to recognize variants as subspecies, without any geographical criteria. Casey's subspecies (*C. lanigera obesa* Casey 1915: 90) may not be valid. There are evidently new species of this genus from Mexico (Howden, personal communication). It should be noted that the date of the original description for *Scarabaeus lanigera* Linnaeus, is 1758, *not* 1764 as is usually cited (see Landin 1956: 10).

PARACOTALPA Ohaus

Paracotalpa Ohaus 1915:256, 1918:10, 1925:75, 1934:38; Saylor 1940:194; Arnett 1963:30. Type = *Cotalpa ursina* Horn 1871:337.
Pocalta Casey 1915:92; Fall 1932:203. Type = not designated.

I agree with the treatment of Saylor (1940), except for the "subspecies" of *P. ursina* as treated in his work. *Paracotalpa ursina* Horn is a very common, very variable species in Southern California. I do not believe that any of the trinomials that Saylor uses are valid geographic populations. Rather they represent combinations of the normal variation and melanism, since several "subspecies" have been collected at the same localities. At present it seems best to consider the diverse *P. ursina* as without subspecies until an in-depth study properly utilizing geography is completed.

CHECKLIST OF THE AREODINA OF THE UNITED STATES

Parabyrsopolis Ohaus	
arizonae (Ohaus) 1915:313 (*Byrsopolis*)	Ariz.
rufobrunnea (Casey) 1915:100 (*Pararoeda*)	Ariz.
Cotalpa Burmeister	
consobrina Horn 1871:337	Ariz.
flavida Horn 1878:53	Utah, Nev., Ariz.
lanigera (Linnaeus) 1758:350 (*Scarabaeus*)	New England to Fla., to Iowa
obesa Casey 1915:90	
vernicata Casey 1915:91	
molaris Casey 1915:90	
tau Wickham 1905:2	
subcribrata Wickham 1905:3	Kansas
Paracotalpa Ohaus	
granicollis (Haldeman) 1852:374 (*Cotalpa*)	Wash., Ore.
pubicollis (Casey) 1915:98 (*Pocalta*)	S. Cent. Calif. to Utah, Colo., Nev.
deserta Saylor 1940:195	S. Calif., N. Baja Calif.
puncticollis (LeConte) 1863:78 (*Cotalpa*)	S. Calif. to N. M.
ursina (Horn) 1867:95 (*Cotalpa*)	S. Calif.
laevicauda (Casey) 1915:95	
brevis (Casey) 1915:95	
leonina (Fall) 1932:204	
piceola Saylor 1940:197	
rotunda (Casey) 1915:96	
seriata (Casey) 1915:96	
nigripennis (Casey) 1915:97	
rubripennis (Casey) 1915:97	

Pseudocotalpa Hardy n. gen.
andrewsi Hardy n. sp. S. Calif.

Pseudocotalpa Hardy, new genus

TYPE SPECIES.—*Pseudocotalpa andrewsi* Hardy, new species.

Body form robust. Clypeus deeply concave, with anterior and lateral margins forming high vertical carina between ocular canthi. Clypeus separated from front by complete suture swinging toward vertex centrally. Disc of clypeus with large punctures. Vertex impunctate, gradually becoming punctate towards clypeal suture. Ocular canthus thin; provided with long, pale hairs; not extending more than one-third distance across eye. Eye large, globular, only slightly flattened posteriorly, black. Entire head pale except portions of clypeal suture and marginal carina. Antennae 10 segmented, with three segmented club. Labrum thin, bilobed, at least three times wider than long. Mandible with outer edges rounded, without external teeth. Maxillae with five or six teeth internally; palp four segmented with fourth segment enlarged, longer than other three segments, and longer than entire body of maxilla. Apical palpal segment with deeply impressed groove on outer edge, running entire length. Labium small, nearly parallel sided, as wide as long; bilobed apically between insertion of palps. Prothorax fringed anteriorly, posteriorly, and laterally with long, dense, pale hairs. Thorax with scattered fine punctures, punctures usually separated by own width or more. Prothorax margined anteriorly and posteriorly. Postcoxal prosternal spine poorly developed, not present as well developed knob. Prothorax ventrally with long, fine, pale hairs. Elytra with poorly defined striae represented by scattered punctures. Flight wings well developed. Scutellum clothed with sparse covering of fine, long, pale hair. Abdomen generally covered with pale hair except for central portions of ventral sternites. Six abdominal sternites visible from below. Without well developed process between mesocoxae. Pygidial margin complete. Anterior tibia tridentate, with or without apical spur. Middle tibia with inner edge straight, outer edge gently rounded, apically supplied with one or two spurs and a number of fine, long spinules. Posterior tibia enlarged at apex, with one or two spurs; outer edge fimbriate with long spinules. All tarsal claws simple, not cleft, all chelate.

The genus *Pseudocotalpa* may be distinguished from closely related genera in the Areodina by the distinctive shape of the clypeus, *Pseudocotalpa* being the only genus in which the clypeus is deeply concave; and by the poorly developed prothoracic postcoxal spine or knob, which is well developed and evident in other genera. The enlarged, deeply grooved maxillary palp is also characteristic.

Pseudocotalpa andrewsi Hardy, new species
(Figs. 1–4)

HOLOTYPE MALE.—greatest length 17.5 mm, width at elytral humeri 8.8 mm. Disc of clypeus with small, yellowish setae emerging from many of the punctures. Apical segment of labial palp cone-shaped, slightly impressed on dorsal surface. Disc of prothorax glabrous, sparsely punctured; punctures separated by at least own diameter, becoming closer laterally, until rugose at lateral edges. Anterior angles poorly defined, lateral margins rounded down to ventral surface, lateral margin present only as fine carina. Elytra glabrous, except for tuft of hair at articulation. Pygidium apically rugulose, becoming slightly more rugose basally. Dense pale hairs laterally and basally. Apex of mesotibia with two apical spurs. Apex of metatibia with a single apical spur. All other characters as in generic description.

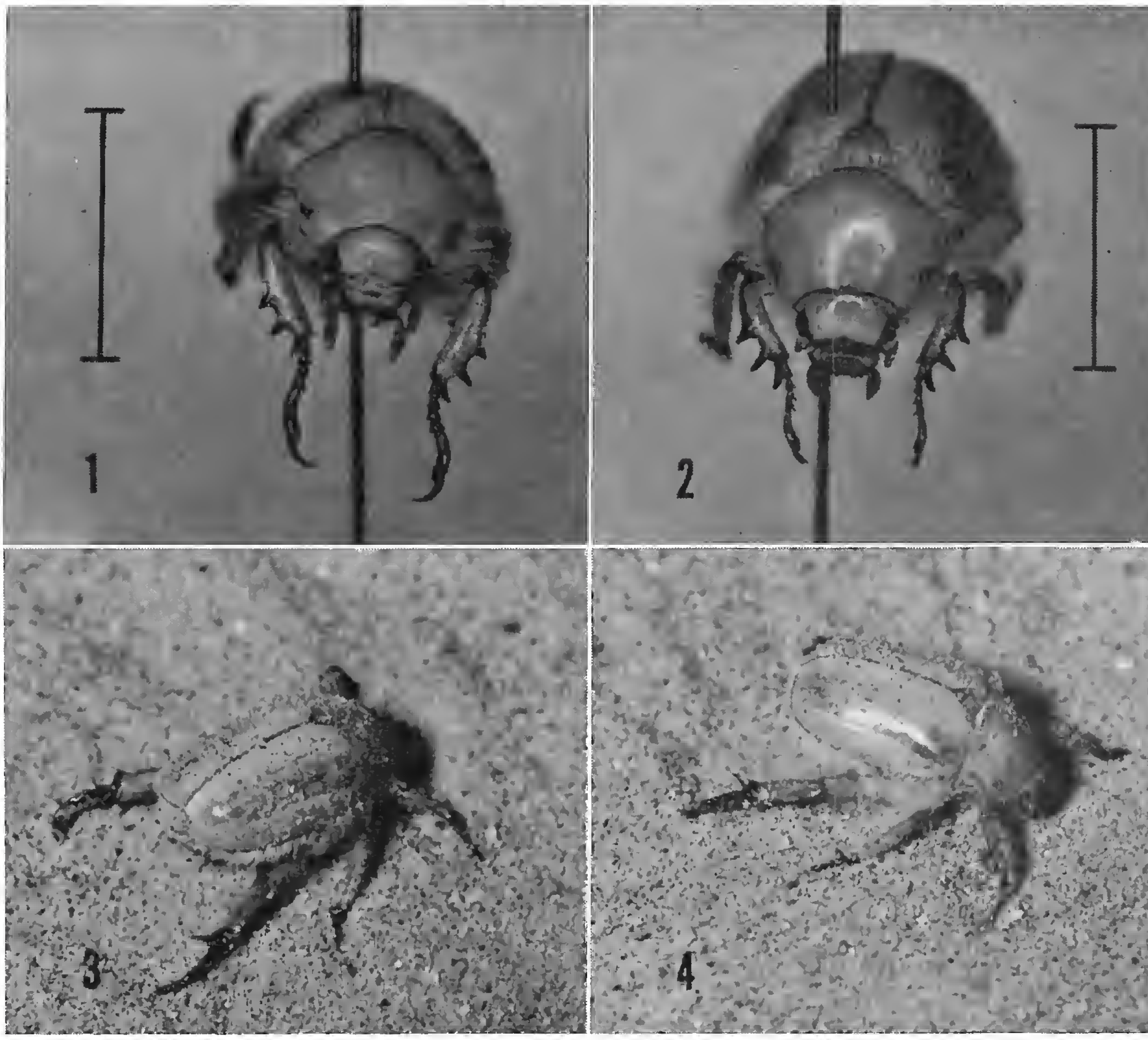
ALLOTYPE FEMALE.—greatest length 16.8 mm; width at elytral humeri 8.6 mm. Differs from the male in these respects: Maxillary palpi not as large, antennal club slightly shorter, anterior tibiae with spines longer and finer, with deeper emarginations between spines. All tarsi smaller, posterior tarsi flatter and wider. Abdomen more robust. Mesotibia with single apical spur.

PARATYPE VARIATION IN SERIES: Males 13.7 mm to 17.6 mm; females 14.2 mm to 18.4 mm. Morphologically most agree with the holotype or allotype, except in the character of the apical tibial spurs. Of the 118 paratypes (101 males, 17 females) 78 (64 males, 14 females) had only one apical spur on both the middle and hind tibia; 35 (32 males, 3 females) had vestiges of the second apical spur on the mesotibia; while 5 (males) had the second spur present on both mesotibia and metatibia. Evidently this is a character in the process of change as both spurs are present and well developed in other genera of Areodina. The protibial spur is absent from most, but present on some individuals.

Holotype male (Calif. Acad. Sci. # 10648), Glamis, Imperial County, California, 23 April 1970, A. R. Hardy and J. W. Prichard. Allotype (Calif. Acad. Sci.) and 107 paratypes (90 males, 17 females), same data as holotype, A. R. Hardy and J. W. Prichard. Additional paratypes, all from Imperial County, California include: 7 males, Glamis, 5 May 1970, A. R. Hardy and B. S. Cheary; 1 male, Glamis, 22 April 1967, F. G. Andrews; 2 males, Glamis, blacklight, 12 April 1969, A. R. Hardy; 1 male, Yuma Dunes, 30 April 1960, Betty Aaron.

Paratypes deposited in these collections: California Academy of Sciences; University of California, Riverside; University of California, Berkeley; University of California, Davis; Los Angeles County Museum; California State College, Long Beach; United States National Museum; American Museum of Natural History; Canadian National Collection; Illinois Naatural History Survey Collection; Museum of Comparative Zoology; Texas A&M University; British Museum of Natural History; Humboldt University (Berlin); California Dept. of Agriculture; Field Museum of Natural History (Chicago); Cornell University; Henry F. Howden; Fred Andrews; Terry Taylor; James Robertson; Brian Cheary; Dave Verity; and the collection of the author.

REMARKS.—An additional specimen from 5 mi. S. Ogilby taken in February was also examined, but was excluded from the type material because the specimen showed differences in the main characteristics of *P. andrewsi* sufficient perhaps to indicate a distinct taxon. More material needs to be examined before it can be placed.



FIGS. 1–4, *Pseudocotalpa andrewsi* Hardy, n. gen., n. sp. FIG. 1, Female Allotype. Line equal to one cm. FIG. 2, Male Holotype. Line equal to one cm. Note anterior tibiae which are narrower than in female. Note also deeply excavated, enlarged maxillary palp. FIGS. 3 & 4. Beetle on surface of sand after recent emergence from dune (see text).

That *Pseudocotalpa* has managed to escape detection for so long is due no doubt to the secretive habits of this insect. On 23 April 1970, collection of a large series was made, and observations on the behavior noted. *Pseudocotalpa* was noted emerging from the troughs of loose, drifting dunes, in the latter part of twilight. As darkness started to rapidly increase, the insects would burrow to the surface, where they would remain partially buried, with the head exposed, until the proper conditions, when, as if on a signal, large numbers would climb out onto the surface of the dune (Figs. 3 & 4), and after a moment begin to fly. The air was generally still, and the beetles would fly over the dunes at a height of several inches. When a breeze did move the air, males would orient upwind, and search until a female was found resting on the sand. At such time, copulation would occur. Evidently following a pheromone gradient, numbers of males would occasionally descend on a single female.

After flight that lasted for from 10 to 15 minutes, the beetles disappeared as rapidly as they had appeared. Following marks on the sand, the author located one individual that had rapidly burrowed approximately six inches into the sand. Extensive sifting has been conducted in these dunes in search of insects, with depths of several feet excavated, without the location of a single individual. Evidently the days are passed deep in the sand. While nearly 100 specimens were collected by hand on the dunes, a blacklight set up only a few yards away took about six specimens. Two weeks later (5 May) only seven examples were collected at the same locality. Occasional stragglers would come to the light on that occasion for as much as an hour after the initial flight time.

I take pleasure in naming this species after Mr. Fred Andrews, who first called this species to my attention.

Key to the Genera of Areodina of America North of Mexico

1. Postcoxal prothoracic spine poorly developed, not overtopping coxae, reduced to height of base of coxa; clypeus deeply concave, surrounded on sides and in front by equally reflexed clypeal margin; fourth segment of maxillary palp deeply impressed on anterior edge. S. Calif. .... *Pseudocotalpa* Hardy, n. gen.
   Postcoxal prothoracic spine well developed, often extending to level of coxal apex; clypeus either flat on disc, or if curved, lateral margins not reflexed to same degree as anterior edge; fourth segment of maxillary palp normal 2
2. Prothorax, and usually elytra, provided with dorsal hairs; all tarsal claws of both sexes simple; prothorax metallic blue, black or green .... *Paracotalpa* Ohaus
   Upper surface glabrous; at least anterior tarsal claws of male cleft, all claws of female simple; prothorax metallic yellow or golden, or reddish brown 3
3. Clypeus parabolic; anterior edge reflexed; clypeus densely rugosely punctured. Color reddish brown .... *Parabyrsopolis* Ohaus
   Clypeus transverse; anterior angles rounded; clypeus finely punctured. Color yellow or golden .... *Cotalpa* Burmeister

Acknowledgments

I would like to thank the following for the loan of comparative material used in this paper: Dr. C. Hogue and Mr. R. Snelling, Los Angeles County Museum; Mr. S. Frommer, University of California, Riverside; Drs. J. Chemsak and E. Schlinger, University of California, Berkeley; and especially Mr. Hugh Leech, California Academy of Sciences.

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BOOK NOTICE

Introduction to Zoology. By Theodore H. Savory. Philosophical Library, Inc., New York, N. Y. xiii + 239 pp., 79 figs. 1968. $6.00.

A pocket-sized handbook, the content being sketchily treated in general terms. Chapter 16 (pp. 105–123, figs. 30–44) contains the Insecta, the classification of which is given (p. 23) as: Subclasses Apterygota and Pterygota, Infraclasses Palaeoptera and Neoptera, and Superorders Polyneoptera, Paraneoptera and Oligoneoptera.—Hugh B. Leech, *California Academy of Sciences, San Francisco 94118.*

BOOK NOTICES

THE POCKET ENCYCLOPAEDIA OF PLANT GALLS IN COLOUR. By Arnold Darlington, with illustrations by M. J. D. Hirons, Blanford Press Ltd., London; Philosophical Library, Inc., 15 East 40th Street, New York, N. Y. 10016. 191 pp., incl. 293 figs. in color, 21 figs. in text. 1968. $7.50.

This book is for the general naturalist. There is a short section on the organisms which cause galls and their typical life histories, the plants' reactions to attack, types of galls, collecting of galls and rearing of insects from them, etc. The color plates are from photographs of live specimens, often combined with paintings of items not suited to photography; the photographs are nearly all good, the paintings adequate. The main text (pp. 113–183) treats representative British galls; the authors of scientific names are given in the index only.—HUGH B. LEECH, *California Academy of Sciences, San Francisco 94118.*

BEETLES. Written and illustrated by Wilfrid S. Bronson. Harcourt, Brace & World, Inc., New York. 160 pp., about 60 mostly composite figs. in text. 1963. $3.25.

Written simply and interestingly, with delightful "action" drawings, this book makes an excellent gift for anyone with a beginning interest in beetles. There is an introductory section on structure, skillfully made as interesting as that on life histories and habits. North American species and some exotics are figured and named, and there is a terminal "how to do it" chapter. The author has obviously read widely and been observant in his own field work.—HUGH B. LEECH, *California Academy of Sciences, San Francisco 94118.*

THE BIONOMICS OF BLISTER BEETLES OF THE GENUS *MELOE* AND A CLASSIFICATION OF THE NEW WORLD SPECIES. By John D. Pinto and Richard B. Selander. University of Illinois Press, Urbana, Chicago and London. Illinois Biological Monographs, No. 42. Pp. [8+] 222, frontispiece on p. [2], 198 figs. February, 1970. $10.00, paperbound.

In 1928 the late Edwin C. Van Dyke published a revision of the species of *Meloe* of North America north of Mexico, in a larger paper on the reclassification of the genera of North American Meloidae. That taxonomic treatment is the precursor of the new work in more ways than one, for Dr. Van Dyke's encouragement was largely responsible for Dr. Selander's decision, as a young student, to concentrate on the study of blister beetles. The present book is most appropriately dedicated to Dr. Van Dyke, and in tune with the times is broadly founded; the classification (pp. 92–180) is based largely on the anatomy of adults and first instar larvae, while the bionomics section (pp. 6–91) results chiefly from original work on five Illinois species. Seven new species are described and five names placed in synonymy, giving a total of 23 recognized species for the New World. The phoretic larvae are depredators or parasitoids in the nests of wild bees in the New World, but those of the Old World subgenus *Lampromeloe* damage colonies of honey bees. The adults are phytophagous; some are still rare, known from one or a few museum specimens.—HUGH B. LEECH, *California Academy of Sciences, San Francisco 94118.*

BOOK NOTICES

PRACTICAL ENTOMOLOGY. A GUIDE TO COLLECTING BUTTERFLIES, MOTHS AND OTHER INSECTS. By R. E. L. Ford. Frederick Warne & Co., Inc., London and New York: 101 Fifth Ave., New York, NY 10003. x + 198 pp., 36 figs., 12 pls. 1963. $4.95.

A book of techniques, based on English methods, some of them new to American collectors; slightly modified, most are suited for use here. With the current fast changes in our native environment the following British viewpoint on conservation may become of significance to us: (p. 27) "Before you decide to kill any insect for collecting purposes you should make certain that it is one you really want and also that it is a perfect specimen . . . it is silly to kill a female when you can keep it for eggs, breed a long fresh coloured series and let the surplus go."—HUGH B. LEECH, *California Academy of Sciences, San Francisco 94118.*

THE DISTRIBUTIONAL HISTORY OF THE BIOTA OF THE SOUTHERN APPALACHIANS. PART I: INVERTEBRATES. Edited by Perry C. Holt, with the assistance of Richard L. Hoffman and C. Willard Hart, Jr. Research Division Monograph 1, Virginia Polytechnic Institute, Blacksburg, Va. 24060. Pp. VIII + 295 (18, 66 and 220 are blank), + 1 un-numbered of Errata, 90 figs. May, 1969. Price not stated.

The 11 papers and Epilogue here published result from a symposium sponsored by the Virginia Polytechnic Institute and the Association of Southeastern Biologists, held at Blacksburg 27–29 June 1968. Those of immediate interest to entomologists are: Evolution of the Carabidae (Coleoptera) in the Southern Appalachians, by Thomas C. Barr, Jr. (pp. 67–92, 9 figs.); The origin and affinities of the Southern Appalachian Diplopod fauna, by Richard L. Hoffman (pp. 221–246, 8 figs.); and Ecological and geographical relationships of Southern Appalachian Mecoptera (Insecta), by George W. Byers (pp. 265–276).—HUGH B. LEECH, *California Academy of Sciences, San Francisco 94118.*

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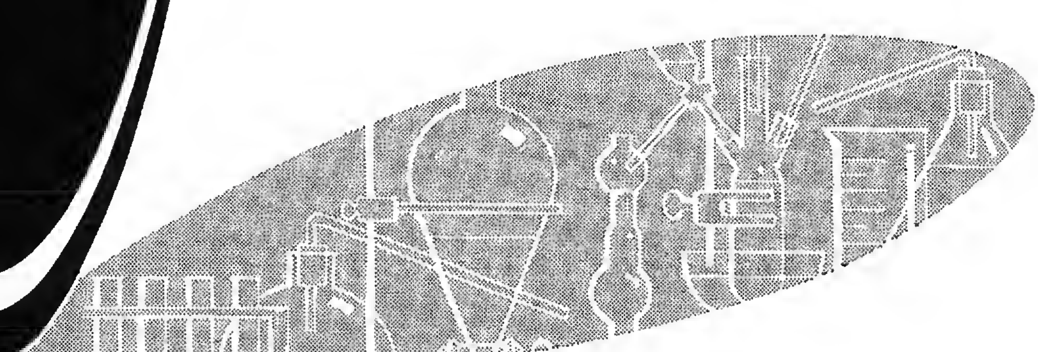

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THE PAN-PACIFIC ENTOMOLOGIST

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Ant Larvae of the Subfamily Myrmeciinae
(Hymenoptera: Formicidae)

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Emery (1911) and Wheeler (1922) placed the genus *Myrmecia* in the tribe Myrmeciini of the subfamily Ponerinae. Clark (1951) with Brown (1954) concurring raised the tribe to subfamily rank, Myrmeciinae.

The genus *Myrmecia* occurs only in Australia and New Caledonia and comprises between 65 (Brown and Taylor, 1970) and 96 (Clark, 1951) species. The workers range in length from 4 mm to 36 mm. The larger species are called bulldog ants because of "the vicious way they attack and the tenacity with which their huge jaws hang on to their victim. All the workers and females are provided with a large sting with which they inflict a severe and painful wound. A burning sensation accompanied by redness and swelling may be felt at the wound some time afterwards and may last several days" (Clark 1951: 18).

The Myrmeciinae are generally regarded as the most archaic of living ants. Brown (1954: 22–23) divided them into three tribes of one genus each: Prionomyrmecini, *Prionomyrmex* from the Baltic Amber (Oligocene); Nothomyrmeciini, *Nothomyrmecia*, one species (only two specimens known) from Western Australia, which "appears to satisfy nearly all conditions demanded of an ancestral stock leading to the *Dolichoderinae* and *Formicinae*"; and Myrmeciini, *Myrmecia*.

In our previous papers (1952, 1964) we have treated *Myrmecia* as a ponerine. Now we are convinced that it should be in a separate subfamily, the Myrmeciinae. In 1952 we described the larvae of two species (*M. gulosa* and *M. sanguinea*). In this paper we describe the larvae of 28 additional species. For all of this new material we are deeply indebted to the Rev. Bede B. Lowery, Head Master of St. Ignatius School, Norwood, South Australia. Rev. Lowery's gift renders *Myrmecia* the largest genus in our collection except *Camponotus*. Since *Camponotus* is the largest genus of ants (about 600 species), our 60 species constitute only 10%; but our 30 species of *Myrmecia* are either 42% or 31% of the genus.

Genus Myrmecia Fabricius

Not differentiated into neck and body; elongate and terete; anterior half strongly curved ventrally. Integument tough. Body hairs simple or denticulate. Head hairs few, simple and slightly curved; about as many sensilla as hairs on head. Clypeus granulose. Labrum small and short; posterior surface with spinules usually isolated and rather large and with sensilla of various sizes. Mandibles stout and subtriangular; heavily sclerotized; basal half usually bearing isolated spinules. Maxillary spinules usually rather large and isolated. Labium with spinules usually large and isolated; with dorsal transverse densely and coarsely spinulose ridge; each palp a slightly elevated cluster of sensilla; opening of sericteries wide and salient. Hypopharynx without spinules.

The following revised description of *M. gulosa* is our standard: *all other species are compared with it.*

Myrmecia gulosa Fabricius

Length[1] about 25 mm. Elongate, terete and slender; diameter greatest at AV and VI, diminishing gradually toward strongly ventrally curved anterior end; posterior half stout; posterior end broadly rounded; lateral longitudinal welt well developed. Anus ventral. Leg vestiges moderately large. Segmentation distinct, 10 differentiated somites. Integument of venters of TI and TII spinulose. Body hairs simple, slightly curved, short (0.06–0.2 mm long), uniformly distributed and moderately abundant. Head very small, subpyriform in anterior view; cranium subovoidal in anterior view, with numerous minute sensilla irregularly scattered over surface. Head hairs very few, minute (about 0.03 mm long), simple. Antennae mounted on low bulges; small; with 3 sensilla each. Labrum small and short; breadth twice the length; strongly bilobed due to wide median incision of ventral border; anterior surface of each half with about 12 sensilla and two or three minute hairs; posterior surface sparsely spinulose, spinules rather large and usually isolated; each half of posterior surface with about 12 sensilla of various sizes. Mandibles large; each subtriangular in anterior view; heavily sclerotized apically; apical tooth sharp-pointed and slightly curved posteriorly; medial teeth smaller, sharp-pointed and directed ventromedially; basal half of anterior surface with rather coarse spinules, these usually isolated; apical half with longitudinal striae on anterior and posterior surfaces. Maxillae lobose, narrowly round-pointed and with apical half spinulose; each palp a frustum with two apical, two subapical and one lateral sensilla; each galea a stout cone with two apical sensilla. Labium subhemispherical; anterior surface spinulose, the spinules rather large and isolated; a large densely and coarsely spinulose transverse welt posteriorly; each palp a rounded knob with five sensilla; opening of sericteries wide and salient. Hypopharynx without spinules. (Material studied: 12 larvae from New South Wales.)

Myrmecia arnoldi Clark

Length about 25 mm. Body hairs slightly longer (0.09–0.24 mm long). Head hairs longer (0.04–0.08 mm long). Mandibles without spinules on anterior surface. Maxillary palps each with four apical and one lateral sensilla. (Material studied: one larva from Western Australia.)

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[1] All of these larvae are measured from the mouth, through the line of spiracles to the anus.

Myrmecia brevinoda Forel

Length about 23 mm. Head hairs longer (0.036–0.072 mm long). Labrum with length ¾ the breadth. Maxillary palp with one apical, three lateral and one subbasal sensilla.

Very Young Larva.—Length about 4.8 mm. Shape similar to mature larva. First abdominal spiracle about 3 times as large as remainder. Integument with numerous denticles 0.11–0.32 mm long, and few minute spinules on venter of each somite. Body hairs 0.018–0.11 mm long. Head hairs 0.036–0.072 mm long, with tips simple or minutely spinulose. Mandibles with teeth relatively longer and more slender. Each maxillary palp a rounded mound; each galea a short stout peg. Each labial palp represented by cluster of five sensilla. Opening of sericteries a depressed transverse slit.

Material studied: numerous larvae from New South Wales.

Myrmecia chasei Forel

Length about 20 mm. Stouter. Entire integument spinulose or rugulose. Body hairs 0.06–0.43 mm long. Head hairs longer (0.06–0.12 mm long). Mandibles without spinules on anterior surface. Maxillae entirely spinulose; each palp a round-tipped conoid with four apical and one lateral sensilla. (Material studied: 6 larvae from Western Australia.)

Myrmecia clarki Crawley

(Figs. 1, 2)

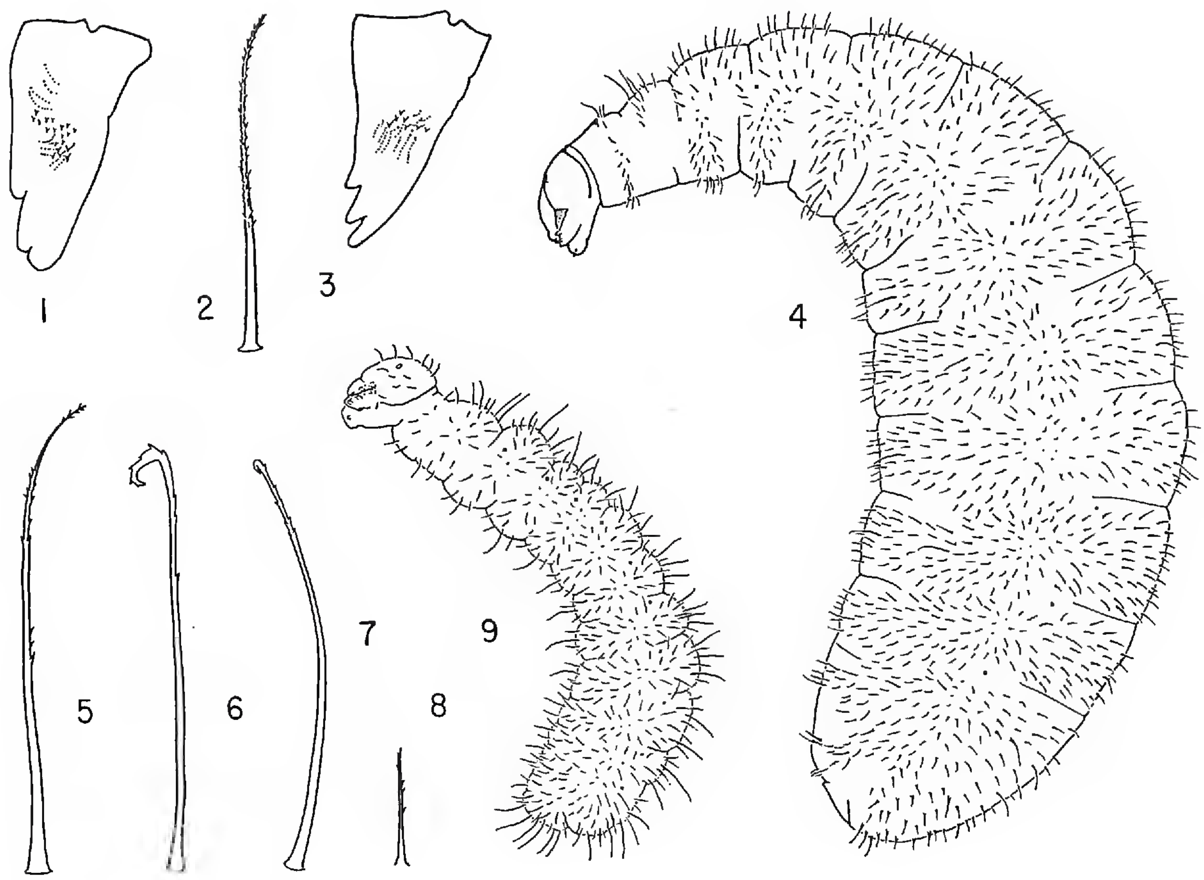
Length about 10 mm. Stouter. Integument of ventral surfaces of anterior somites with rather coarse spinules in short arcuate rows and of dorsal surfaces of posterior somites with minute spinules in short arcuate rows. Body hairs sparse, 0.03–0.35 mm long, finely denticulate and feebly flexuous. Head hairs about 0.05 mm long; very finely denticulate. Mandibles with teeth all reduced to rounded stumps; anterior surface with fewer spinules. Maxillae entirely spinulose. Opening of sericteries wide and salient from bottom of a trough. (Material studied: six larvae from Western Australia.)

Myrmecia comata Clark

Length about 15.5 mm. Venter of thorax with numerous spinules in short arcuate rows. Body hairs longer (0.075–0.41 mm long) and of two types: (1) simple; (2) with few minute denticles near tip. Cranium more nearly circular; entire head less pear-shaped. Head hairs longer (0.054–0.08 mm long). Mandibles with teeth larger; each apical tooth more slender and tip more hooked. Galeae longer. (Material studied: six larvae from New South Wales.)

Myrmecia dixoni Clark

Length about 9.6 mm. Not so slender; posterior end more rounded; entire body more curved. Integument of venters of thorax and AI, II, IX and X with spinules in short transverse rows. Body hairs less numerous, longer (0.075–0.53 mm long), with denticles. Head with occipital outline flatter; widest above antennal level. Posterior surface of labrum with spinules fewer, smaller and arranged in short



FIGS. 1 and 2. *Myrmecia clarki.* FIG. 1. Left mandible in anterior view, ×160. FIG. 2. Body hair, ×267. FIG. 3. *M. elegans* left mandible in anterior view, ×128. FIGS. 4–9. *M. fulvipes.* FIG. 4. Larva in side view, ×19. FIGS. 5 and 8. Two denticulate body hairs, ×183. FIGS. 6 and 7. Two views of a hooked hair, ×183. FIG. 9. Side view of a very young larva, ×19.

arcuate rows. Mandiblar teeth longer and more slender. Each maxillary palp with three apical, one subapical and one lateral sensilla. Labium with border between the palps flatter; each palp a low knob with five sensilla. (Material studied: three larvae from New South Wales.)

MYRMECIA ELEGANS Clark

(Fig. 3)

Length about 9.6 mm. Stouter. Integument of ventral surfaces of anterior somites and dorsal surfaces of posterior somites with spinules in short transverse rows. Body hairs few, short to long (0.06–0.54 mm), finely denticulate, tip highly varied (clubbed, spatulate, short-bifid or tapered). Head capsule more nearly circular. Head hairs fewer and longer (0.03–0.09 mm long). Mandibles with teeth stouter and round-pointed; fewer spinules on anterior surface. Each labial palp a slight elevation with five sensilla. (Material studied: three larvae and one semipupa.)

MYRMECIA FORCEPS Roger

Immature Larva.—Length about 11 mm. Entire integument spinulose, spinules larger and more numerous on venters of anterior somites and dorsa of posterior somites. Body hairs 0.01–0.32 mm long, very finely denticulate. Head with straight sides. Head hairs longer (0.025–0.065 mm long). Mandibles without spinules. Each maxillary palp with four apical and one lateral sensilla; galeae digitiform. Each labial palp a cluster of four sensilla; opening of sericteries a wide slit in trough. (Material studied: eight larvae from South Australia.)

MYRMECIA FORFICATA Fabricius

Length about 2 mm. The middorsa of TII and TIII each with transverse welt, which extends to level of spiracles. Entire integument of most somites with minute spinules, isolated or in short transverse rows. Body hairs sparse, slightly longer (0.052–0.3 mm long), with numerous minute denticles. Anterior surface of each half of labrum with two or three hairs (about 0.018 mm long) and about 20 sensilla on or near ventral border. Mandibles with teeth wider and longer. Each maxillary palp a short peg with four apical and one lateral sensilla. Each labial palp a small knob with five sensilla. (Material studied: numerous larvae from New South Wales.)

MYRMECIA FUCOSA Clark

Length about 9.2 mm. Thorax and AI more curved; remainder of abdomen more swollen, with venter flatter and dorsal surface more nearly C-shaped. Integument of venters of thorax and AI–IV and dorsa of AI–X with minute spinules in short arcuate rows. Body hairs sparser, longer (0.075–0.45 mm long), flexuous and with minute denticles. Anterior surface of each half of labrum with two minute hairs and about 17 sensilla on or near ventral border. Each maxillary palp with three apical and two lateral sensilla. (Material studied: seven larvae from South Australia.)

MYRMECIA FULVIPES Roger

(Figs. 4–9)

Length about 11 mm. Abdomen much stouter and shorter, diameter greatest at AIV and V, tapering gradually to more narrowly rounded posterior end. Integument of venters of anterior somites and AIX and entire integument of AX with minute spinules in short transverse rows. Body hair sparser and with numerous denticles. Cranium with occipital outline flattened. Antennae larger and near mouth parts. Each mandible with apical tooth narrower and medial teeth larger. Each maxillary palp with four terminal and one lateral sensilla; galeae digitiform.

Young Larva.—Length about 5 mm. Similar to mature larva except in following details. Spiracles of thorax only ⅔ diameter of those on abdomen. Body hairs of two types: (1) 0.012–0.3 mm, denticulate, on all somites; (2) 0.09–0.18 mm, uncinate, with hook and apical portion of shaft minutely denticulate, on AVII–X. Antennae smaller. Each maxillary palp a cluster of five sensilla; opening of sericteries a transverse slit.

Very Young Larva.—Length about 4 mm. Similar to young larva except in following details. Body of nearly uniform diameter. Body hairs (1) 0.09–0.22 mm; (2) 0.11–0.22 mm. Head capsule subhexagonal with corners rounded. Head hairs 0.015–0.06 mm. Labrum with smaller spinules.

Material studied: numerous larvae from New South Wales and Australian Commonwealth Territory.

Myrmecia gracilis Roger

Length about 18 mm. AIX bearing gonopod vestiges. Integument of thorax and AI–II bearing minute spinules. Body hairs of two types: (1) 0.038–0.38 mm long, with minute denticles near tip, on all somites; (2) 0.032–0.41 mm long, with bifid tip and with minute denticles apically. Head hairs 0.024–0.11 mm long, denticulate. Mandibles more slender apically. Each maxillary palp a frustum with four apical and one subapical sensilla; galeae digitiform. (Material studied: nine larvae from South Australia.)

Myrmecia gratiosa Clark

Length about 11 mm. Body hairs 0.025–0.35 mm long, very finely denticulate. Head hairs 0.01–0.09 mm long, simple. Each maxillary palp a round-tipped peg, with four apical and one lateral sensilla. (Material studied: three larvae from Western Australia.)

Myrmecia harderi Forel

Length about 13 mm. Stouter. Gonopod vestiges on AIX–X. Integument of venters of anterior somites and dorsa of posterior somites with spinules in transverse rows. Body hairs sparser and longer. Of two types: (1) 0.035–0.53 mm long, minutely denticulate, the longer with numerous denticles; (2) about 0.019 mm long, a few on abdominal somite X, with denticulate uncus. Head capsule nearly circular. Head hairs longer (0.036–0.1 mm long). Anterior surface of each half of labrum with two hairs and about 13 sensilla. Mandibles with stouter teeth and fewer spinules and striae. Each maxillary palp a frustum with four apical and one lateral sensilla; galeae digitiform.

Very Young Larva.—Length about 3 mm. Denticulate body hairs 0.009–0.18 mm long; uncinate hairs 0.15–0.23 mm long, few on each AIV–X. Mandibular teeth narrower and sharper. Each maxillary palp a low knob with five sensilla. Labium feebly bilobed; each palp a cluster of five sensilla; opening of sericteries a depression. Hypopharynx with minute spinules in short transverse rows.

Material studied: 13 larvae from Queensland.

Myrmecia lucida Forel

Semipupa.—Length about 13.5 mm. Integument of venters of anterior somites and dorsa of posterior somites with few spinules in short rows. Body hairs fewer, 0.04–0.36 mm long. Each mandible with apical tooth more curved, medial teeth stouter and blunter. Each maxillary palp with four apical and one lateral sensilla. Labium with much larger spinules basally. (Material studied: one semipupa from Western Australia.)

Myrmecia michaelseni Forel

Immature Larva.—Length about 10.8 mm. Stouter. Body hairs less numerous, length 0.025–0.35 mm. Head more rounded. Head hairs longer (0.027–0.75 mm long). Mandibles with teeth stouter and round-pointed. Maxillae entirely spinulose; each palp with four apical and one lateral sensilla. (Material studied: one larva from Western Australia.)

Myrmecia murina Clark

Length about 17.7 mm. Stouter. Entire integument spinulose. Body hairs fewer, 0.01–0.4 mm long, minutely denticulate. Head hairs 0.013–0.025 mm long, simple. Each maxillary palp with four apical and one lateral sensilla; galeae digitiform. (Material studied: 17 larvae from Australian Commonwealth Territory.)

Myrmecia nigrocincta F. Smith

Length about 9.7 mm. Gonopod vestiges on AVII–IX. Integument of venters of anterior somites and dorsa of posterior somites with minute spinules in transverse rows. Cranium subhexagonal in anterior view. Head hairs 0.038–0.075 mm long, simple. Anterior surface of mandibles with more striae and fewer spinules. Each maxillary palp a short peg with four apical and one lateral sensilla; galeae digitiform.

Young Larva.—Length about 4.7 mm. Similar to mature larva except in following details. Body hairs 0.014–0.15 mm long, with denticles. Cranium with occipital border concave. Mandibles with longer and more sharply pointed teeth; anterior surface with minute spinules, striae feeble. Each maxillary palp a short cone with three apical and two lateral sensilla; each galea a frustum. Each labial palp a slightly raised cluster of five sensilla; opening of sericteries a slit in depression.

Material studied: numerous larvae from New South Wales.

Myrmecia picta F. Smith

Length about 10.6 mm. Stouter. Gonopod vestiges on AVII–IX. Integument of venters of anterior somites and dorsa of posterior somites with minute denticles in short transverse rows. Body hairs sparser and longer (0.019–0.41 mm long), each with few minute denticles near apex. Head with occipital border flatter. Head hairs about ¼ as numerous, 0.018–0.1 mm long, with few minute denticles near apex. Mandibles with fewer and weaker striae. Each maxillary palp with four apical and one lateral sensilla. Labium with smaller spinules; each palp a slightly raised cluster of five sensilla.

Very Young Larva.—Length about 4.9 mm. Similar to mature larva except as follows. Body hairs 0.09–0.38 mm long, with numerous minute denticles. Maxillary palp a low knob with three apical and two lateral sensilla. Opening of sericteries a depressed slit on labium.

Material studied: 11 larvae from New South Wales.

Myrmecia piliventris F. Smith

Young Larva.—Length about 8 mm. Integument of venters of anterior somites and dorsa of posterior somites with minute spinules in short transverse rows. Body hairs sparser and longer. Of two types: (1) 0.045–0.27 mm long, with simple shaft and rather numerous minute denticles apically, on all somites; (2) 0.036–0.063 mm long, uncinate and with minute denticles, thin in plane of hook and wide perpendicular to that plane. Occiput flatter. Head hairs longer (0.027–0.72 mm long). Mandibles with teeth more acute and closer together. Each maxillary palp a short cone with three apical and two lateral sensilla; galeae digitiform. Each labial palp a slightly raised cluster of five sensilla. Opening of sericteries a transverse slit in slight depression.

Very Young Larva.—Length about 2 mm. Similar to young larva except as follows. Body hairs of two types: (1) 0.018–0.216 mm long, denticulate, on all somites; (2) about 0.16 mm long, uncinate, on AVI–X, more numerous posteriorly.

Material studied: numerous larvae from New South Wales.

The young and very young larvae are clumped with their posterior ends in contact and held together by the uncinate hairs. It is impossible to pry them apart with needles.

MYRMECIA PILIVENTRIS FEMORATA Santschi

Length about 12 mm. Entire integument spinulose, spinules minute and isolated or in short rows. Body hairs 0.025–0.35 mm long, stout, with numerous denticles. Head hairs simple, 0.036–0.054 mm long. Each mandible with apical tooth longer and more slender and medial teeth larger. Each maxillary palp a slender skewed peg, with three apical and two lateral sensilla; galeae digitiform. (Material studied: five larvae from Australian Commonwealth Territory.)

MYRMECIA PILOSULA F. Smith

Length about 12.5 mm. Slightly stouter and shorter. Entire integument spinulose, spinules minute and isolated or in short rows. Body hairs sparser and longer (0.025–0.45 mm long), with minute denticles. Occipital outline flatter. Head hairs 0.037–0.072 mm long, simple or with minute denticles. Mandibles with teeth longer and stouter. Each maxillary palp a tall cylinder with four apical and one lateral sensilla; galeae digitiform. Labial palp a short peg with five apical sensilla.

Young Larva.—Length about 2.7 mm. Similar to mature larva except in following details. Thoracic spiracles ⅓ diameter of abdominal spiracles. Integument with minute spinules, most abundant on AX and venter of thorax, more scattered elsewhere. Body hairs of two types: (1) 0.009–0.18 mm long, denticulate, on all somites except AX; (2) 0.054–0.18 mm long, on AIV–X, increasing in number posteriorly. Each maxillary palp a frustum; galeae shorter.

Very Young Larva.—Length about 2.4 mm. All spiracles minute. Entire integument of posterior somites with minute isolated spinules, venters of anterior somites with minute spinules in short transverse rows. Body hairs of two types: (1) 0.018–0.2 mm long, with minute denticles, on all somites except AX; (2) 0.054–0.18 mm long, uncinate and denticulate, increasing in number posteriorly. Labrum not deeply bilobed; posterior surface with spinules relatively smaller and not so numerous. Mandibular spinules minute. Maxillary spinules minute; each palp a low knob with five sensilla; each galea a slight elevation with two sensilla. Labial spinules shorter, many isolated; each palp a cluster of five sensilla; opening of sericteries a short depression. Hypopharynx with minute scattered spinules.

Material studied: numerous larvae from New South Wales and South Australia.

MYRMECIA PYRIFORMIS F. Smith

The name *M. sanguinea*, which we used in 1952 (p. 112) and 1964 (p. 444), is a synonym of *M. pyriformis* (Clark, 1951).

Revision.—Entire thoracic integument spinulose; spinules few and minute dorsally becoming more numerous and in transverse rows ventrally. Body hairs fewer and shorter (0.037–0.175 mm long). Each maxillary palp taller and with four apical and one lateral sensilla; each galea digitiform. Each labial palp with slight constriction near base. (Material studied: the thorax and attached heads of three larvae from New South Wales.)

Myrmecia simillima F. Smith

Length about 35 mm. Gonopod vestiges on AIX. Integument with minute spinules in short transverse rows on all surfaces of AX, on dorsa of other posterior somites and on venters of anterior somites. Body hairs fewer and longer (0.036–0.5 mm long), with minute denticles. Head hairs longer (0.038–0.11 mm long). Mandibles with teeth longer and closer together. Each maxillary palp a short cone with one apical, two subapical and two lateral sensilla; galeae digitiform. Each labial palp a short peg with five sensilla. Hypopharynx with few short transverse rows of minute spinules.

Young Larva.—Length about 17.6 mm. Similar to mature larva except in following details. TII with transverse welt across the dorsum from spiracle to spiracle. Entire integument spinulose, spinules minute but more numerous and larger anteriorly and ventrally. Each maxillary palp a frustum with four apical and one lateral sensilla.

Very Young Larva.—Length about 8.3 mm. Very similar to young larva except in following details. Thoracic spiracles about half diameter of abdominal spiracles. Venters of somites with minute spinules in short rows, more prominent anteriorly. Body hairs of two types: (1) 0.015–0.45 mm long, with few minute denticles, on all somites; (2) about 0.19 mm long, uncinate and flattened, with denticles in plane of uncus. Each maxillary palp a frustum with three apical and two lateral sensilla. Labium with spinules minute; each palp a slight elevation; opening of sericteries a transverse slit in depression.

Material studied: numerous larvae from New South Wales.

One of our specimens of *M. simillima* measures 35 mm in length and is the largest ant larva we have seen; its volume is about 350 mm^3. We do not have a preserved larva of the largest known ant, *Dinoponera grandis*, but as far as we can estimate from a tattered integument, that larva has a volume of about 400 mm^3.

Myrmecia swalei Crawley

Immature Larva.—Length about 8.8 mm. Stouter. Integument of venters of anterior somites and dorsa of posterior somites spinulose. Body hairs less numerous, 0.05–0.3 mm long, with numerous minute denticles. Cranium more rounded. Head hairs 0.013–0.05 mm long, simple. Mandibles with teeth stouter and round-pointed; with fewer spinules. Maxillae entirely spinulose; each palp with four apical and one lateral sensilla; galeae digitiform. (Material studied: one larva from Western Australia.)

Myrmecia tepperi Emery

Length about 11.5 mm. Stouter. Integument with spinules in short rows on all surfaces of AX and on venters of anterior somites. Body hairs 0.05–0.45 mm long, with fine denticles. Head hairs longer (0.036–0.072 mm long). Maxillae with most of anterior surface of each stipes covered with coarse isolated spinules; each palp digitiform, with four apical and one lateral sensilla.

Very Young Larva.—Length about 3.6 mm. Similar to mature larva except as follows. Entire integument minutely spinulose, spinules most prominent on AX and on venter of TI. Cranium subhexagonal with all corners rounded. Mandibles straighter, with teeth long, slender, straight and directed ventrally. Maxillae with spinules minute and in short rows on apex; each palp a low knob with four apical and one lateral sensilla; each galea a short cone. Each labial palp a slightly raised cluster of five sensilla; opening of sericteries a transverse slit in depression. Hypopharynx with few minute spinules.

Material studied: numerous larvae from New South Wales.

Myrmecia urens Lowne

Length about 7.3 mm. Gonopod vestiges on AIX. Entire integument spinulose, spinules minute and mostly isolated but in short rows on AX and on venters of anterior somites. Cranium with occipital outline flatter. Mandibles bearing few striae, teeth more prominent and closer together. Each maxillary palp a skewed peg with one apical, two subapical and two lateral sensilla.

Young Larva.—Length about 3.3 mm. Similar to mature larva except as follows. Thoracic spiracles about ½ diameter of abdominal spiracles. Mandibular teeth slender and very acute.

Material studied: 14 larvae from New South Wales.

Myrmecia varians Mayr

Immature Larva.—Length about 9.2 mm. Gonopod vestiges on AIX. Integument with spinules on all surfaces of AX and on venters of anterior somites. Body hairs less numerous and longer (0.025–0.51 mm long), with short denticles; hairs mostly short, but with ring of the longer hairs around middle of each somite. Mandibles with notably larger teeth. Each maxillary palp a short cone with four apical and one lateral sensilla; galeae digitiform. Each labial palp a slight elevation with five sensilla.

Very Young Larva.—Length about 4.3 mm. Similar to mature larva except in following details. Body hairs shorter (0.018–0.3 mm long). Mandibles with teeth narrow and more acute.

Material studied: 15 larvae from New South Wales.

Myrmecia vindex F. Smith

Length about 21 mm. Integumentary structures of unknown nature and function on each ventrolateral surface of each abdominal somite; minute spinules in short transverse row on venters of anterior somites. Body hairs fewer, 0.06–0.3 mm long, minutely denticulate. Head hairs very few, longer (0.03–0.09 mm long). Mandibles with stouter teeth; spinules fewer and smaller. Maxillae with apex narrower; each palp a round-topped peg, with four apical and one lateral sensilla. Labium with fewer and smaller spinules. (Material studied: one larva from Western Australia.)

Myrmecia wilsoni Clark

Semipupa.—Length about 12 mm. Stouter. Body hairs finely denticulate, of two types (with few intergrades): (1) short (0.035–0.1 mm long), generally dis-

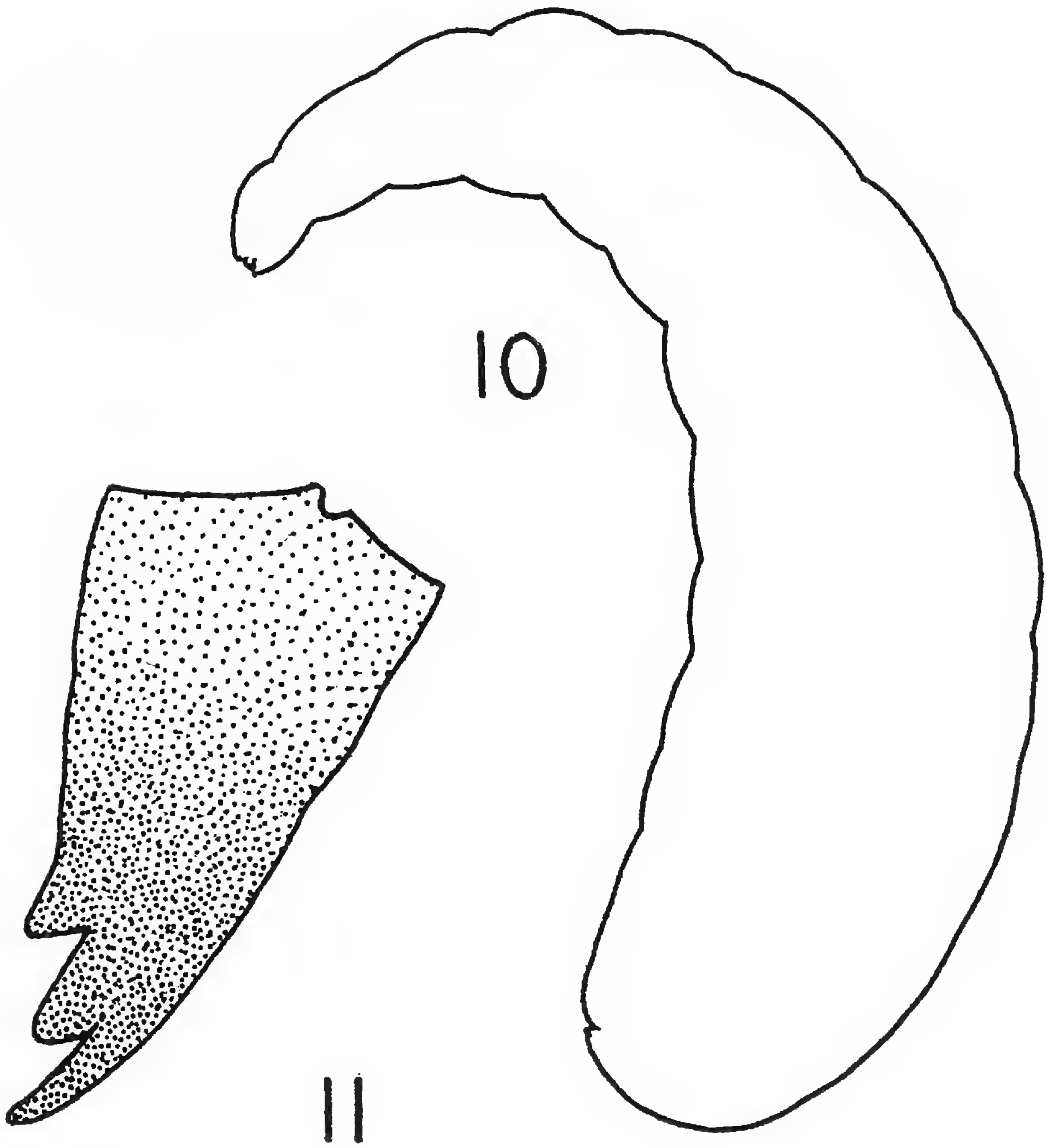


FIG. 10. Myrmeciiform body profile. FIG. 11. Myrmeciiform mandible shape.

tributed; (2) long (0.2–0.3 mm long), a few on each somite. Head hairs longer (0.015–0.075 mm long), tip notably slender. Mandibles with teeth much larger and round-pointed; fewer spinules. Each maxillary palp with four apical and one lateral sensilla; galeae digitiform. Labium with smaller spinules; each palp a slight elevation bearing five sensilla. (Material studied: one semipupa from Western Australia.)

DISCUSSION

In our study of the larvae of the subfamily Myrmicinae (1960) we discussed the importance of various characters in taxonomy and described our techniques for generalizing about body profile and mandible shape. We later (1964) applied the same reasoning and techniques to the larvae of the Ponerinae, which then included *Myrmecia.*

The larva of *Myrmecia* has a myrmeciiform profile, which was figured and described (1964: 458) thus: "Not differentiated into neck and body; elongate and rather slender; diameter diminishing gradually from the fifth abdominal somite to the anterior end; anterior half strongly curved." It is refigured here (Fig. 10). The mandible shape which is also termed myrmeciiform is revised to read thus: "Subtriangular in anterior view; straight and stout; without a medial blade; with one apical tooth and two subapical medial teeth" (Fig. 11). As the term myrmeciiform suggests, the profile and mandible shape are both distinctive for this genus.

We have selected the myrmeciiform profile as the least specialized among known ant larvae, because (1) *Myrmecia* has generally been considered one of the least specialized genera of ants; (2) among the larvae of this genus no character shows an extreme deviation from the average for all known ant larvae; (3) no character shows adaptation to any limited function or habit; (4) among the larvae of *Myrmecia* the majority of characters are only moderately developed in contrast to the extremes of the same characters in the family.

We believe that the larvae of *Myrmecia* are unspecialized in the following characters: body shape; body hairs; head hairs; size, shape and position of antennae; size and shape of labrum; mandible shape; maxillary palps paxilliform; galeae digitiform; labial palps low rounded elevations; opening of sericteries wide and salient; hypopharynx without spinules; spinules on other mouth parts few, coarse and isolated.

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A New Species of *Scaphinotus* from Oregon[1]

(Coleoptera: Carabidae)

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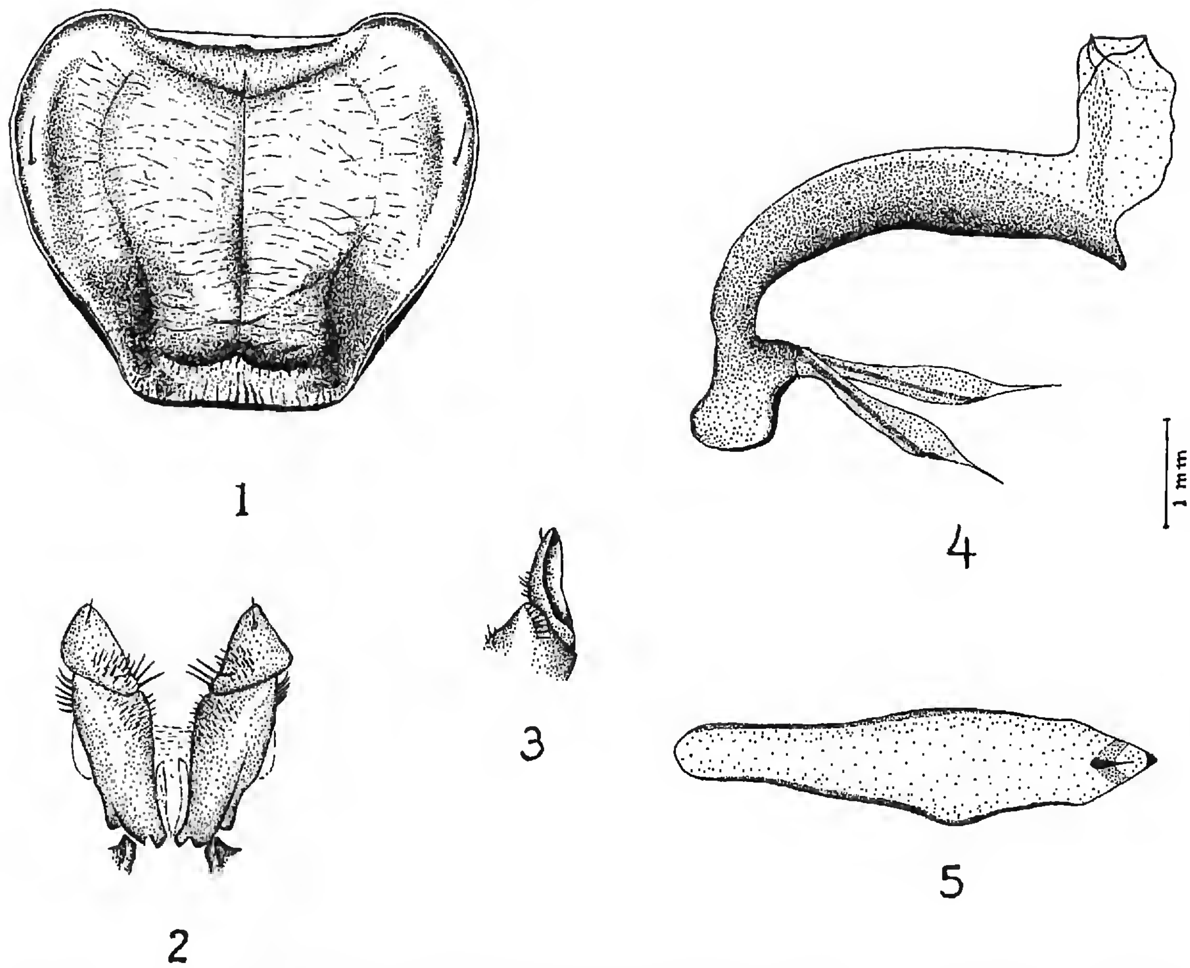
During the past three summers I have collected throughout western Oregon attempting to get a reasonable series of specimens of the species and subspecies of *Scaphinotus,* subgenus *Stenocantharis* Gistel (*Pemphus* Motschulsky), to determine geographic distribution and to study their biology, ecology and morphology. While searching the high Cascade Mountains a new species belonging to the above group was discovered.

Scaphinotus (Stenocantharis) hatchi Beer, new species

Moderately large, robust (17.5–23 mm long; 7.7–9 mm wide), rather broad and flattened; brown, with head between antennal ridges and eyes, pronotum, and elytral margins brilliant metallic violet red. Dorsal surface with moderate luster, elytra and central portions of pronotum with greenish reflections in some light. Beneath chocolate brown to dark brown.

Holotype male.—Head 2.5 mm long, measured from tip of clypeus to posterior margin of eyes, 2.6 mm wide at maximum transverse distance across anterior margin of eyes, front smooth, convex with short, shallow longitudinal depression at apical center of clypeus, surface becoming shallowly transversely wrinkled between antennal ridges and eyes, genae slightly and obtusely notched in front of eyes; antennae reaching two thirds length of body, basal segment reaching beyond eyes, only slightly shorter than the next two combined; eyes moderately prominent. Pronotum cordate, 3.4 mm long, 4.3 mm wide, slightly wider at base than apex; sides strongly rounded in front, oblique in posterior half, posterior angles rounded, with setigerous punctures near middle of lateral margin, margins moderately reflexed, more so in apical half; anterior margins broadly sinuate, base truncate; disk biconvex, formed by a well impressed but fine median line, with both anterior and posterior impressions well indicated, a short longitudinal depression anterior to base of each elytron; surface finely and sparsely wrinkled (Fig. 1). Elytra oval, flattened, nineteen striae feebly impressed becoming irregular and rather indistinct at sides, intervals with fine, shallow punctures, striae five and eleven slightly elevated and more distinct, elytral margins with small, rather regularly placed punctures becoming nearly obsolete toward apex; epipleura smooth. Undersurface smooth, posterior coxal plate bearing anterior and posterior setae, front and middle femora with punctures on anterior face, none on ventral surface. First three segments of anterior tarsi slightly dilated, tarsal pads (adhesive hairs) of first segment limited to slightly less than its apical half, second and third for most of their length; last segment with two anal setae. Length, from tip of mandibles to apex of elytra along mid-dorsal line, 18 mm; greatest width across elytra, 8.2 mm.

[1] This study was made possible through a grant from the General Research Fund of the Graduate School, Oregon State University.



FIGS. 1–5. *Scaphinotus hatchi* Beer, new species. FIG. 1. Pronotum, dorsal view. FIG. 2. Female genitalia, ventral view. FIG. 3. Female genitalia, stylus, lateral view. FIGS. 4–5. Male genitalia. FIG. 4. Lateral view. FIG. 5. Dorsal view.

Allotype female.—Somewhat larger and more robust, slightly less red on head and pronotum; antennae reaching slightly beyond middle of elytra when laid along side; front tarsi not dilated and without tarsal pads, anal segment with four setae. Length, measured as in male, 20.5 mm; width, 8.7 mm.

Holotype male, allotype and 16 paratypes taken along a two mile stretch of road TWO MILES EAST OF ISLET CAMPGROUND AT WALDO LAKE, LANE COUNTY, OREGON, 29 July 1970. Two original paratypes were collected on 27 September 1969, the remainder, 67 paratypes were collected between the dates of 2 June and 4 August 1970, all at the type locality by F. M. and V. S. Beer. The holotype, allotype and six paratypes will be deposited with the Museum of the California Academy of Sciences, four with the U. S. National Museum, four with the American Museum of Natural History, four with the Museum of Comparative Zoology, eight with Dr. Melville H. Hatch of the University of Washington, Seattle, Wn., and four with Dr. G. E. Ball of the University of

Alberta, Edmonton, Alberta, Canada. The remainder will be retained in my collection.

It is with much pleasure that I dedicate this beautiful species to my good friend Dr. Hatch, whose untiring labor has done so much for the coleopterology of the Pacific Northwest.

Very little variation is observable except in size and in the number of striae, ranging from eighteen to twenty, eighteen or nineteen being the most common. The background color in a few instances appears to be a very deep brown black, but under magnification the basic color is brown. The punctures on the front and middle femora are quite variable, ranging from two in one specimen to eight in another. The fourth tarsal segment also has a few adhesive hairs in some males. Two anal setae are most common for the males, while two, three, four, five or six occur in the females, four being the most common.

Scaphinotus hatchi is most closely related to *S. a. angusticollis* Mann., and this is the only Northwestern species with which it might be confused. It would key to *S. angusticollis* in Hatch's monograph (1953, p. 46, couplet 5), but may readily be separated from that species by having the head and pronotum red on a brown background instead of green on a black background, elytra widest at middle instead of back of middle, and the first segment of protarsi smooth in the basal half instead of in the basal third. Van Dyke could find no differences in the male genitalia of *S. angusticollis* and its subspecies, but this organ in *S. hatchi* (Figs. 4 and 5) is decidedly different, as is also the female structure (Figs. 2 and 3), and both will also serve to separate the two species.

Scaphinotus hatchi was taken in mature stands of mountain hemlock (*Tsuga mertensiana* (Bong.) Sarg.) under old logs, bark and occasionally rocks, being most abundant in broad depressions of the region which contained more moisture and was thinly overgrown with stands of dwarf red whortleberry (*Vaccinium scoparium* Leiberg).

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A Review of the Nearctic Species of *Platystethus*
(Coleoptera : Staphylinidae)

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During the course of a survey of synanthropic fly species, numerous species of staphylinid beetles were encountered. Among these were species of *Platystethus* found in manure associated with species of *Musca, Fannia, Stomoxys* and other Diptera and in damp soil associated with the eye gnat, *Hippelates collusor* (Townsend). The biology of the Nearctic species of *Platystethus* has yet to be investigated. It is assumed that interaction of these often abundant predators and early stages of flies is important in the dynamics of fly populations. As a preliminary step toward a better understanding of the genus *Platystethus* we review the systematics and distribution of the Nearctic species of the genus. Two species of *Platystethus* have been hitherto recorded from the Nearctic region. In this paper we record for the first time from the Nearctic region the Palearctic species *Platystethus cornutus* Gravenhorst.

Platystethus is a member of the tribe Oxytelini of the subfamily Oxytelinae. The genus can be defined among the Staphylinidae by the following four characters: 1) second sternite present, 2) tarsi three-segmented, 3) inner apical angles of the elytra rounded, 4) middle coxae separate. The last of these distinguishes *Platystethus* from *Bledius* in which genus the middle coxae are contiguous. Most keys separate *Platystethus* and *Bledius* by the statement that in the former the anterior tibiae possess only a single row of spines. However, two rows of spines are often present.

PLATYSTETHUS Mannerheim

Platystethus Mannerheim, 1831, p. 460.

Form subparallel, depressed. *Head* with supraantennal prominences; nuchal constriction present; gular sutures united or obliterated in front, widely divergent behind; antennae incrassate; labrum transverse, apex emarginate, anterior angles membranous; mandibles gently arcuate, with two or three teeth on inner edge; maxillary palpi four-segmented, first segment small, second longer than wide, curved, widest at apex, third about as long and as wide as second, fourth narrower than third and a little shorter, narrowed to apex; labial palpi three-segmented, first segment longer than wide, second narrower and longer than first, third narrower than second and about one-half as long. *Thorax* pronotum with sides evenly arcuate into base; hypomera separated from disc by carina; trochantin prominent; epimera absent; prosternal process short; middle coxae separated by mesosternal and metasternal processes which meet between them; elytra dehiscent; tibiae with

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one or two rows of spines on outer edge; tarsi three-segmented, segments one and two short, segment three much longer than one and two together.

KEY TO THE NEARCTIC SPECIES OF PLATYSTETHUS

1. Pronotum with reticulate ground sculpture .... *cornutus* Gravenhorst
   Pronotum without ground sculpture 2
2. Punctures of head sparse, discrete .... *spiculus* Erichson
   Punctures of head dense towards the sides, arranged in close-set irregular longitudinal grooves .... *americanus* Erichson

PLATYSTETHUS AMERICANUS Erichson

Platystethus americanus Erichson, 1840, p. 784.

MALE.—*Color* black except elytra and femora piceous, tibiae and tarsi testaceous. *Head* subquadrate; tempora twice as long as eyes; not narrowed to a neck; surface polished and sparsely punctured on disc, transversely rugulose anteriorly, coarsely punctured at sides with punctures arranged in irregular, closely placed longitudinal grooves; with straight impunctate groove above eye; each outer angle of clypeus produced in straight slender horn distinctly longer than space between horns. Antennae with first three segments elongate, segments two and three subequal, shorter than first, four through six moniliform, seven through ten transverse, eleven as long as two preceding. *Pronotum* as wide as and shorter than head, wider than long, surface polished, finely sparsely punctured, with fine central longitudinal groove. *Elytra* conjointly a little narrower than pronotum, a little wider than long, very finely rugulose apically. *Abdomen* highly polished with very few fine punctures; seventh visible sternite with semicircular impression in central third extending almost to base.

FEMALE.—Head narrower than pronotum, anterior angles of clypeus hardly produced, tempora about as long as eye, pronotum as long as head, seventh visible sternite not impressed.

LENGTH.—2.6–4.2 mm.

TYPE LOCALITY.—"Pennsylvania et Virginia."

Location of type either in Hope Museum, Oxford or Zoologische Museum, Berlin.

Common in manure throughout the United States and in Mexico. In California, much more common in isolated field droppings than in accumulated manure deposits. Occasionally taken in other decaying organic matter and at lights.

This species is most easily recognized by the strong anastomotic, punctured longitudinal grooves at the sides of the head above and behind the eyes.

PLATYSTETHUS SPICULUS Erichson

Platystethus spiculus Erichson, 1840, p. 784.

MALE.—*Color* piceous except elytra rufopiceous and legs testaceous. *Head* subquadrate; tempora almost twice as long as eye; not narrowed to a neck; surface polished and very finely sparsely punctured throughout with clypeus faintly microreticulate; with three longitudinal impunctate grooves internal to each eye; each outer anterior angle of clypeus produced as slightly arcuate slender horn about as long as space between the horns. Antennae with first three segments elongate, segments two and three shorter than first, four and five moniliform, six through ten transverse, eleven as long as two preceding. *Pronotum* as wide as and somewhat shorter than head, wider than head, wider than long; surface polished, finely sparsely punctured; with fine central longitudinal groove. *Elytra* conjointly about as wide as pronotum, a little wider than long, very finely sparsely punctured and very finely rugulose on disc and apically. *Abdomen* highly polished with very few fine punctures; seventh visible sternite semicircularly impressed in central third, impression extending almost to base of segment.

FEMALE.—Head narrower than pronotum; anterior angles of clypeus slightly produced; with two longitudinal impunctate grooves internal to each eye; tempora about as long as eye; pronotum as long as head; seventh visible sternite not impressed.

LENGTH.—2.0 mm.

TYPE LOCALITY.—"Caracas in Columbia" (= Venezuela).

Originally described from Venezuela this species has been reported from Argentina, Colombia, Panama, Guatemala, Mexico, the West Indies, and in the United States from Texas (Casey, 1886) and southern California (Moore, 1937). We have seen material from the following: San Diego County, Imperial County, Orange County, Los Angeles County, Riverside County, Kern County, and Stanislaus County, California (Legner and Olton, 1970); Tucson, Phoenix, Ehenberg and Oak Creek Canyon, Arizona; Tehuacan and Chilpancinco, Mexico and Sabana Grande, Puerto Rico. E. F. Legner and G. S. Olton collected it most often from accumulated manure. It has also been collected in damp sand at Thermal, California in a date grove in association with *Hippolates collusor* by E. F. Legner, from decaying watermelon at Blythe, California by G. S. Olton and by vacuum by E. I. Schlinger from cotton fields.

PLATYSTETHUS CORNUTUS Gravenhorst

Platystethus cornutus Gravenhorst, 1802, p. 109.

MALE.—*Color* black except legs and mouth parts testaceous with femora, coxae and bases of antennae infumate, elytra flavus on disc and toward suture with suture, sides, base and apex fuliginous to piceous. *Head* subquadrate; tempora a little longer than eyes; not narrowed behind to a neck, surface strongly reticulate except central tumidity and strigulose antennal tubercles; disc rather strongly punctured, punctures separated by one to two times their diameters; with single straight longitudinal impunctate groove above each eye; each outer anterior angle of clypeus produced in long straight horn about as long as space between horns. Antennae with first three segments elongate, second segment about one-half longer than third, fourth through sixth moniliform, seventh through tenth slightly transverse, increasing gradually in width, eleventh more than twice as long as tenth. *Pronotum*

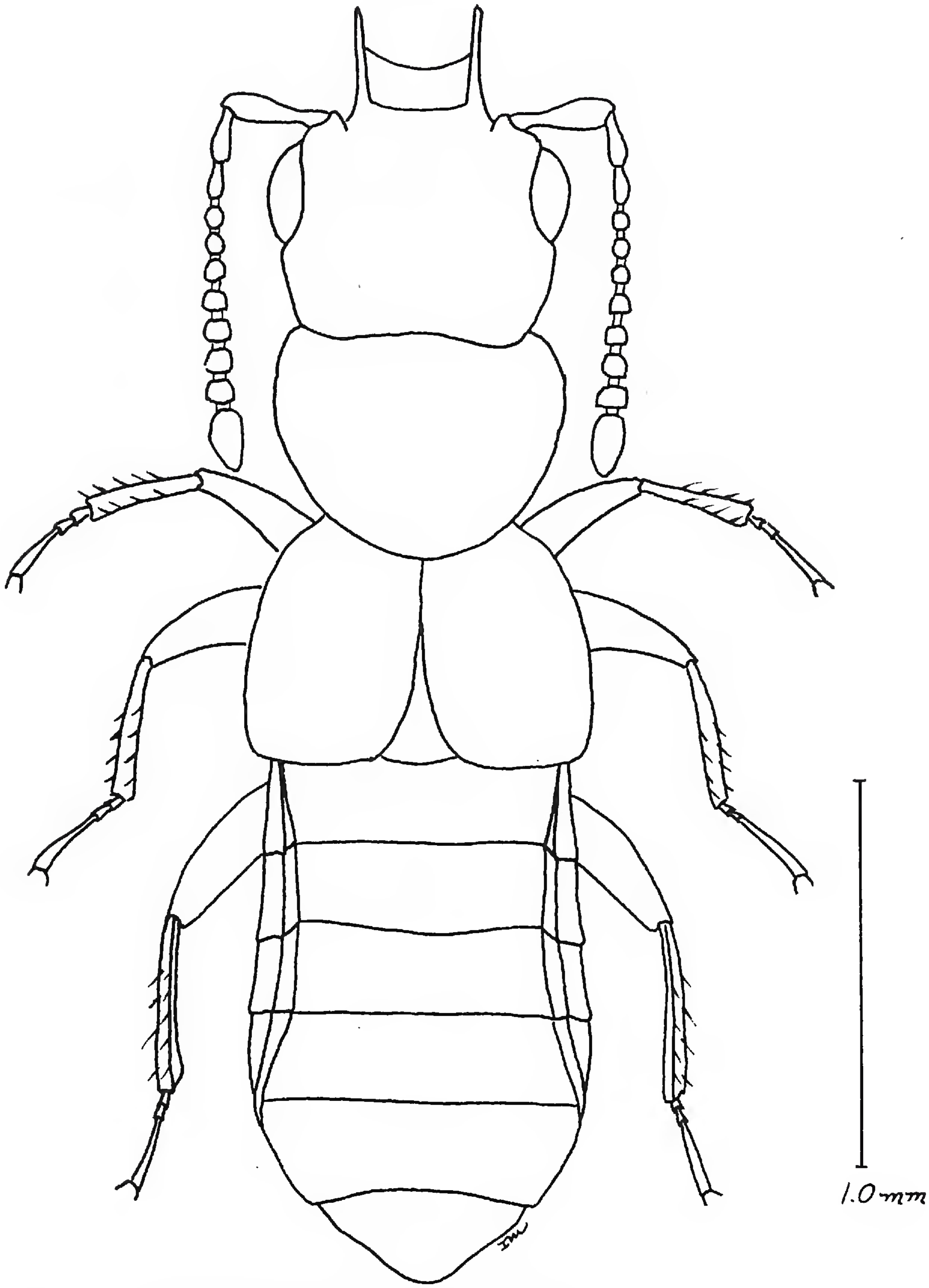

Fig. 1. *Platystethus cornutus* Gravenhorst, Male.

as wide as and shorter than head, wider than long; surface strongly reticulate throughout; as strongly but more sparsely punctured than head; with impressed longitudinal central groove. *Elytra* conjointly a little narrower and about as long as pronotum; reticulate and punctured as pronotum. *Abdomen* strongly reticulate, very finely sparsely punctured; seventh visible sternite deeply, semicircularly emarginate in central third, each side with two elongate, horn-like processes.

FEMALE.—Head narrower than pronotum; anterior angles of clypeus slightly produced; seventh visible sternite lobed.

LENGTH.—2.5–3.1 mm. (Fig. 1).

TYPE LOCALITY.—Not recorded but presumably Germany.

Location of type probably in the Zoologische Museum, Berlin.

This species is easily known by its strongly reticulate head and pronotum.

Previously known from the Palaearctic and Asiatic regions where it has been reported from "dung and decaying matter." A single female was taken on highway 30 two miles east of North Platte, Lincoln County, Nebraska, elevation 2,800 feet, 23 July 1970 by vacuum from emergent vegetation associated with a marsh by T. W. Fisher and R. E. Orth.

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A Review of the Genus *Leptopteromyia* in the Western Hemisphere[1]

(Diptera: Leptogastridae)

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In 1907 Williston published the *nomen nudum Leptopteromyia*, but he validated the name in 1908 by publishing a figure of *Leptopteromyia*

[1] Support by National Science Foundation Grant GB 7804 is acknowledged.

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gracilis Williston from Brazil. Aldrich (1923) designated *L. gracilis* as the type of *Leptopteromyia.* Hermann (1924) designated his *nomen nudum L. willistoni* Hermann from Mexico as the type of *Leptopteromyia.* Hardy (1947) described the second species *L. americana* Hardy from southern Texas. Carrera (1947) discussed *Leptopteromyia* and designated a specimen from Estado Rio Janeiro, Quinta Boa Cista e Jardin Botanica, Brasil, as the neotype of *L. gracilis.* The location of either Williston's or Hermann's holotype specimens is unknown.

Leptopteromyia is represented in collections by only a small number of specimens. Of the six species described here, four are represented by only one specimen each, and two species by three specimens each. *Leptopteromyia americana* is represented by 15 or 20 specimens.

Loans of specimens by the following colleagues makes it possible to describe six new species of *Leptopteromyia* from Mexico and South America. Dr. Paul H. Arnaud, Jr., California Academy of Sciences (CAS); Mr. Eric Fisher, Long Beach State College (Type, gift to CAS); Dr. H. de Souza Lopes, Academia Brasileira Cienias, Rio de Janeiro, Brasil (ABC); Dr. Nelson Papavero, São Paulo Universidade, São Paulo, Brasil (SPU); Dr. A. Willinik, Universidad Nacional de Tucuman, Tucuman, Argentina. In my personal collection is a Brasilian species collected by the indefatigable Fritz Plauman, Nuevo Teutonia, Brasil (CHM).

LEPTOPTEROMYIA Williston

Leptopteromyia Williston, 1907: p. 1. *Nomen nudum*; Williston, 1908: p. 195, fig. 35, lateral aspect of body of *L. gracilis*; Aldrich, 1923: p. 3; Hermann, 1924: p. 143; Hardy, 1947: p. 72–74; Carrera, 1947: p. 89–96 (Neotype).

Antennal segment 3 discoid with long style extending from dorsal surface, eyes nearly contiguous below antennae; halteres about as long as thorax, one group of *Leptopteromyia* with longitudinal thoracic stripes, and one without stripes; abdomen very slender, tergites 2 and 3 of *L. americana* abut, hiding sternites 2 and 3, but these sternites visible in all other species, tergite 5 of four species yellow with brown markings, other species with tergite 5 brown; male genitalic structures differ from those of other Leptogastridae; wings with four posterior cells, costal and subcostal veins coalescing on apical half, wing veins with or without hair, but when present pattern differs from that of the hairy-veined *Schildia* Aldrich.

Hardy (1947) indicated that *Leptopteromyia* is sexually dimorphic. Apparently Hardy's figure 1b illustrates the thoracic pattern of the female of a second species. I have a female from Southmost, Cameron County, Texas, 25 March 1951 (R. H. Beamer) with a thoracic pattern similar to Hardy's (1947) figure 1f of the male and also to a male paratype at hand.

Leptopteromyia ranges from southern Texas, United States of America, to Tucuman, Argentina.

Dr. H. Sousa Lopes reports (Carrera, 1947) rearing *Leptopteromyia* from the nests of Embioptera in Brasil. Dr. E. S. Ross, California Academy of Sciences, reared a specimen of *L. peruae* Martin in Peru, and an undescribed teneral specimen in Guatemala from Embioptera nests. The teneral specimen belongs to the group with tergite 5 yellow with brown marks. The late Dr. R. H. Beamer reports (Hardy, 1947) *L. americana* Hardy in association with large numbers of Aleyrodidae.

Key to the Species of Leptopteromyia

1. Mesonotum yellowish or reddish, 3 dark red to blackish longitudinal stripes; tergite 2 with yellow band medially 4
   Mesonotum either chestnut or dark cherry red, without longitudinal stripes; tergite 2 without a band 2

2(1). Abdomen reddish brown, narrowly paler at joints of tergites; face reddish brown above, grayish below; length 6 mm. (Peru) .... *peruae* Martin, n. sp.
   Tergites 3–5 or 3–6 with narrow yellow bands either on anterior margins or both anterior and posterior margins 3

3(2). Face brown tomentose; posterior margin of scutellum blackish; tergite 5 dorsoposteriorly yellow; length 11 mm. (Brasil) .... *lopesi* Martin, n. sp.
   Face yellow tomentose; posterior margin of scutellum yellow; tergite 5 dorsoposteriorly brown; length 6–8 mm. (Brasil) .... *gracilis* Williston

4(1). Thoracic lateral stripes not extending to ventral margin of dorsum 7
   Thoracic stripes extending to ventral margin of dorsum 5

5(4). Tergite 5 of female dark reddish brown, of male a narrow anterior yellow band, dorsally posterior half more or less red, laterally broadly yellow; length 9 mm. (s. Brasil) .... *brasilae* Martin, n. sp.
   Tergite 5 and apex of hind tibia reddish brown 6

6(5). Tergite 5 of male with anterior dorsal half dark brown extending as narrow stripes on posterior reddish half, of female totally dark reddish brown; clavus of hind femora with weak pale hair; length 7–8 mm. (s. Texas) .... *americana* Hardy
   Tergite 5 of both sexes totally reddish brown; dorsally clavus of hind femora with strong brown bristles; length 8 mm. (Argentina) .... *argentinae* Martin, n. sp.

7(4). Anterior humeri with brownish spot anterior to lateral stripe; tergite 5 yellow with small brownish triangle anteriorly, tergites 6–7 reddish brown, narrowly gray on posterior margins; length 9 mm. (Colombia) .... *colombiae* Martin, n. sp.
   Anterior humeri without spot; tergite 5 reddish white with more or less blackish irregular triangle anteriorly; tergites 6–7 black on margins; length 9 mm. (Sonora, Mexico) .... *mexicanae* Martin, n. sp.

SPECIES WITHOUT LONGITUDINAL STRIPES

LEPTOPTEROMYIA GRACILIS Williston

Leptopteromyia gracilis Williston, 1908: p. 195, fig. 35, lateral aspect; Carrera, 1947: p. 89–96, 7 figs.

Both *Leptopteromyia gracilis* Williston and *L. lopesi* Martin are without longitudinal thoracic stripes. Both are collected near Rio de Janeiro, Brasil, but *L. lopesi* is a long species with a brown tomentose face, while *L. gracilis* is a short species with a yellow tomentose face according to Carrera (1947).

These notes summarize a translation of Carrera's description of *L. gracilis* in Portuguese.

MALE AND FEMALE.—Sexual dimorphism not noted. Length 6–8 mm. Face black, sparse yellow tomentum, occipital bristles weak, black; thorax polished, dark chestnut without markings, posterior margins of mesonotum and scutellum whitish yellow tomentose; tergite 1 yellow tomentose, abdomen brown except yellow bands between tergites 2–3, 3–4, 5–6; clavus of hind femora with yellow band apically and basally; epandria notched at about one-third the distance from apex.

Leptopteromyia lopesi Martin, new species

Leptoptomyia lopesi Martin is similar to *L. gracilis*, but the longer body and brown tomentose face separates it from *L. gracilis*.

MALE.—Length 11 mm. Face black, brown tomentose, behind ocellar tubercle a black polished triangle, occipital bristles black, palpi yellow, proboscis yellowish brown; style equal to length of antennal segments 2 + 3.

Thorax cherry red, polished, thoracic hair short, sparse, posterior humeri yellow, posterior border of mesonotum and scutellum red, white tomentose, pleura white tomentose.

Abdomen very slender, brownish red, anterior margins of tergites 3, 4, and 5 yellow, tergite 5 yellow on posterior margin, tergite 1 reddish brown tomentose; epandria broadly rounded apicoventrally, apicodorsally a long slender point (epandria of *L. gracilis* deeply notched).

Hind femora apicodorsally yellow.

Holotype male, RIO DE JANEIRO, MANGUMHOS, BRASIL, October 1956 (H. S. Lopes) (ABC).

Leptopteromyia peruae Martin, new species

Leptopteromyia peruae Martin is the third species without longitudinal stripes on the thorax.

FEMALE.—Length 6 mm. Head black, two-thirds of face below antennae brown, lower third gray to brownish gray, front and occiput subshining brown, orbitals and ocellar tubercle narrowly densely light brown tomentose; antennal segments 1 and 2 yellowish brown, segment 3 and style darker brown; mystax of four short reddish hairs, occipital bristles erect, dark brown.

Thorax brownish red, polished, laterally and posteriorly thinly white tomentose, few scattered erect brownish hairs anteriorly, slightly more abundant posteriorly; scutellum dark brown, yellowish tomentose; pleura brownish red, gray tomentose.

Abdomen reddish brown, narrowly lighter at joints of tergites; sparse short semi-recumbent brown hairs, tergites 5–8 laterally with stronger black bristles.

Wings faintly brownish.

Hind femora pale reddish brown, base of weak clavus with yellowish band, hind tibia pale reddish brown, a yellowish band closer to apex than to base.

Holotype female, Tingo Maria, Peru, 8 November 1954 (Ross and Schlinger) (Emerged from Empioptera culture) (CAS).

Species With Longitudinal Stripes

Leptopteromyia americana Hardy

Leptopteromyia americana Hardy, 1947: p. 72–74.

Hardy (1947) described the thorax of *Leptopteromyia americana* as "Chiefly polished brown to black ground color, with two median yellow vittae." In relation to other Leptogastridae the median stripe is black, and separated from the broad black lateral stripes by narrow yellow stripes.

Distribution. Type locality: Hidalgo, Texas. Paratypes: Hidalgo and Brownsville, Texas. Also, I have identified the species from Southmost, Cameron County, Texas.

Leptopteromyia brasilae Martin, new species

Male.—Length 9 mm. Eyes nearly contiguous below the antennae; head black, face whitish gray tomentose, front and occiput light brown tomentose, orbitals darker; four whitish bristles in mystax, occipital bristles white, erect, long, numerous; proboscis brownish yellow.

Thorax reddish yellow, median stripe reddish brown, not reaching anterior declivity, lateral stripes reddish brown, broad, extending to lateroventral margin of thoracic disc, cleft anteriorly, laterally white tomentose over ventral margins of lateral stripes and posteriorly; scutellum brownish black, thinly white and brown tomentose, posterior margin dark brown; pleura yellowish above, blackish brown ventrally, thinly white tomentose.

Abdomen black to reddish black, tergite 2 with yellow band almost medially, yellow band on posterior margin, tergites 3 and 4 with yellow bands on anterior and posterior margins, tergite 5 dark reddish brown, abdomen with nearly erect black hairs.

Hind femora reddish brown, yellowish bands basally, clavus with rather broad yellow bands apically and basally, hind tibia blackish brown, yellow band medially, color lighter basally.

FEMALE.—Occiput light brown tomentose, orbitals more grayish than on male; tergites 5–8 dark reddish brown.

Holotype male, NOVA TEUTONIA, BRASIL, 22 November 1968 (Fritz Plaumann) (SPU). Paratype, female, same data as for holotype (CHM). Allotype, São Paulo, Baruci, 22 July 1955 (Lenko-Ag.) (SPU).

Leptopteromyia colombiae Martin, new species

MALE.—Length 8 mm. Head black, face white tomentose, front gray tomentose, occiput below ocellar tubercle gray, laterally broadly grayish brown; mystax a pair of white hairs on each side of oral margin, occipital bristles below ocellar tubercle, and also ventrolaterally pale.

Thorax yellowish, shining, median stripe reddish brown, narrow, not reaching anterior declivity, brown spot on anterior humeri separate from lateral reddish brown stripes which do not reach lateroventral margin of mesothorax; laterally and posteriorly long white tomentum, sparse tomentum on lateral stripes; scutellum black, white tomentose, small brown spot above middle coxa and one below wing base, white tomentose.

Abdomen reddish brown, tergite 2 with yellow band anterior to middle, posterior margin with broad yellow band, tergites 3 and 4 with yellow bands on posterior margins, tergite 5 yellow, brown band near anterior margin extending medially as stripe, not reaching posterior margin, tergites 6–8 reddish brown; epandria pointed apically; vestiture pale on yellow areas, brown on dark areas.

Wings hyaline, costa and subcosta veins close together.

Hind femora pale, reddish brown basally, clavus with apical and basal yellow bands about as wide as median reddish band, hind tibia pale brown basally, yellowish band medially, clavus reddish brown, yellowish apically.

Holotype male, 11 MILES EAST OF CONGUEZA, CUNDIN AMARCA, COLOMBIA. 1340 meters elevation, 13 March 1955 (Schlinger and Ross) (CAS).

Leptopteromyia mexicanae Martin, new species

MALE.—Length 8 mm. Head black, face and front grayish white tomentose, occiput brownish gray tomentose, behind ocellar tubercle a triangle outlined by narrow polished black line, mystax a pair of white bristles on each side of oral margin, weak occipital bristles pale and beyond the orbitals.

Thorax reddish yellow, median stripe narrow, black, not reaching anterior declivity, lateral stripes narrow, black, not reaching anterior lateroventral margin of mesothorax, laterally thorax broadly white tomentose to lateral stripe, posteriorly broadly white tomentose, covering median and lateral stripes; scutellum black, white tomentose; pleura yellow, black spot above middle coxa, second black spot before wing base, white tomentose.

Tergite 2 black before reddish yellow band, reddish brown posteriorly, reddish yellow band on posterior margin, tergites 3 and 4 dark reddish, yellow bands on anterior and posterior margins, tergite 5 reddish laterally and narrowly dorsoposteriorly, dorsally an obscure black stripe not reaching posterior margin, anterolaterally narrowly black, tergites 6–8 shining black, vestiture pale, apex of epandrium truncate on posterior margin, a sharp triangular point extending upward above dorsal surface of epandrium.

Wings hyaline; from posterior vein and apicad costa and subcosta veins coalesce. Hind femora basally pale brown, clavus apically with reddish band broader than reddish black median band, base of clavus pale yellowish, hind tibia pale brown basally, medially a broad yellowish band about as broad as median dark reddish brown band.

Holotype male, BAHIA SAN CARLOS, SONORA, MEXICO, 11 April 1968 (E. M. Fisher) (CAS) (Edge of magroves).

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New Species of *Nemoura* from Western North America

(Plecoptera: Nemouridae)

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The Rocky Mountain species of the genus *Nemoura* were studied by Baumann (1970). This paper presents some of the results of that study. Three species new to science are described belonging to the subgenera *Soyedina* and *Zapada* of Ricker (1952).

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Subgenus SOYEDINA Ricker

Nemoura (Soyedina) potteri Baumann and Gaufin, new species

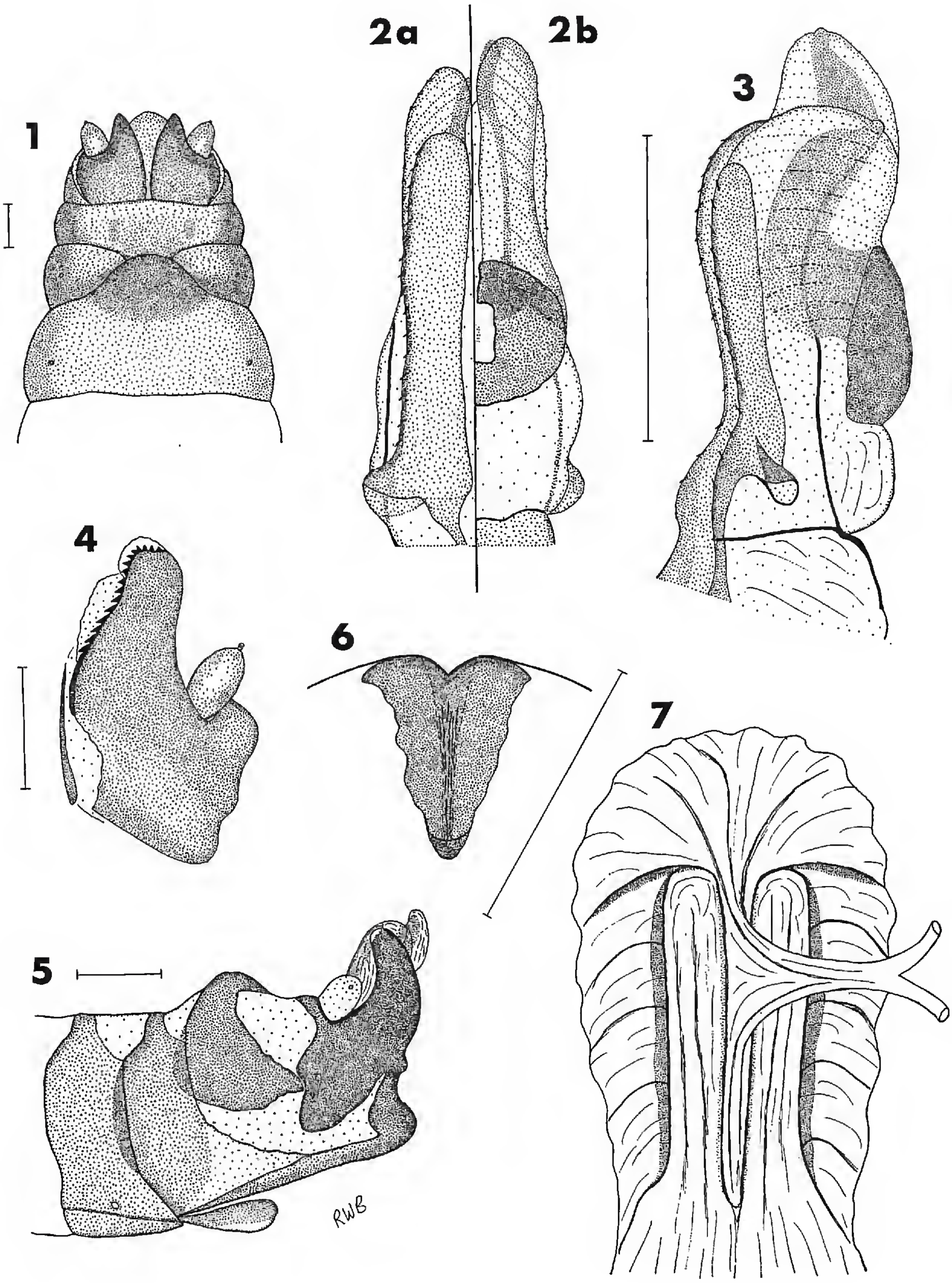
Nemoura (Soyedina) nevadensis interrupta, Logan and Smith, 1966 (not Claassen, 1923), Occas. Pap. Biol. Soc. Nev., p. 1.

MALE.—Macropterous. Length of forewings 5.0–6.5 mm; length of body 5.5–7.0 mm. General color brown. Legs yellowish brown. Wings hyaline; forewings with dark areas at cord and costal space beyond cord; veins A_1 and A_2 joined near margin; anal area of hindwings large. Gills absent. Abdominal tergites membranous in apical half. Cerci small, membranous. Subgenital plate large, very long, anterior fourth bent abruptly upward between paraprocts, forming narrow point at apex; ventral lobe large, broadly rounded (Fig. 5). Paraprocts with two sclerotized lobes; inner lobes small and narrow; outer lobes very large, upcurved laterally alongside epiproct, base very broad, tapering to broad round apex, with row of small stout teeth on inner apical margin (Fig. 4). Epiproct not recurved but produced backward and upward, slightly asymmetrical with right half larger; anterior sclerotized bars of equal width throughout, broadly rounded at apex, bearing row of small spinules on outer lateral margin; posterior portion mostly membranous, apical half covered with rows of very small spinules, basal half with large circular sclerotized plate which supports a sclerotized internal structure that extends to apex (Figs. 2a, 2b & 3).

FEMALE.—Macropterous. Length of forewings 7.0–9.5 mm; length of body 7.0–10.0 mm. Body, appendages and wings similar to male. Subgenital plate well developed, posterior margin of seventh sternite rounded and produced over eighth sternite, produced portion lightly sclerotized (Fig. 1). Eighth sternite deeply excavated at median-posterior margin, excavated area membranous except for triangular sclerotized patch over genital opening (Fig. 6). Vagina with fairly distinct sclerotized pattern dorsally at junction of seminal receptacles; pattern characterized by lateral grooves on each side of junction, grooves surrounded by radiating sclerotized folds (Fig. 7).

Holotype male, allotype, and 5 male, 5 female paratypes, BUTLER CREEK, SNOW BOWL, MISSOULA COUNTY, MONTANA, 17 April 1970, D. S. Potter and R. A. Haick (RWB). Holotype and allotype deposited at the United States National Museum, Washington, D. C.

PARATYPES.—*Idaho*: Clearwater Co., 8 miles northeast of Orofino, 18 June 1964, E. R. Logan, 1 ♀ (UI). Idaho Co., spring seep, Elk Summit Road, 1 May 1970, D. S. Potter, 1 ♂, 1 ♀ (RWB); Cedar Seep, Hwy. 12, near Devoto Cedars, 1 May 1970, D. S. Potter, 1 ♀ (RWB); Dolly Pool Seep, Hwy. 12, 1 May 1970, D. S. Potter, 1 ♂ (RWB); Steep Seep, Hwy. 12, 1 May 1970, D. S. Potter, 4 ♀ (RWB). *Montana*: Flathead Co., Middle Fork Flathead River, 12 April 1969, A. R. Gaufin, 1 ♂ (UU). Glacier Co. (Glacier National Park): creek, 1 mile east of Logan Pass, 23 June 1965, A. V. Nebeker, 1 ♀ (UU); Cataract Creek, below Hidden Falls, 9 July 1966, A. R. Gaufin, 1 ♀ (UU); Iceberg Lake, 24 July 1964, D. C. Lowri, 1 ♀ (SGJ). Missoula Co., Butler Creek, Snow Bowl, 14 May 1970, D. S. Potter & R. A. Haick, 3 ♂, 13 ♀ (RWB) (DSP).



FIGS. 1–7. *Nemoura potteri*. FIG. 1. Female terminalia, ventral view. FIG. 2a. Epiproct, left half, anterior view. FIG. 2b. Epiproct, right half, posterior view. FIG. 3. Epiproct, lateral view. FIG. 4. Paraproct, ventral view. FIG. 5. Male terminalia, lateral view. FIG. 6. Sclerotized patch over genital opening. FIG. 7. Vagina, dorsal view. Length of scale lines .25 mm.

Nemoura potteri is most similar to the eastern *Nemoura washingtoni* Claassen and *Nemoura vallicularia* Wu. All three species have slightly asymmetrical epiprocts with the right half larger than the left. The paraprocts of *N. potteri* are broader apically than those of *N. vallicularia* and they differ from *N. washingtoni* in having rounded tips which bear stout teeth on the inner apical margin. The detailed structure of the epiproct is also species specific. The females of these species are almost inseparable externally but seem to exhibit differences in the sclerotized pattern on the dorsum of the vagina.

Some specimens included in the *N. potteri* type series were listed by Baumann (1970) under *Nemoura (Soyedina) nevadensis interrupta* and the manuscript name, *Nemoura (Nemoura) barri.*

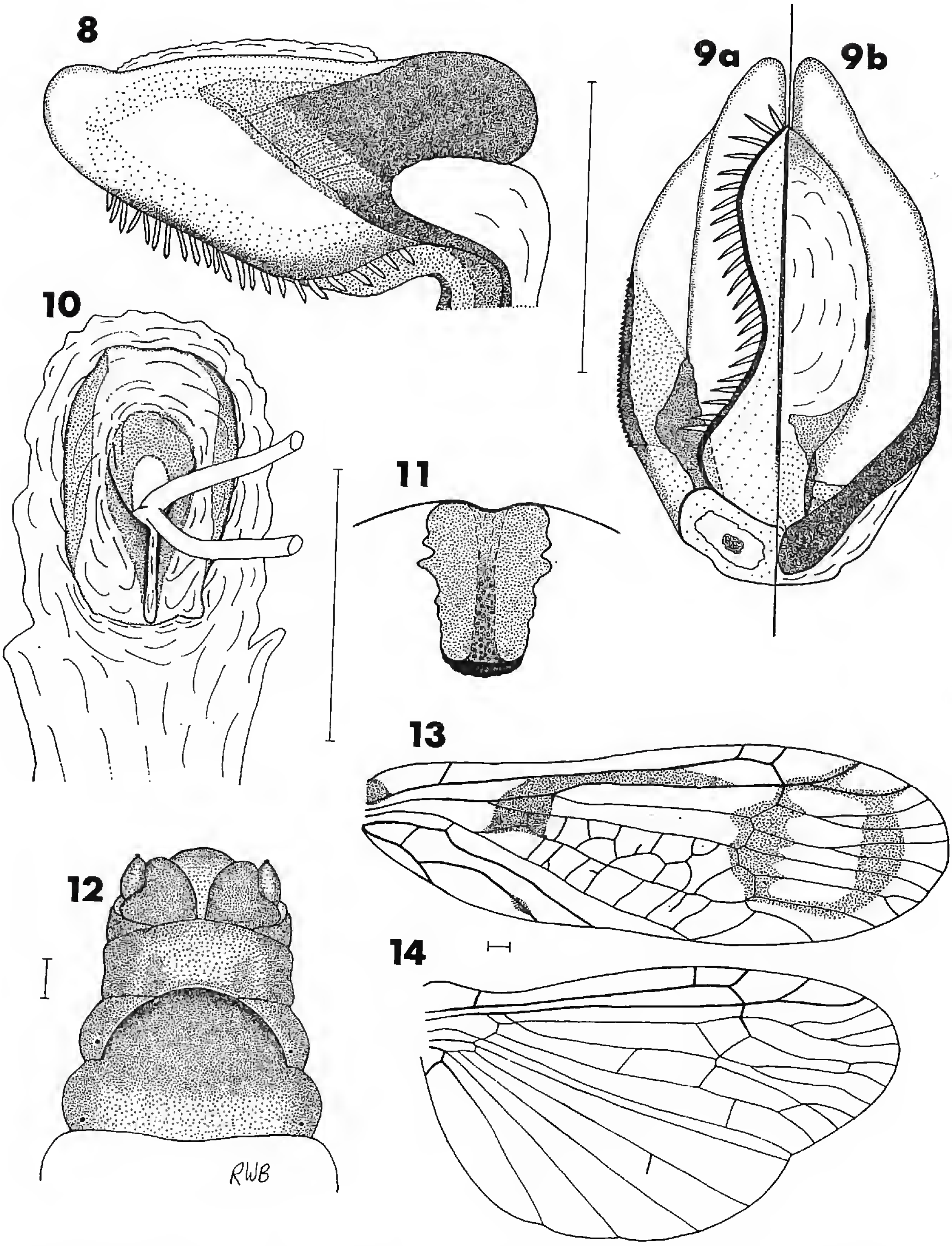
This species is named for Mr. David S. Potter of Leicester, Massachusetts. Mr. Potter has collected many interesting Plecoptera specimens as a graduate student at the University of Montana, Missoula, Montana.

Subgenus Zapada Ricker

Nemoura (Zapada) cordillera Baumann and Gaufin, new species

Male.—Slightly brachypterous. Length of forewings 5.0–6.0 mm; length of body 6.0–8.5 mm. General color brown. Legs yellowish brown, femora with dark areas at base and apex, tibiae dark at base. Wings hyaline; forewings with dark transverse bands at cord and near apex, dark areas in basal half between Sc and Cu, longitudinal veins branched near margin in apical fourth, median and costal crossveins often aberrant; hindwings with large anal area, extra branches and crossveins present in apical half. Four unbranched cervical gills, constricted at base, tapering to pointed tip. Subgenital plate small, broad at base, tapering abruptly to pointed tip; ventral lobe large, twice as long as wide. Paraprocts with two sclerotized lobes; inner lobes long and very thin, ⅓ length of outer lobes; large rectangular outer lobes, slightly pointed at lateral posterior corner. Cerci rather small, rounded and membranous. Epiproct recurved, mostly membranous; dorsally oblong, base broad, tip narrowly rounded and divided, broad transverse sclerotized bands at base, central area membranous, lateral margins slightly sclerotized; laterally triangular, base broad, tapering to rounded tip, very broad sclerotized bands at base, running transversely from dorsal margin, small narrow sclerotized bands arising ventrally at base, running forward and loosely joining broad bands, large spinules visible along ventral margin; ventrally two narrow sclerotized bands bear row of large spinules, rows close together medially but separated at base and apex (Figs. 8, 9a & 9b).

Female.—Slightly brachypterous. Length of forewings 6.5–9.0 mm; length of body 7.0–10.0 mm. Body, appendages and wings similar to male. Wing aberrations even more developed than in male; forewings with numerous branches in apical area near margin, median and costal crossveins often highly aberrant (Fig. 13); hindwings with numerous crossveins and branches in apical half (Fig. 14). Subgenital plate well developed, posterior margin of seventh sternite greatly expanded and broadly rounded, almost completely covering eighth sternite, produced portion sclerotized (Fig. 12). Eighth sternite excavated medially, excavated area mem-



FIGS. 8–14. *Nemoura cordillera*. FIG. 8. Epiproct, lateral view. FIG. 9a. Epiproct, left half, ventral view. FIG. 9b. Epiproct, right half, dorsal view. FIG. 10. Vagina, dorsal view. FIG. 11. Sclerotized patch over genital opening. FIG. 12. Female terminalia, ventral view. FIG. 13. Right forewing, female. FIG. 14. Right hindwing, female. Length of scale lines .25 mm.

branous except for wide rectangular sclerotized patch over genital opening (Fig. 11). Vagina with distinctive sclerotized pattern dorsally at junction of seminal receptacles; pattern characterized by elongate lightly sclerotized ring around junction, ring covering vertical groove with darkly sclerotized margins, groove narrow at base and becoming abruptly wider at apex, two wide lateral sclerotized bands resulting from dorsal lateral invaginations (Fig. 10).

Holotype male, allotype, and 5 female paratypes, BUTLER CREEK, SNOW BOWL, MISSOULA COUNTY, MONTANA, 4 May 1969, R. W. Baumann (RWB). Holotype and allotype at the United States National Museum.

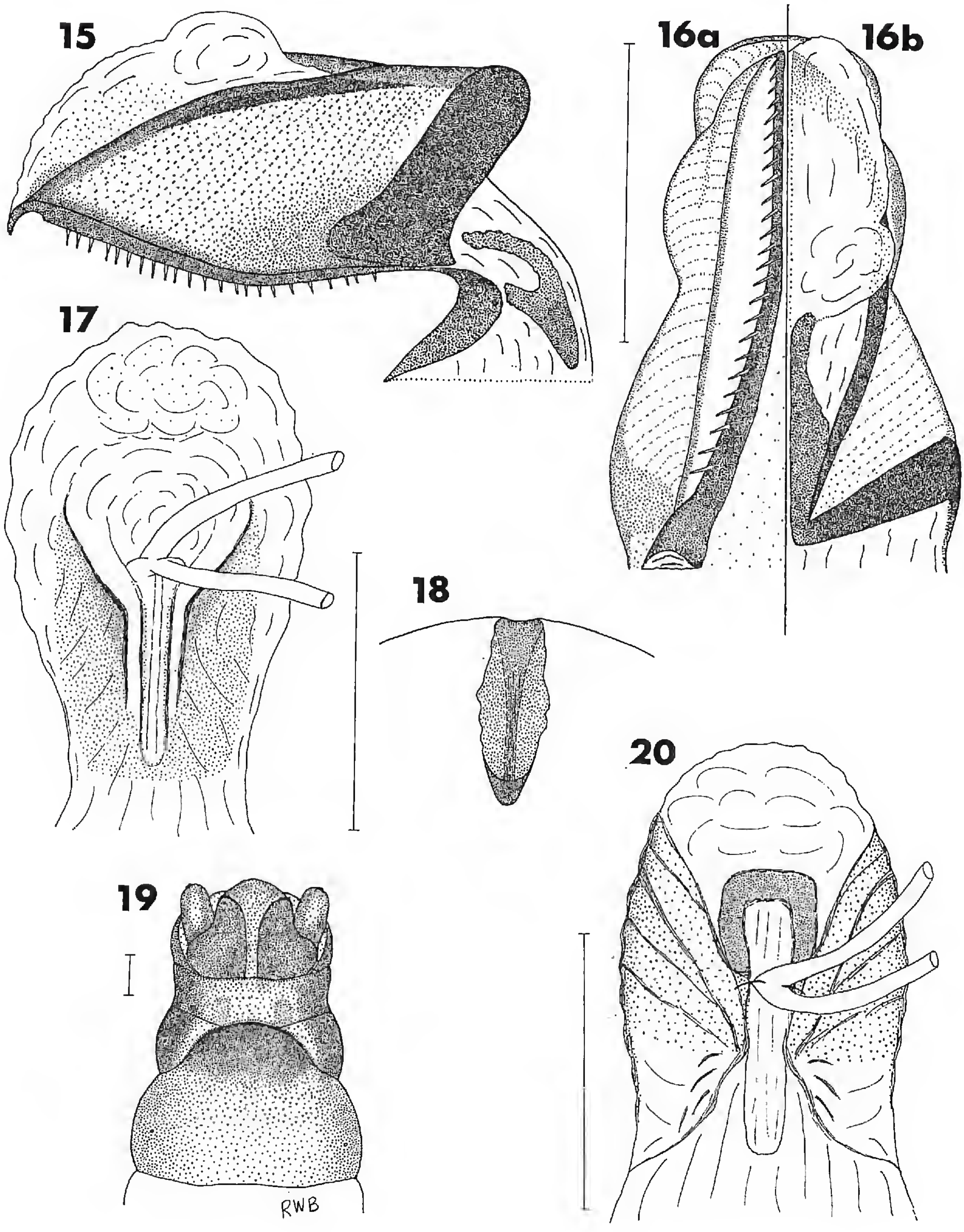
PARATYPES.—*Idaho*: Idaho Co., Sherman Creek, Hwy. 12, junction Lochsa River, 24 March 1969, R. W. Baumann & B. R. Oblad, 1 ♂ (UU). *Montana*: Flathead Co., Boulder Creek, Flathead Lake, 24 April 1970, D. S. Potter, 1 ♂, 1 ♀ (RWB); Middle Fork Flathead River, Walton Ranger Station, Glacier National Park, 26 March 1966, P. Milam, 1 ♂; 4 April 1969, A. R. Gaufin, 7 ♂, 3 ♀ (UU); Wolf Creek, 24 April 1966, P. Milam, 11 ♂, 4 ♀ (UU). Missoula Co., Butler Creek, Snow Bowl, 15 April 1970, D. S. Potter, 2 ♀; 14 May 1970, D. S. Potter & R. A. Haick, 9 ♂, 16 ♀ (RWB) (DSP); Grant Creek, Snow Bowl Road, 27 March 1970, D. S. Potter, 1 ♂, 2 ♀; 15 April 1970, D. S. Potter, 1 ♂, 1 ♀ (RWB). *Washington*: King Co., Rocky Run Creek, Snoqualmie Pass, 21 April 1954, W. E. Ricker, 1 ♂, 2 ♀ (WER); Snoqualmie River, Hwy. 10, 21 March 1970, R. A. Haick, 1 ♀ (RWB).

This species is most similar to *Nemoura oregonensis* Claassen but can be easily separated by its shortened wings with their aberrant venation. The male also differs in the details of the epiproct. The female subgenital plate is similar, but its vaginal pattern is much different from the very distinct vagina of *N. oregonensis*.

The species *Nemoura cordillera* is named as a noun in apposition after the cordilleran mountains.

Nemoura (Zapada) glacier Baumann and Gaufin, new species

MALE.—Macropterous. Length of forewings 7.0–8.0 mm; length of body 6.5–8.0 mm. General color brown. Legs yellowish brown, femora dark at tip; tibiae dark at apex. Wings hyaline; forewings with wide dark transverse bands at cord; hindwings with dark area in costal space beyond cord. Four unbranched cervical gills, constricted at base, width equal throughout length, tip blunt; some specimens possess one or more short, round malformed gills. Subgenital plate small, broad at base, tapering abruptly to pointed tip; ventral lobe large, broadly rounded at apex. Paraprocts with two sclerotized lobes; inner lobes long and thin, ⅓ length of outer lobes; large rectangular outer lobes, slightly pointed at lateral posterior corner. Cerci rather small, rounded and membranous. Epiproct recurved, mostly membranous; dorsally triangular, base wide, apex narrow, L-shaped sclerotized bands at base, central area membranous, longitudinal sclerotized bands running from band of L forward along lateral margin; laterally triangular, base wide, downward directed hook-like band at apex, vertical sclerotized bands at base, lateral surface covered with rows of very small spinules, margins sclerotized, ventral spinules visible along ventral margin; ventrally two median sclerotized bands, base of bands wide, tapering to narrow apex, bearing row of spinules (Figs. 15, 16a & 16b).



FIGS. 15–19. *Nemoura glacier.* FIG. 15. Epiproct, lateral view. FIG. 16a. Epiproct, left half, ventral view. FIG. 16b. Epiproct, right half, dorsal view. FIG. 17. Vagina, dorsal view. FIG. 18. Sclerotized patch over genital opening. FIG. 19. Female terminalia, ventral view. FIG. 20. *Nemoura oregonensis.* Vagina, dorsal view. Length of scale lines .25 mm.

FEMALE.—Macropterous. Length of forewings 9.0–11.0 mm; length of body 8.0–10.0 mm. Body, appendages and wings similar to male. Subgenital plate well developed, posterior margin of seventh sternite expanded and rounded, extending over eighth sternite, produced portion sclerotized (Fig. 19). Eighth sternite excavated medially, excavated area membranous except for narrow elongate sclerotized patch over genital opening (Fig. 18). Vagina with fairly distinct sclerotized pattern dorsally at junction of seminal receptacles, pattern characterized by ventral vertical groove, two narrow parallel sclerotized bands on each side of groove, outer bands close together at base, becoming abruptly divergent at junction of receptacles, inner band closely parallel throughout length, broad patch of light sclerotization ventrally (Fig. 17).

Holotype male, allotype, and 1 male, 1 female paratypes, CATARACT CREEK, BELOW GRINNELL LAKE, GLACIER NATIONAL PARK, GLACIER COUNTY, MONTANA, 11 July 1964, A. R. Gaufin (UU). Holotype and allotype deposited at the United States National Museum.

PARATYPES.—*Montana*: Glacier Co. (Glacier National Park): Cataract Creek, 9 July 1966, A. R. Gaufin, 1 ♂, 3 ♀ (UU) (RWB); Grinnell Creek, 9 July 1966, A. R. Gaufin, 3 ♀ (UU); Iceberg Creek, below Iceberg Lake, 28 July 1964, A. R. Gaufin, 3 ♀; 27 July 1965, A. R. Gaufin, 1 ♀; 30 July 1965, A. V. Nebeker, 2 ♀; 19 July 1966, M. L. Miner, 3 ♀; 27 July 1969, R. A. Haick, 2 ♀ (UU) (RWB); Ptarmigan Creek, 28 July 1964, A R. Gaufin, 1 ♀ (UU); Wilbur Creek, Many Glacier, 13 July 1963, A. R. Gaufin, 1 ♀ (UU).

Nemoura glacier resembles *Nemoura haysi* Ricker in general appearance. The male epiproct is, however, quite different. Female specimens are almost inseparable externally but differ in the details of the sclerotized pattern on the dorsal surface of the vagina.

The specific name is a noun in apposition taken from Glacier National Park, Montana. All specimens in the type series were collected in glacier-fed streams. Further collections at lower elevations in the spring months could result in an enlargement of the known range.

DISCUSSION

The detailed studies of the vagina were accomplished after preparation by a technique described by Ludwig and Schmidbauer (1966). The method involves clearing with KOH and then staining with safranin. This technique has not been used before in the study of North American Plecoptera and promises to be very useful in future revisions.

A *Nemoura* (*Zapada*) female collected at Tuckermans Ravine, Mt. Washington, New Hampshire was studied by this technique. This female was listed in Ricker (1952) and Hitchcock (1969) as possibly belonging to *Nemoura oregonensis* Claassen. It was found that this specimen did not belong to any known species and especially not *N. oregonensis*, which has very distinct vaginal sclerotizations (Fig. 20). A description is not given here, but will be included later in a revision of the subgenus *Zapada* by the senior author.

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The authors would like to thank Dr. William F. Barr, University of Idaho (UI); Mr. Stanley G. Jewett, Jr., Portland, Oregon (SGJ); Mr. David S. Potter and Mr. Roger S. Haick, University of Montana (DSP) and Dr. William E. Ricker, Fisheries Research Board of Canada (WER) for sending specimens for study. Abbreviations for collections of the authors are: Richard W. Baumann (RWB) and University of Utah (UU).

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SCIENTIFIC NOTE

The type locality of *Endeodes terminalis* Marshall (Coleoptera: Malachiidae).—Following his description of *Endeodes terminalis* (1957, Coleopt. Bull., 11:13) Marshall stated "Holotype, male, 'Baja Calif., Mexico. SE end of Isla Caballo. III-20-53. J. P. Figg-Hoblyn, collector.'" After fruitlessly attempting to locate "Isla Caballo," I wrote to John Figg-Hoblyn, who replied that he feels certain the correct locality is Isla Ceralbo. Hugh B. Leech informs me that the labels on the type specimen read as follows: top label "Mexico: B. Cal. SE. end Isla Ceralbo III-20-1953" under label "Col. by J. P. Figg-Hoblyn." Isla Ceralbo is the southernmost large island in the Gulf of California. According to John Figg-Hoblyn the spellings: Ceralvo, Cerralvo and Cerralbo appear with equal frequency.—Ian Moore, *University of California, Riverside 92502.*

A New Scenopinid Genus with Three New Species from Chile[1]

(Diptera: Scenopinidae)

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It has been my privilege to examine the Scenopinidae collected by Michael E. Irwin while on an extended collecting trip with Dr. Evert I. Schlinger to Chile.[2]

Although only a few species were collected these included one specimen of a previously described species, the second-known specimen of the rare *Heteromphrale chilensis* (Kröber) (Kelsey, 1969, p. 286). The remaining material, comprising 64 specimens, represents three species in a new genus that I take great pleasure in naming for Mr. Irwin who has contributed so much new material through his extensive collecting. Terminalia were dissected, cleared in KOH and drawn under water. All scale marks on drawings equal one-half millimeter—the shorter mark applies to the wing and head, the longer to the terminalia.

Irwiniana Kelsey, new genus

Type-species *Irwiniana irwini* Kelsey, new species. This genus, though related to the South American genus *Heteromphrale* and the North American genus *Brevitrichia*, has much closer affinities to the genus *Propebrevitrichia* from Africa and particularly to the Australian genus *Riekiella*. The females show distinct relationships indicating a common origin and a transantarctic distribution pattern; since the females of all three genera have the eighth sternite exceeding the tergum noticeably. The ninth tergites, which may or may not have stiff blunt bristles, indicate a close relation between the *Propebrevitrichia* of Africa and the *Heteromphrale* of South America, both of which possess a limited number of spines on the ninth tergite, a character also shared by the North American *Brevitrichia* which bear a larger complement of spines but differ in having an excavated eighth sternite. The new genus *Irwiniana* exhibits a closer relationship to the Australian genus *Riekiella* in lacking stout spines on the ninth tergite but differs in having the eighth sternite ending in three lobes instead of being pointed.

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[2] Specimens were collected under the auspices of the Universidad de Chile-University of California Cooperative Program, Ford Foundation Grant. In addition, Dr. Schlinger was on a Guggenheim Fellowship.

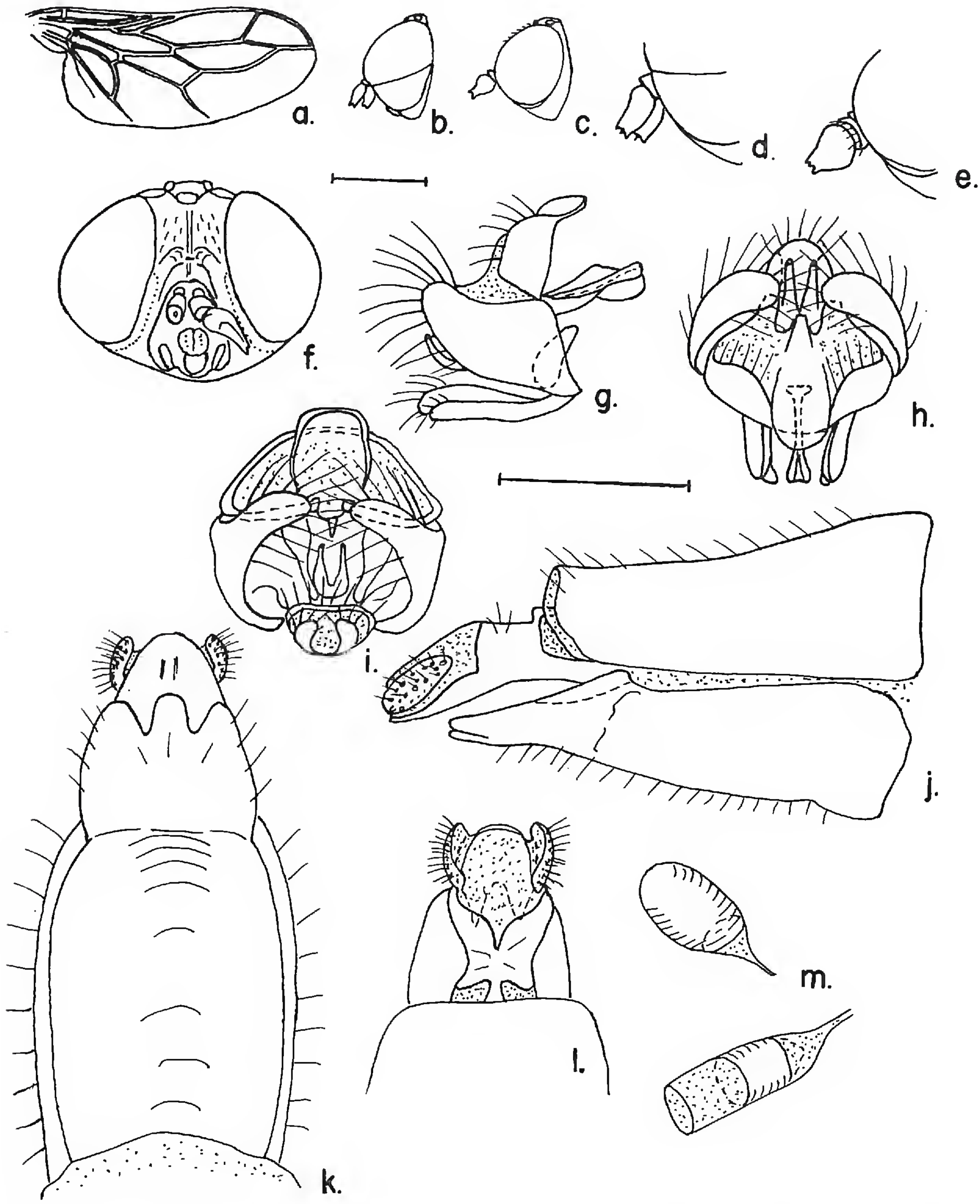

FIG. 1. *Irwiniana irwini* Kelsey, new species ♂ and ♀; a, wing; b, c, lateral aspects of male and female heads; d, e, enlarged details of male and female antennae; f, anterior aspect of female head; g, h, i, lateral, ventral (physically dorsal) and posterior aspects of male terminalia; j, k, l, lateral, ventral and dorsal aspects of female 8th and 9th segments; m, spermathecae.

The heads and antennae of all five genera are similar as are the wings with a closed stalked cell R_5, except that *Riekiella* is somewhat variable in this character with some species having vein M_{1-2} not reaching vein R_5 or the tip of the wing in one or both sexes.

In size the members of the genera *Irwiniana*, *Propebrevitrichia* and

Riekiella are small, averaging 2–3 mm, while *Heteromphrale* is nearly twice as large, at least in the female.

The male ninth tergite is similar in shape to those of *Brevitrichia* and *Propebrevitrichia*, but does not extend as far ventrad, leaving more of the sternite exposed—the aedeagus appears as two wiry prongs of variable length which appear to contain the ejaculatory ducts. They may however actually be the aedeagal parameres and the aedeagus may be a short membranous structure hidden between them. In many Scenopinids the aedeagus is a single median sclerotized structure containing the ejaculatory duct and is flanked by two wiry aedeagal parameres indicating a more advanced development, while the condition found in *Irwiniana*, *Brevitrichia*, *Propebrevitrichia*, *Heteromphrale* and some *Riekiella* represents a more primitive state of development.

Irwiniana irwini Kelsey, new species

(Fig. 1)

MALE.—Head black-brown; eyes red-brown above, black-brown below extending to back of head; frons narrow, triangular, subshining, area above antennal bases with dorsal extension of dull brown pubescence bordering oral cavity; ocellar tubercle black-brown, ocelli black-brown; mouth parts black-brown, well developed, filling oral cavity; palpi black-brown, only half as long as mouthparts; antennae black-brown, the first two segments short, third segment pear shaped, forked at tip, covered with short red-brown hairs.

Thoracic dorsum black-brown, shining, with a few sparse short hairs, a patch of gray pollen above humeral callus; humeral and supraalar calli tan; pleurum black-brown covered with gray pollen; wing milky hyaline, veins brown, lighter behind; halter stem brown, granular, knob black-brown, with tan band between upper and lower surfaces; legs black-brown lightening to brown distally.

Abdomen black-brown. Details of terminalia (Fig. 1).

FEMALE.—Head black-brown; eyes black-brown with narrow postocular rim fringed with short anteriorly directed hairs; frons broad, shining, wider than ocellar tubercle, with few sparse hairs and shallow median groove, a yellow band on lower face between eye and oral cavity; ocellar tubercle black-brown, ocelli black-brown; mouthparts and antennae as male.

Thorax as for male except wings hyaline with brown veins.

Abdomen black-brown, eighth segment black-brown basally with distal third lighter and cleft into three lobes distally (Fig. 1).

LENGTH.—Male body 2–2.3 mm., wing 1.5 mm., female body 2.6–4 mm., wing 2–2.1 mm.

Holotype male, 20.6 KM S. OF BULNES, NUBLE PROV., CHILE 75 m, 26 January 1967 (M. E. Irwin). Flying over fresh dirt from animal burrow. Type to be deposited in the University of Chile collection, Santiago. Allotype, same data as holotype. Paratypes: 47 ♂♂ and 9 ♀♀

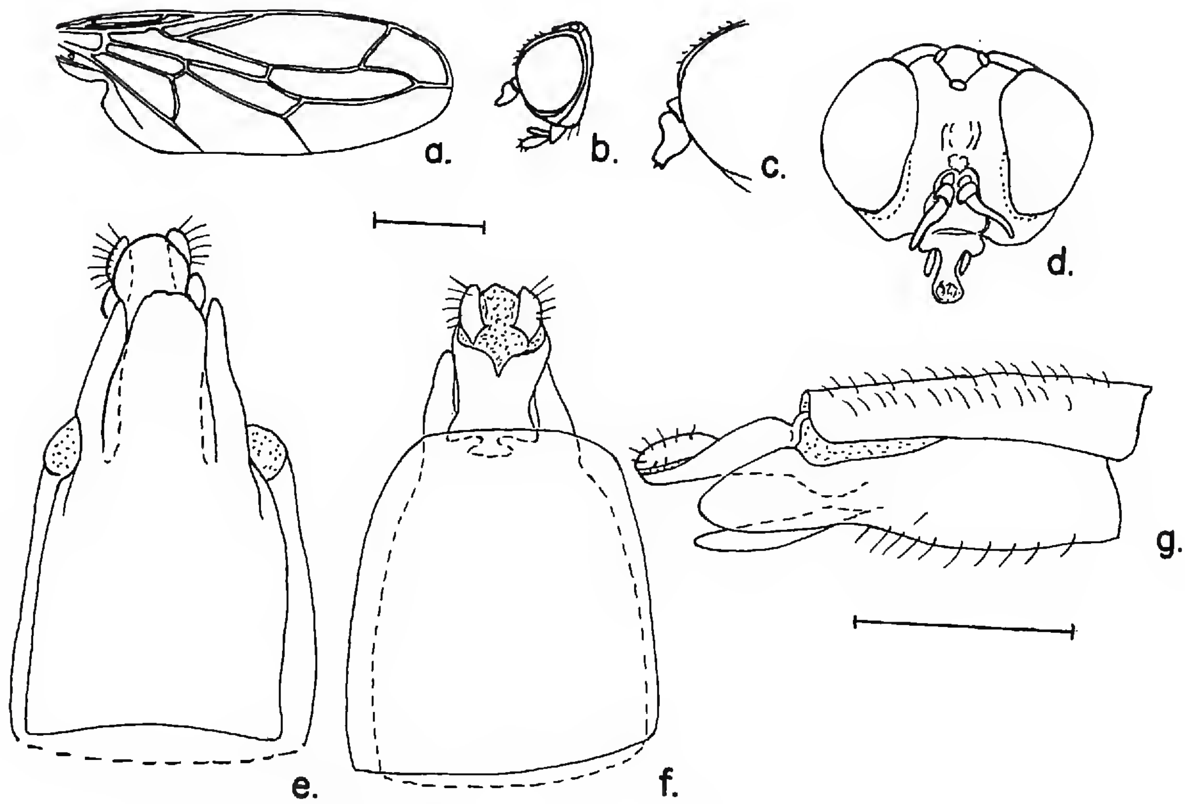

FIG. 2. *Irwiniana glabrifrons* Kelsey, new species ♀; a, wing; b, lateral aspect of head; e, enlarged detail of antennae; d, anterior aspect of head; e, f, g, ventral, dorsal and lateral aspects of female 8th and 9th segments.

deposited as follows: 2 ♂♂ 2♀♀ U.S. National Museum, 4 ♂♂ 2 ♀♀ retained by the author, remainder in University of California, Berkeley and University of Chile.

Irwiniana glabrifrons Kelsey, new species

(Fig. 2)

FEMALE.—Head dark red-brown; eyes tan-brown (black-brown in fresh specimen), postocular ridge moderately broad, subshining, rounded, posterior half granular, continuous with back side of head; frons broad, smooth, shining, with median depression; ocellar tubercle dark red-brown, not set off from frons, ocelli red-orange; mouthparts brown, well developed; palpi black-brown, shorter than mouthparts; orange band next to eyes laterad of oral opening; antennae black-brown, first two segments short, third segment pear-shaped, covered with short hairs, truncate at tip with median peg longer than lateral points; see figure.

Thorax black-brown, shining, few scattered posteriorly directed hairs, thin gray pollen above humeral callus and lateral margins of tergum; humeral and supraalar calli tan to cream; pleural areas black-brown covered with gray pollen scales, tan below wing; wing hyaline, veins brown; halter stem brown, knob yellow-brown broadly split laterally by band of cream-white; legs black-brown.

Abdomen black-brown, basal segment granular dorsally, distal segments shining, eighth segment red-brown, sternum trilobed (Fig. 2).

MALE.—Unknown.

LENGTH.—Female body 2.3 mm., wing 2.0 mm.

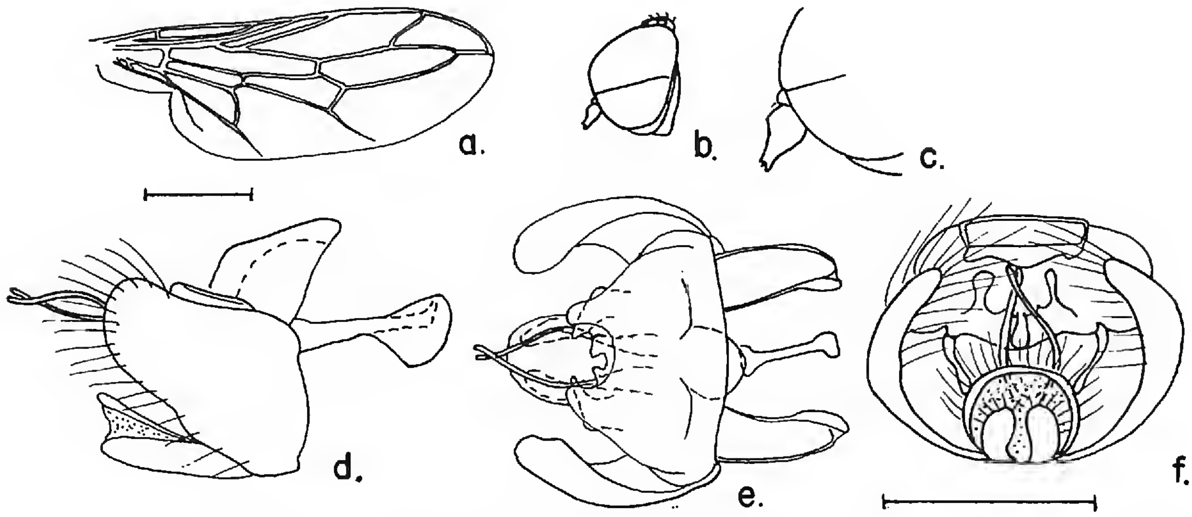

FIG. 3. *Irwiniana graciliparamera* Kelsey, new species ♂; a, wing; b, lateral aspect of head; c, enlarged detail of antennae; d, e, f, lateral, ventral (physically dorsal) and posterior aspects of male terminalia.

Holotype female, QUEBRADA LA PLATA, SANTIAGO PROV., CHILE, 510 m. 33°30′ S, 70°47′ W Rinconada, Maipú; Malaise trap, 26 December 1966 (M. E. Irwin). Type to be deposited in the Unversity of Chile collection, Santiago.

Irwiniana graciliparamera Kelsey, new species
(Fig. 3)

MALE.—Head black, eyes red-brown above, black-brown below, glinting reddish in certain light; frons narrow, triangular, upper half shining, lower portion dull black-brown; ocellar tubercle black-brown with some gray pollen, ocelli brown; back of head dusted with gray pollen; mouthparts black-brown, well developed, filling oral cavity; palpi black-brown, only half as long; border between oral cavity and eye margin orange; antennae black-brown, first two segments short, third segment pear shaped, hairy, ending bluntly in three subequal points with ventral point longest (Fig. 3).

Thoracic dorsum with ground color black-brown dusted with fine pollen appearing as bands of tan and black-brown longitudinal stripes and under certain light appearing shining black-brown; humeral and supraalar calli orange-brown; scutellum dusted with tan pollen; pleural areas black-brown dusted with tan pollen, katepisternum with areas of lighter integument; wings brownish hyaline, veins brown; halter stem black-brown, knob white; legs black-brown dusted with gray pollen.

Abdominal segments 2–4 black-brown, dusted with tan pollen and separated by thin white bands; white bands between next three segments broader; ninth tergum black-brown, hairy (Fig. 3).

FEMALE.—Unknown.

LENGTH.—Male body 2.3–2.8 mm., wing 2.0–2.3 mm.

Holotype male, 10 KM E. FRAY JORGE NATIONAL PARK, COQUIMBO PROV., CHILE, 28 December 1966 (M. E. Irwin), dry wash. Type to be deposited in the University of Chile collection, Santiago. Paratypes:

4 ♂♂ same data, 1 ♂ U. S. National Museum, 1 ♂ my collection, 2 ♂♂ University of California, Berkeley.

HETEROMPHRALE CHILENSIS (Kröber)

One female .51 m. W. Vilcho, Talca Prov., Chile, 615 m, 13 January 1967 (M. E. Irwin). This specimen will be deposited in the University of Chile collection, Santiago.

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New Records of North American Tabanidae I. Species New to the Faunas of Mexico and of the United States

(Diptera)

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Significant, though perhaps not unexpected, additions to the recently cataloged Western Hemisphere faunas of tabanid flies, Neotropical for Mexico (Fairchild, 1971) and Nearctic (Philip, 1965), have been found in recently studied collections as acknowledged below.

Abbreviations below include: California Academy of Sciences (CAS); Arizona State University (ASU); University of California, Berkeley (Calif. Insect Survey) (CIS); United States of America (US); and the author (CBP).

Apatolestes ater Brennan.—Two females taken in Baja California Norte, 17 miles inland from Ensenada at 3,200 ft., 10 July 1969, by S. C. Williams and V. F. Lee (CAS), extend previously known, sparse distribution of this species south from southern California. First Mexican record.

Silvius (Silvius) gigantulus (Loew).—Several females of this rather widespread species in western US were found in CIS collection from Baja California: 2 ♀, Melling Ranch, 26 May 1958, I. Powell; 1 ♀, Sierra San Pedro Martir, La Grulla, 6,500 ft., 28 May 1958, and 1 ♀, 5 mi. s. Socorro, 6,000 ft., 27 May 1958, both by J. Powell. First record for Mexico.

Chrysops chiriquensis Fairchild.—A series of 12 females of this Central American species was represented in the Dampf collection (CBP) from Chiapas:

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San Cristobal, 15 July 1926; La Casas, September 1940, M. Masias; and "road from Tuxtla to San Cristobal, behind wood near stream on vegetation, 5–8 AM," 3 June 1926. Six females were also taken in the San Cristobal area, 7–11,000 feet, 7 May to 8 August by the 1969 Canadian National Museum Expedition—(H. J. Teskey). Previously unrecorded for Mexico.

Chrysops clavicornis Brennan.—Dr. Paul Arnaud, Jr. (CAS) took four females of this western Nearctic species in the Sierra San Pedro Martir: La Grulla, 6,900 ft., 12–16 June 1953, and Rancho Viejo, 7,000 ft., 14 June 1953.

Myiotabanus muscoideus (Hine).—Dr. G. B. Fairchild (personal correspondence) identified in the U. S. National Museum, a male of the peculiar sarcophagid-like fly from Villa Hermosa, Tobasco, 6 August 1964, Spangler coll. This rare fly was previously known only from Guatemala.

Atylotus incisuralis (Walker).—Another new record from Mexico supplied by Dr. Arnaud is a typical, unpatterned female taken in the same La Grulla collection. This is also a widespread and variable fly in the western Nearctic fauna.

Tabanus laticeps Hine.—New to Mexico, also from Baja California, courtesy of Dr. L. L. Pechuman, Cornell University, are females of this taken in Sierra San Pedro Martir, Socorro, June 1963, E. L. Sleeper.

Tabanus oldroydi Philip.—A female from Dr. F. F. Hasbrouck of ASU (courtesy of Dr. Mont. Cazier), establishes this northwestern Mexican species just across the US border near Yuma, Arizona (as predicted when originally described), and is another example of the arbitrary nature of utilitarian separation of the two faunas by political boundaries: Yuma, 2 April 1965, J. DeNolse. Also from ASU were received: 4 ♀, Baja California, 28 mi. sw El Crucero, 27 July 1968, Bentzien, Bigelow, S. C. Williams and M. Cazier, and 1 ♀ "taken above a mangrove border on the beach," 18 mi. se Mulegé, 20 April 1969, Williams. In CAS, also from B. C., 14 females are labelled "18 mi. n. Bahia de los Angeles, nr La Gringa, 30.iv.63, Papp." In CIS, 2 ♀ are from Gonzales Bay (Bahia Gonzaga on some maps), 29 April 1921, Van Duzee ("a series April 28" with same data otherwise, listed by Cole (1921) as *T. rubescens* Bell., also probably represented *T. oldroydi*). The species is obviously early on the wing and is unexpectedly well established in northwestern Mexico; other specimens in CIS are from La Cholla, Sonora, April.

Systematically, *T. oldroydi* is closer to *Poeciloderas* Lutz in several respects than to *Tabanus s. str.* It has hairy eyes in both sexes and a prominent, bare callus at the vertex (♀), but it lacks the enlarged antennal scape and narrowed wing cell R_5 ascribed to the group by Fairchild (1961), both of which characters may be variable in *Tabanus* spp. The eye pattern comprises two, plus a short, narrow purple bands on green ground, instead of two narrow green bands on purple possessed by the genotype, *Poeciloderas quadripunctatus* (Fabr.) (syn. *T. nigropunctatus* was described from Mexico by Bellari). The general hoary-gray appearance of *T. oldroydi* becomes, in worn specimens, rather shining blackish on the thorax, and the reddish on the abdomen is accentuated which probably accounted for Cole's misdetermination.

Tabanus ebeneus Philip.—When this large black fly was described from Guatemala and Panama, two females were overlooked in the Dampf Coll. from Oaxaca: Cerro de la Aguilerro, 8 August 1935, Dampf. Dr. G. B. Fairchild (personal correspondence) considers this to be a variant of *T. morbosus* Stone from Arizona. Though there is considerable resemblance, comparison of the respective types at

U. S. National Museum shows apparent critical differences in *T. ebeneus*: longer flagellum including style, more excised plate with more acute tooth, frontal keel a little more slender, knob of halter pallid on distal half, and abdomen with more brownish shades and less pruinosity. As more specimens of both species accumulate, subspecific relationship may be revealed by intergradation in these characters or geographic overlap.

Stenotabanus xenium Fairchild.—A female in CAS from Chiapas, Ruins at Palenque, 26–30 June 1959, P. and C. Vaurie, is labelled "agrees with paratype" by Fairchild. The species was originally described from Canal Zone & Colombia.

Stenotabanus guttatulus (Townsend).—Since revival of this Arizona species from synonymy with Mexican *Stenotabanus cribellum* (Osten Sacken) (Philip, 1959), Mexican records require review. Osten Sacken's type and mine of the later synonymized *Stenotabanus currani* were from the west coast (?Sinaloa and Nayarit). In CAS, there is a typical *S. guttatulus* taken 11 mi. sw Sawmill, Sierra Juarez, (B.C.) 5,200 ft., 16 July 1969, by S. C. Williams and V. F. Lee, the first undoubted record from Mexico.

Silvius (Assipala) aquilus (Philip).—In 1967, I described an unusual, unique small fly, "presumed to be from Central America" based on a "pinned but unlabelled specimen in the collection of the late Alphonso Dampf . ." The first additional specmens in fresher condition were received from Dr. Mac A. Tidwell of the University of North Carolina, and provide opportunity to augment the original description. Data on the small series, collected by C. N. Ross in Vera Cruz, Mexico in 1965, are: 5 ♀ Ocotal Chico, 1,900 ft., 16 February and 17 March, "riverine secondary rain forest"; 3 ♀, 1 mi. n Soteapan (similar forest), 1,400 ft. 29 March; 1 ♀, 2 mi. ne Vigis, "lower montane rain forest," 700 ft., 23 April. These observations suggest sylvan habits.

Length, 7.5 to 11 mm. All darker than type, body colors like *S. melanoptera* (Hine), legs and antennae of several almost black; venters vary from having typical semilunar, mediobasal spots on sternites, to occasionally entirely gray. Mesonotum and scutellum blackish with two inconspicuous, submedian gray stripes anteriorly. A pair of swollen parafacial calli above unusually enlarged apodemal pits more conspicuous shining black than in type; gray pollinosity between them sparse and fragmented across lower clypeus. Inconspicuous midtergal yellow hairs evident in certain lights on only one. All show heavy substigmal and subapical infuscation in wing patterns similar to type (the original figure printed too faintly), but labia normal (unextended), and palpi about half as long.

Silvius (Assipala) megaceras (Bellardi).—This most closely approaches *S. aquilus* but has a row of middorsal pale triangles on the abdomen which, in related *S. tanycerus* (Osten Sacken), expand to narrow incisural bands; *S. aquilus* is darker bodied and lacks the pale notal and scutellar margins of both. None of these has the scape and pedicel apically as swollen as in *S. ceras* (Townsend).

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Studies on the Distribution and Biology of *Atimia helenae* Linsley on Two California *Cupressus* Species

(Coleoptera: Cerambycidae)

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The biology of *Atimia helenae* Linsley on cypress is poorly known. The species was originally described by Linsley (1934) from a collection taken on *Cupressus sargentii* Jepson in 1921 at Cypress Ridge, Marin County, California. Observations by Linsley (1939, 1962) provide some information on the flight period, host specificity and the restricted geographic distribution in California. In 1966, Dr. J. A. Powell reared adults from cypress material which was collected at Carson Ridge in Marin County. At that time he also made the first observations on the distinct "pitch shelters" that are constructed on the host by developing *Atimia* larvae.

Ten coastal California foothill stands of cypress, comprisng four closely related species, were surveyed for *Atimia* and its associates from 1966– 68. *Atimia*-infested branches and trunk sections were periodically sampled during an 8-month period from two of the more heavily infested stands for the purpose of studying the immature stages and seasonal history development. Infested material was sectioned into small billets which were then split apart by means of a hand axe, thereby exposing the life stage for examination. A portion of this sample was left intact and

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TABLE 1. Ten cypress stands surveyed for evidence of *Atimia helenae* activity in California, 1966–68.

	Location		
Cypress Stand	County	*Cupressus* sp.	*Atimia* activity
Ft. Bragg	Mendocino	*pygmaea*	present
Anchor Bay[1]	"	"	absent
Red Mt. (Ukiah)[1]	"	*sargentii*	present
Mt. St. Helena[1]	Napa and Lake	"	"
Occidental[1]	Sonoma	"	"
Carson Ridge	Marin	"	"
Cedar Mt.[1]	Alameda	"	"
Bonny Doon[1,2]	Santa Cruz	*abramsiana*	absent
Huckleberry Hill[1]	Monterey	*goveniana*	"
La Cuesta Pass[3]	San Luis Obispo	*sargentii*	present

[1] See Wolf and Wagener (1948) for exact locations.
[2] Examined only briefly.
[3] See Chemsak and Powell (1964) for exact location.

placed in outdoor screened cages at Berkeley for rearing adults. Observations on preferred host attack sites were recorded at each cypress stand.

CUPRESSUS TAXONOMY.—Wolf and Wagener (1948) recognize 15 native New World *Cupressus* species. In their treatise they indicate that the taxonomic status of most of these species is still in question since they are quite similar in all characteristics. They conceive that this number could be reduced to seven species, one of which would consist of *C. goveniana* Gordon, *C. abramsiana* C. B. Wolf, *C. pygmaea* (Lemmon) Sargent and *C. sargentii* Jepson. In this paper these four cypresses are considered as separate species belonging to the "Sargentii" complex.

Ten endemic "Sargentii" cypress locations were surveyed from 1966–68 for the presence of *A. helenae.* Active or past infestations of the beetle were found in seven of the ten isolated stands (Table 1). The survey also revealed three interesting facts: (1) in addition to *C. sargentii*, the beetle is commonly found on a closely related species, *C. pygmaea*, (2) it occurs in scattered locations over a wide geographic area from Mendocino to San Luis Obispo County, and (3) it does not occur in all stands of the two known hosts.

LIFE HISTORY STAGES.—Biological information was collected on the life history stages by sampling 10–25 *Atimia*-infested branches and trunk sections every two months from August 1966 to April 1967 from *C. pygmaea* at Ft. Bragg and *C. sargentii* at Carson Ridge. The former site is located two miles east of Ft. Bragg on state highway 20, while the latter site can be reached by first traveling southwest on Carson Road

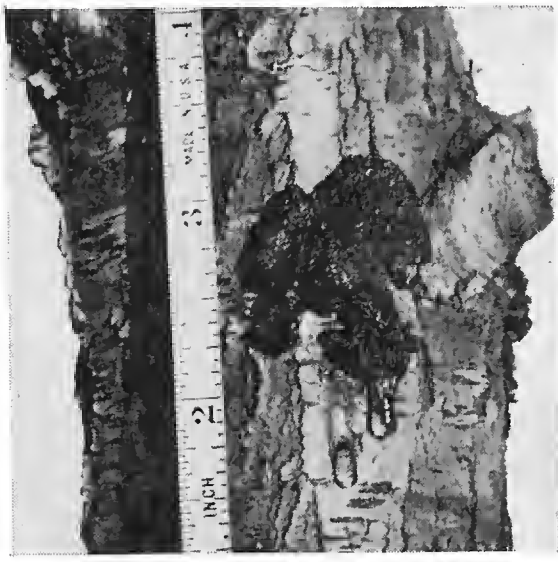

FIG. 1. (top left), Mantle of accumulated frass and resin produced by *Atimia* larva in branch of *C. pygmaea*. FIG. 2. (top right), Exposed excavation of *Atimia* larva in phloem tissue of *C. pygmaea*. FIG. 3 (bottom), *Atimia* pupa in branch of *C. sargentii*.

from Woodacre for approximately one mile. At the end of Carson Road there is a continuing dirt road and a gate which leads into a municipal watershed area. The cypress stand is located along the dirt road on a ridge top about ½ mile uphill from the gate.

Eggs.—None observed.

Larvae.—Larvae were observed infesting branches and trunks of all age trees and developing to maturity in any wood substrate that was greater than 6 mm in diameter. Early instars confined their feeding to localized areas of the phloem tissue where they spent at least three months in clearing out shallow oblong concavities in the inner bark, which measured approximately 35 mm in length by 25 mm in width. The depressions were covered by shelters or mantles of accumulated resin and frass (Fig. 1). These masses of sticky material were soft, red-brown and protruded about one cm above the wood surface. As the accumulations aged, they assumed a gray color and became hardened. The number of larval instars that pass in the phloem phase was not determined.

After the larvae fed sufficiently in the inner bark, they bored perpendicularly into the xylem at approximately the center point of the cleared phloem area (Fig. 2). The average vertical boring depth for 25 larvae at Carson Ridge was 8.4 ± 2.3 mm, while at Ft. Bragg the same number of larvae averaged 12.8 ± 4.0 mm. Once this phase of tunneling was completed, the larvae made an abrupt 90° turn and continued to feed in a direction horizontal to the wood substrate. All horizontal tunnels were oriented toward the proximal sector of the branch or trunk and averaged 24.3 ± 5.3 mm and 46.3 ± 14.2 mm in depth for the Carson Ridge and Ft. Bragg sites respectively. Differences in boring depths between the two locations were obvious, however no apparent explanation can be given for these characteristic patterns. No noticeable tree damage resulting from *Atimia* feeding was observed at any cypress location.

Pupae.—Once the larva bored to the desired depth, thereby completing its pupal chamber, it gathered together several wood fibers, 5–7 mm in length, and formed a rigid plug between itself and the tunnel exit. The construction, which sealed in the larva at the distal end of the tunnel, occurred just prior to pupation (Fig. 3).

Adult.—Prior to emergence, the adult chewed and shredded the fiber plug to allow for its unobstructed exit through the tunnel. A second hole was chewed through the resin-frass mantle as the insect passed out of the wood substrate. Females can be distinguished from males by their larger and more robust size (Fig. 4).

FLIGHT PERIOD.—Adults fly primarily from February to May. The earliest flight record was made in late February at Carson Ridge when one adult male was observed resting on cypress foliage. Twenty adults, ten emerging in February and ten emerging in March, were reared from *Atimia*-infested branches which were collected periodically at Carson Ridge from August 1966 to February 1967. Each collection of infested material was placed into a separate rearing cage at Berkeley. No adult emergence was noted after March. The beetle is also active during April and May as evidenced by Linsley's account (1962) of the beetle's flight period during these months. Also, in our studies, ten adults that were reared in March survived under confined conditions until the first week of May.

SEASONAL HISTORY.—The length of time needed to pass from egg to adult could not be determined accurately since the insect was not sampled continuously for one year; however, a 2-year period is probably required for its development (Chemsak, personal communication). In addition, we observed *Atimia* overwintering in the larval and adult stages, a combination which suggests at least a 2-year life cycle. We further observed

FIG. 4. Female (left) and male (right) of *Atimia helenae*.

that none of the winter and spring larvae formed wooden plugs, indicating that their feeding was continuous until the following pupation period. Based on fragmentary samples, the pupation period probably extends from summer to early fall.

No eggs were observed in the field, but they should be present from March to June, since new larvae were extracted as early as April and as late as August.

ATIMIA ASSOCIATES.—Two hymenopterous parasites, *Dolichomitus californicus* Townes and a *Coeloides* sp. were infrequently reared from *Atimia*-infested wood. The first species, an ichneumonid, is also known to parasitize other cerambycids in the Coniferae and occurs throughout western North America (Townes and Townes, 1960). The second parasite, a braconid, could not be determined to species. Both wasps were observed parasitizing the larval stage.

Laspeyresia cupressana (Kearfott) and an undescribed *Petrova* species, both belonging to the family Tortricidae, occasionaly were observed in association with active *Atimia* sites. Larvae of *L. cupressana*, the more common of the two species, fed and developed to maturity in the phloem periphery of the *Atimia*-excavated sites. The damaged wood provided an especially favorable substrate for successful larval establishment; however, the larvae are known to occur in uninjured wood (Frankie and Koehler, 1971). The relationship of *Petrova* to *Atimia* sites was never determined. The damaged wood tissue may provide *Petrova* with an additional host site similar to that of *Laspeyresia*. The primary host site(s) of this *Petrova* species is unknown.

After *Atimia* and its moth associates have emerged, the excavations are invaded frequently by earwigs, ants and a variety of hemipteran species. The earwigs were observed primarily in the old *Atimia* tunnels.

INSECT-PLANT RELATIONSHIPS.—*Atimia helenae* is known only from *C. sargentii* and *C. pygmaea*. Both trees occur endemically in widely scattered, coastal foothill locations from south central to north central California. The sites are generally small areas that are composed of relatively pure stands of slow growing cypress. The slow growth, which often results in stunting, is due to the characteristic poor soil. Many of the cypress stands are situated on serpentine outcroppings. Better soil conditions are generally found in all areas surrounding the cypress sites.

Trees within the stands were infested by *Atimia* primarily at the points of attachment of cone clusters to branchlets. To a lesser extent the insect was found feeding in the larger branches and trunk region. It appeared that the larger trees were more attractive to the beetle as compared to the stunted individuals which commonly occur in extensive patches within the stand.

Some trees, which exist on better soil in the peripheral areas of the stands, appeared to be more attractive to *Atimia* than any of the trees within the stand. When infestations were observed on these trees, the numbers were relatively high and most of them occurred in the lower trunk region. Infestations in the branchlets of these peripheral trees were uncommon. Since most of the marginal trees were fast growing, as evidenced by their larger size and luxuriant crowns, there may be a correlation between the site and degree of infestation with some associated aspect of rapid tree growth. A similar change in insect-host relationship was observed by Frankie and Koehler (1971) with *Laspeyresia cupressana* on *C. macrocarpa*.

ACKNOWLEDGMENTS

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information supplied to us through Dr. Powell's investigation of "Biology of Microlepidoptera" (N.S.F. Grant GB-4014).

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Mealybugs of Santa Cruz Island, California[1]

(Homoptera: Coccoidea: Pseudococcidae)

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The purpose of this paper is to discuss the mealybugs of Santa Cruz Island. By examining the distribution patterns of mainland pseudococcids and by reviewing studies of other parts of the California insular biota, it has been possible to locate likely sources of the Santa Cruz Island mealybug fauna.

There are 16 major islands along the Baja California-southern California coast which are normally called the California Islands; these islands are divided into three groups. Those off the coast of Baja California are the Baja California Islands, those off the coast of California

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from Point Conception to San Diego are the Southern Channel Islands, and those off the coast near the town of Oxnard are the Northern Channel Islands. The Northern and Southern Channel Islands are collectively called the Southern California Islands (Philbrick, 1967).

This paper is primarily concerned with the Northern Channel Islands. From east to west the four islands comprising this group are: Anacapa, with three islets, Santa Cruz, Santa Rosa, and San Miguel.

The California Island Biota

The fauna and flora of the Northern Channel Islands is basically the same as that of the adjacent mainland; however, there are several notable exceptions. First, there is a surprisingly large number of endemics considering that the islands have been separated from the mainland only since the mid-Pleistocene (Valentine and Lipps, 1967; Axelrod, 1967) and are presently only 13 miles from the nearest point on the mainland (Philbrick, 1967). Second, components of the Northern Channel Island biota show striking affinities with biotas either far to the north or to the south on the mainland.

Although the percent of endemism on the California Islands is relatively low, endemic forms are known throughout most of the carefully studied groups of plants and animals. Among scientists there is disagreement regarding the source of this endemism. Some believe that the endemics have evolved on the islands themselves, while others think that the islands, with their moderate climates, are relictual areas of previously more widely dispersed species. It is now apparent that the majority of the endemics are of relictual origin. Axelrod (1967) pointed out that in the past most of the woody endemics occurred rather extensively on the mainland. However, there are still a few examples of endemics which are not easily explained by the refugia concept. The divergent forms of the tarweed genus *Hemizonia* (Carlquist, 1965) and the concentration of dwarf and giant endemics on the islands, appear to be examples of divergent endemism. It is likely therefore that both sources of endemism have added to the California insular biota with relictual endemism being the more predominant type.

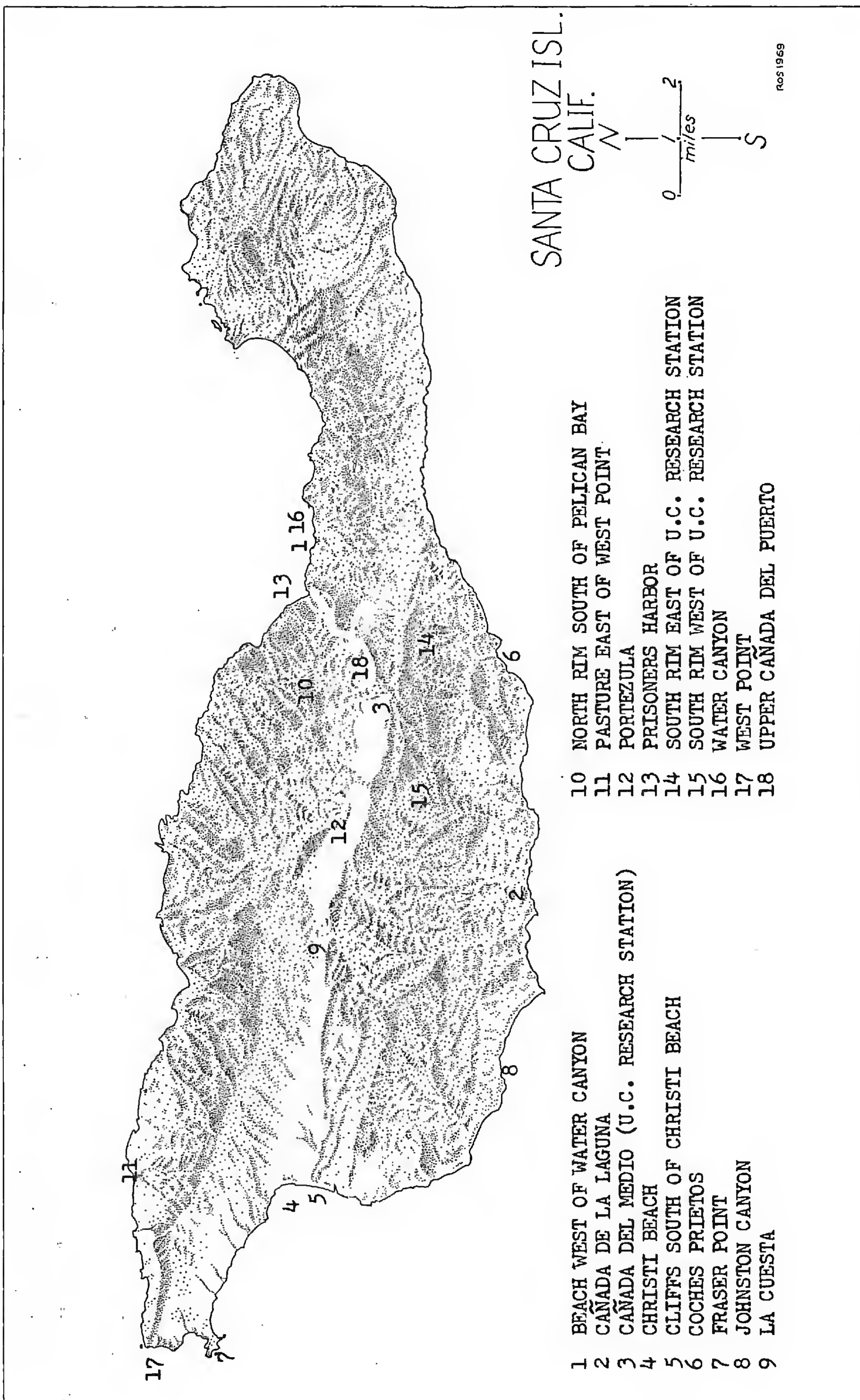
Disjunct distribution patterns are also of interest. A number of the California insular vascular plants are distributed on the mainland in areas which are not adjacent to the islands where they occur (Raven, 1967). On the Northern Channel Islands these affinities are mainly with biotas which occur at least 100 miles to the north. A few cases of affinities to the south are also known.

The presence of northern and southern components within the extant flora of a single island has been best explained by Axelrod (1967). He believes that during the last glacial period the flora of the coastal areas of southern California was most similar to the present flora of Monterey, approximately 200 miles to the north of Santa Cruz Island. A warming trend, called the Xerothermic period, followed this glaciation and allowed a more arid flora to become predominant. The previous flora receded northward leaving only remnant populations in localized pockets which remained favorable. The more moderate and moist climates of the islands apparently favored these remnants. Approximately 5,000 years later the climate gradually became more moist and the Xerothermic period ended. The arid flora was pushed southward and inland leaving remnants along the coast and on the islands. Therefore the present insular biotas possess components which are allied to both northern and southern mainland elements.

Santa Cruz Island

From a zoogeographical standpoint, Santa Cruz is probably the most interesting of the Northern Channel Islands. Of the four islands comprising this group, Santa Cruz is the largest in land area (Philbrick, 1967), has apparently been land-positive for the longest period of time (Weaver and Doerner, 1967), and probably has the greatest potential for ecological diversity (i.e., diversity in soil type, climate, and elevation). For these reasons the biota of Santa Cruz is most likely to give clues to the past history of the Northern Channel Islands.

Santa Cruz Island is diverse ecologically. Most of its shoreline is made up of steep cliffs, but stream beds which dissect the coastline frequently support small coastal beaches of sand or smooth, surf worn rocks, or of both. Larger beaches are also present, particularly on the southwest end of the island. Deep canyons and rugged hillsides are the predominant surface features; the highest peak is over 2,400 feet. The center of the island supports a linear series of wide valleys formed on a fault which runs along the east-west axis of the island. It is this series of valleys which adds to the diversity of Santa Cruz. Frequently when the coastal areas are windy or covered with fog, the central valley is clear and nearly wind free. Thus, the inland areas are climatically quite different from the coast. The rapid changes in habitats which one experiences on the island are startling. Within its confines I traveled to dense oak groves, open grasslands, pine forests, cactus laden hillsides, dense chaparral areas, barren ridges, wind blown beaches, protected lagoons, steep canyons, open valleys, shingle beaches, permanent freshwater streams, and coastal cliffs.



MAP 1. Santa Cruz Island mealybug collection sites.

The insect fauna of Santa Cruz Island, until recently, has been poorly known. Dr. Carey Stanton, present owner of most of the island, has encouraged scientific studies on Santa Cruz and has allowed the University of California to establish a research station for this purpose. Given this opportunity, entomologists from the Berkeley, Davis, and Riverside campuses have undertaken survey expeditions. I have been fortunate to participate in three trips, and although this paper must be considered preliminary, it probably includes a majority of the mealybug species which occur on the island.

Scale Insects and Plants

There are some notable similarities between the habits of scale insects (Coccoidea) and plants in regard to dispersibility. Female scales are generally sedentary. The eggs are normally covered either by the body of the female or by a waxy secretion produced by her. First instar nymphs of both sexes are mobile, and although they are susceptible to long-range wind movements, they are probably best adapted for short-range dispersal to other parts of the parent plant or to adjacent plants. Once the first instar has settled, further movements are either non-existent or quite unusual. With the exception of the first instar, the immature stages of the male are relatively sessile; movements in search of pupation sites may take place, but these are apparently very limited. The adult male is usually winged and apparently is adapted to long-range as well as short-range movements; it may carry genetic material to geographically isolated populations, but it cannot establish a new population. Movements of adult males are both active and passive. The presence of female sex pheromones (Tashiro and Chambers, 1967) would seem to confirm active movements of the male toward the female. Passive dispersal has not been conclusively established, but the presence of long caudal projections and a light body weight appear to be adaptations to enhance bouyancy for passive wind dispersal.

Plants have many of these characteristics. The primary portion of most plants with the attached female reproductive system is sessile. Seeds usually are enclosed within other plant tissues. Although some seeds are capable of long-range passive dispersal, establishment in many instances occurs in areas adjacent to the parent plant; once established, movements are unlikely. Pollen can carry genetic material to geographically isolated populations, but it is not capable of establishing a new colony. The use of pollinators which actively seek out receptive reproductive parts in plants would seem to qualify as a type of active dispersal, whereas movements of pollen by wind clearly fit passive dispersal.

The similarities between plants and scale insects, though perhaps somewhat superficial, have encouraged me to search for correlation between the Santa Cruz Island flora and the scale insect fauna. On this island Raven (1967) records 31 endemic plants, including seven which are exclusively endemic and 24 which are present on Santa Cruz and at least one other California Island. Plants with disjunct distribution patterns and plants with restricted mainland populations are also present on Santa Cruz. Therefore, I had hoped to find these same characteristics within the scale insect fauna.

Santa Cruz Island Mealybugs

I have restricted my attention to mealybugs because this group is the best known of the California scale insects, and because insular pseudococcids, of all the Coccidea, are normally the most distinctive.

The following list of the mealybugs known to occur on Santa Cruz Island includes 13 genera and 23 species. The localities may be found on the accompanying map. Plant names are presented as listed by Munz and Keck (1965).

Amonostherium
  lichtensioides (Cockerell)
  1. Coches Prietos, 18 June 1967, *Artemisia californica* (crown and foliage)
  2. south rim east of U. C. Research Station, 9 May 1968, *A. californica* (foliage)

Anisococcus
  quercus (Ehrhorn)
  1. upper Cañada del Puerto, 27 April 1969, *Quercus agrifolia* (under bark and in duff beneath tree)

Chorizococcus
  abroniae McKenzie
  1. Christi Beach, 19 June 1967, *Amblyopappus pusillus*, *Franseria chamissonis*, *Mesembryanthemum crystallinum* (roots)

Discococcus
  simplex Ferris
  1. pasture east of West Point, 30 April 1969, *Sitanion* sp. (crown)

  spectabilis McKenzie
  1. Prisoners Harbor, 7 May 1968, *Bromus* sp. (roots)

Distichlicoccus
  salinus (Cockerell)
  1. Cañada de la Laguna, 30 April 1969, *Distichlis spicata* (leaf blade sheath)
  2. Christi Beach, 5 May 1968 and 26 April 1969, *D. spicata* (on leaf blade)
  3. mouth of Johnston Canyon, 21 June 1967, *D. spicata* (leaf blade sheath)

Heterococcus
  arenae Ferris
  1. Cañada del Medio, U. C. Research Station, 16 June 1967, *Festuca* sp. (leaf blade sheath)

2. Cascada, 4 May 1968, grass (leaf blade sheath)
3. Coches Prietos, 18 June 1967, *Festuca* sp. (leaf blade sheath)
4. south rim west of U. C. Research Station, 6 May 1968, grass (leaf blade sheath)

Paludicoccus

distichlium (Kuwana)

1. Christi Beach, 5 May 1968, *Distichlis spicata* (crown)

Phenacoccus

colemani Ehrhorn

1. north rim south of Pelican Bay, 3 May 1969, *Garrya* sp. (undersides of leaves)

eriogoni Ferris

1. Prisoners Harbor, 7 May 1968, *Eriogonum latifolium* (stems)

eschscholtziae McKenzie

1. Fraser Point, 11 May 1968, *Haplopappus venetus* (roots)

gossypii (Townsend and Cockerell)

1. Cañada del Medio, U. C. Research Station, 17 June 1967, *Eschscholtzia californica* (crown and roots)

solani Ferris

1. Fraser Point, 11 May 1968, *Mesembryanthemum nodiflorum* (roots)

Pseudococcus

beardsleyi Miller and McKenzie

1. north rim south of Pelican Bay, 3 May 1969, *Arctostaphylos subcordata* (foliage)
2. south rim west of U. C. Research Station, 18 June 1967, *A. subcordata* (foliage)

longisetosus Ferris

1. Cañada del Medio, U. C. Research Station, 7 May 1968, *Rhus diversiloba* (roots)

obscurus Essig

1. cliffs south of Christi Beach, 26 April 1969, *Castilleja* sp. (crown)
2. La Cuesta, 5 May 1968, *Eriogonum latifolium grande* (crown)

Puto

yuccae (Coquillett)

1. beach west of Water Canyon outlet, 2 May 1969, *Eriogonum* sp. (roots)
2. Christi Beach, 19 June 1967, 5 March 1968, and 5 May 1968, *Amblyopappus pusillus*, *Atriplex semibaccata*, *Chenopodium* sp., *Eriogonum* sp., and *Haplopappus venetus* (roots, crown, and foliage)
3. Portezuela, 20 June 1967, soil
4. Water canyon (500 ft.), 17 June 1967, *Diplacus longiflorus* and *Zauschneria cana* (foliage)

Rhizoecus

bicirculus McKenzie

1. south rim east of U. C. Research Station, 9 May 1968, grass (roots)
2. south rim west of U. C. Research Station, 6 May 1968, *Lotus scoparius* (roots)

gracilis McKenzie

1. Coches Prietos, 18 June 1967 and 10 May 1968, *Artemisia californica* and *Haplopappus canus* (roots)

leucosomus (Cockerell)

1. Coches Prietos, 10 May 1968, *Dudleya greenei* (roots)

Spilococcus

keiferi McKenzie

1. beach west of Water Canyon outlet, 2 May 1969, *Eriogonum* sp. (roots)

Trionymus

caricis McConnell

1. Christi Beach, 26 April 1969, *Distichlis spicata* (leaf blade sheath).

utahensis (Cockerell)

1. Cañada de la Laguna, 30 April 1969, *Bromus* sp. (leaf blade sheath)
2. mouth of Johnston Canyon, 21 June 1967, *Avena* sp. (leaf blade sheath)

There appears to be an unusually small number of pseudococcids on Santa Cruz Island. This is difficult to quantify, but as an indication, when collecting in the coastal areas of southern California, it is exceedingly unusual to find less than ten lots of mealybugs per day whereas, on the island I was never able to find more than four. In addition, McKenzie (1967) lists approximately 53 species of mealybugs which probably occur in the coastal areas near Oxnard and which have been collected on hosts that occur on Santa Cruz Island. Of these 53 species, only 23 are known to occur on Santa Cruz. Therefore, not only are there a small number of mealybug species on Santa Cruz, but these species appear to be sparsely distributed.

All mealybugs that ocur on Santa Cruz Island have been recorded from the California mainland. Nine of the 23 species present on the island are distributed throughout most of continental California, five of the 23 species occur exclusively in the coastal mountain ranges, two occur in the coastal ranges and the southern California deserts, two in the coastal ranges and the beaches, one in the coastal ranges and the Cascade Mountains, one exclusively on beaches, one in the Trinity Alps, and two occur in the saline regions along the coast. These data suggest that the majority of the mealybugs which occur on Santa Cruz Island are most closely allied to the aggregation of pseudococcids which are present in coastal areas on the mainland. The presence of a small number of desert and northern mountain species suggest the displacement of previous northern and southern mealybug faunas. These data are consistent with the findings of botanists.

Although mealybug collecting on Santa Cruz has not been extensive enough to give detailed distribution patterns, it appears that the pseudococcids show no unusual ecological diversity. As far as can be determined, none of the species occur on hosts or in habitats whch are radically different (i.e., species which occur on mainland beaches occur on island beaches).

Perhaps the most interesting aspect of the Santa Cruz Island mealybug fauna is found among the species which show disjunct distribution patterns. They are as follows:

Mealybug	Southernmost mainland locality	Approximate distance north from Oxnard
Anisococcus quercus	Mountain View, Santa Clara Co.	275 miles
Discococcus simplex	San Miguel, San Luis Obispo Co.	135
Pseudococcus longisetosus	Pacific Grove, Monterey Co.	225
Rhizoecus bicirculus	Weaverville, Trinity Co.	480
Trionymus caricis	Patterson, Stanislaus Co.	250

Although only five pseudococcids show this pattern, it is significant that they are all northern disjunctions. This is consistent with the findings of Raven (1967) and Axelrod (1967), who indicate that the majority of the non-endemic Northern Channel Island plants which are not present on the adjacent mainland are present in northern California.

Pseudococcus beardsleyi also shows an interesting distribution pattern, occurring in several small areas in the higher elevations of Santa Cruz Island and in similar areas at Pt. Reyes, Mt. Tamalpais, and Mt. Wilson on the mainland. The occurrence of this species in small, widely separated areas is reminiscent of the restricted distribution patterns of many plant relicts. It seems significant that Pt. Reyes, Mt. Tamalpais, and the upper elevations of Santa Cruz Island are inhabited by a number of these relicts and, in fact, could be considered refugia. Therefore, if *P. beardsleyi* is a relict pseudococcid, careful collecting in these refugia might reveal other interesting mealybug species.

SUMMARY

There are 13 genera and 23 species of mealybugs known on Santa Cruz Island none of which are endemic. The pseudococcid fauna of the island is a depauperate aggregation of species most like the mealybugs of the adjacent mainland, with a small representation of northern species. The majority of the Santa Cruz Island mealybugs have been previously re-

corded from the beaches or coastal mountain ranges on the California mainland.

There are both differences and similarities between the flora and the mealybug fauna of Santa Cruz Island. The most striking difference is the absence of endemic pseudococcids. It is possible that when the more distant Northern Channel Islands are examined, endemic forms will be discovered. Similarities are numerous. Both the flora and the mealybug fauna show close affinities to their respective counterparts on the adjacent mainland, both possess species with disjunct and restricted mainland distribution patterns, and both possess small components of northern and southern biotas.

Acknowledgments

I gratefully acknowledge the assistance of Mr. Michael R. Benedict, Channel Island Field Station, University of California, not only for transporting me to the diverse areas of the island, but also for identifying most of the plant hosts.

Thanks are also due to Dr. Carey Stanton, owner of most of Santa Cruz Island, for permtting me to collect on his property. His encouragement of scientific studies on the island is commendable.

Mr. Robert O. Schuster, University of California, Davis, made available a copy of the map used in this paper and reviewed the manuscript.

Mr. Michael R. Benedict, Dr. Albert A. Grigarick, Dr. Donald S. Horning, Jr., Dr. Arnold S. Menke, Mr. Richard W. Rust, and Mr. Robert O. Schuster all collected specimens utilized in this study.

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SCIENTIFIC NOTE

A teratomorphic carabid beetle with notes on polymorphic asymmetry of the gular region in the same population (Coleoptera: Carabidae).—In a series of ten specimens of *Polpochila impressifrons* Dejean recently collected at Nova Teutonia, Brazil (January–February 1970, Fritz Plaumann) one female had a double tibia on the left anterior leg (Fig. 1). The more anteriorly placed tibia is perfectly formed while the posterior one is deformed, but nearly symmetrical. For example, the antennal comb spur is doubled and the cleaning setae are arranged in a straight row between the spurs. The tarsi on the deformed tibia are incomplete and the apical spur is doubled in laminate fashion.

FIGS. 1 and 2. *Polpochila impressifrons.* FIG. 1. Double tibia on left anterior leg of a female. FIG. 2. Fovea on venter of head of male.

In the same series of specimens, there is a total of 2 females and 8 males. Of the eight males, five have a deep comma-shaped fovea (Fig. 2) in the head capsule adjacent to the gula, but only on the right side (ventral aspect). One of the remaining males has a shallow depression there, while the other two males and the two females have no trace of this structure. Examination by means of a dissecting microscope (180×) did not reveal any sensory structures associated with the fovea and there does not seem to be any corresponding structure on the dorsum of the female, that is, a correlated structure with sexual functions (positioning, grip, etc.). Therefore, the function of this fovea or perhaps its accidental occurrence in some males must be studied further.—T. L. ERWIN, *Smithsonian Institution, Washington, D. C. 20560.*

A New *Trithyreus* from a Desert Oasis in Southern California

(Arachnida: Schizomida: Schizomidae)

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Three species of *Trithyreus* have been collected from a number of sites in California. *Trithyreus belkini* McDonald and Hogue (1957) and *T. pentapeltis* (Cook) (1899) have been found in widespread localities, whereas *T. borregoensis* Briggs and Hom (1966) is known only from Borrego Palm Canyon, a well known desert oasis. This paper describes another *Trithyreus* from a very similar isolated desert oasis at 49 Palms in Joshua Tree National Monument, about 27 miles northeast of Indio, California.

The order Schizomida is represented by seven species in two genera in the United States. Integration of Briggs and Hom's key (1966), with a modified version from Gertsch (1940) produces a key to the males of the United States species and the females of *Schizomus floridanus* Muma (1967) in which the male is unknown. It is assumed to be parthenogenetic.

1. Third cephalothoracic tergum (metapeltidium) entire .... *Schizomus* 2
   Third cephalothoracic tergum divided longitudinally by suture or membrane to form two lateral plates .... *Trithyreus* 3
2. Trochanter of female pedipalp strongly produced distally, one-half diameter of femoral socket. Males unknown .... *S. floridanus* Muma
   Trochanter of pedipalp vaguely produced distally not more than one-fourth diameter of femoral socket .... *S. mulaiki* Gertsch
3. Flagellum long, subtriangular .... *T. pentapeltis* (Cook)
   Flagellum club shaped 4
4. Flagellum trilobed, median lobe projecting dorsad .... *T. wessoni* Chamberlin
   Flagellum not trilobed as above 5
5. Flagellum pentagonal; no mesal spur on tibia of pedipalp .... *T. borregoensis* Briggs and Hom
   Flagellum a rotundate hexagon; mesal spur located apically on tibia of pedipalp 6
6. Dorsal surface of flagellum convex at center .... *T. belkini* McDonald and Hogue
   Dorsal surface of flagellum concave at center .... *T. joshuensis* Rowland, n. sp.

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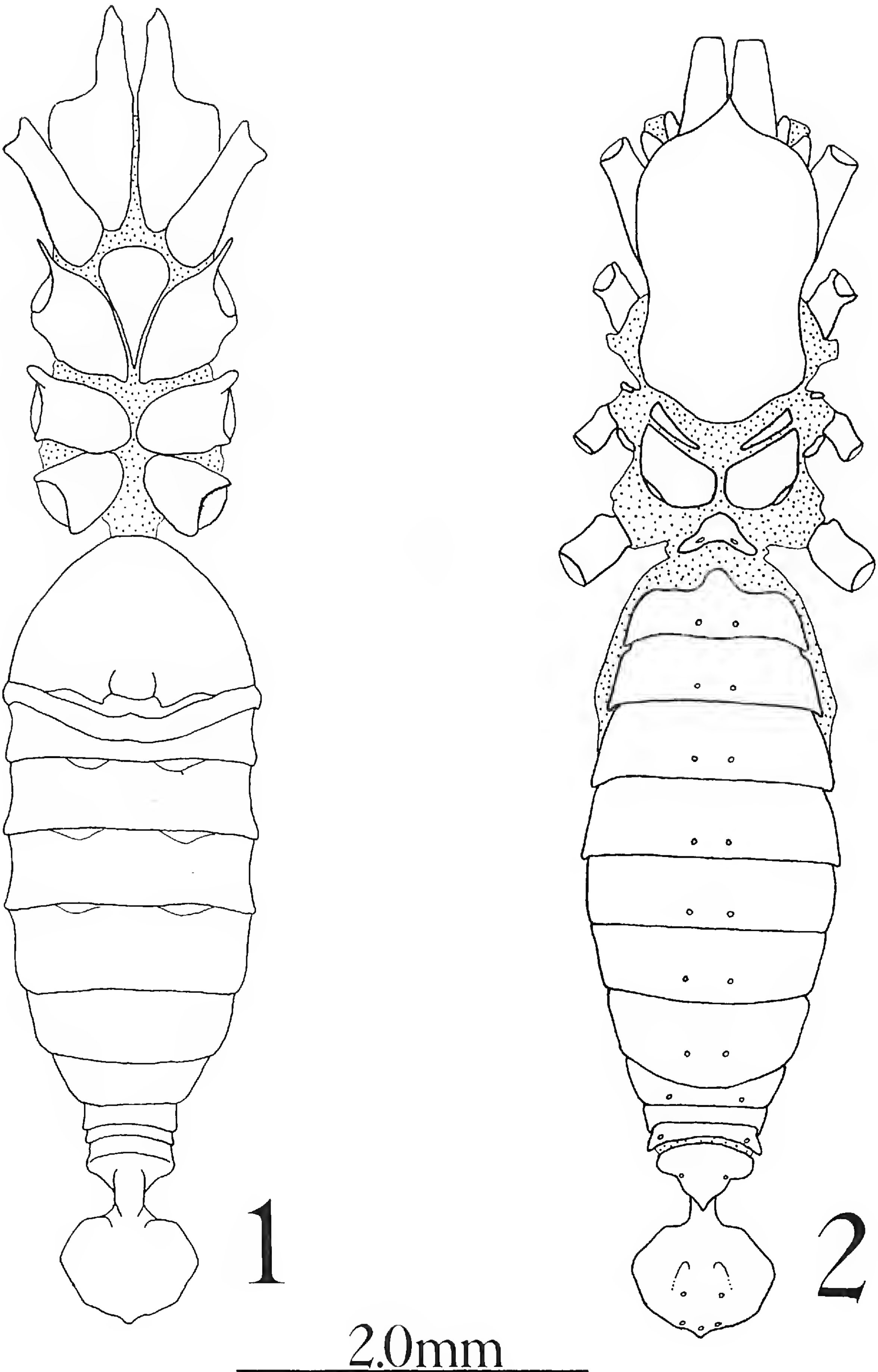
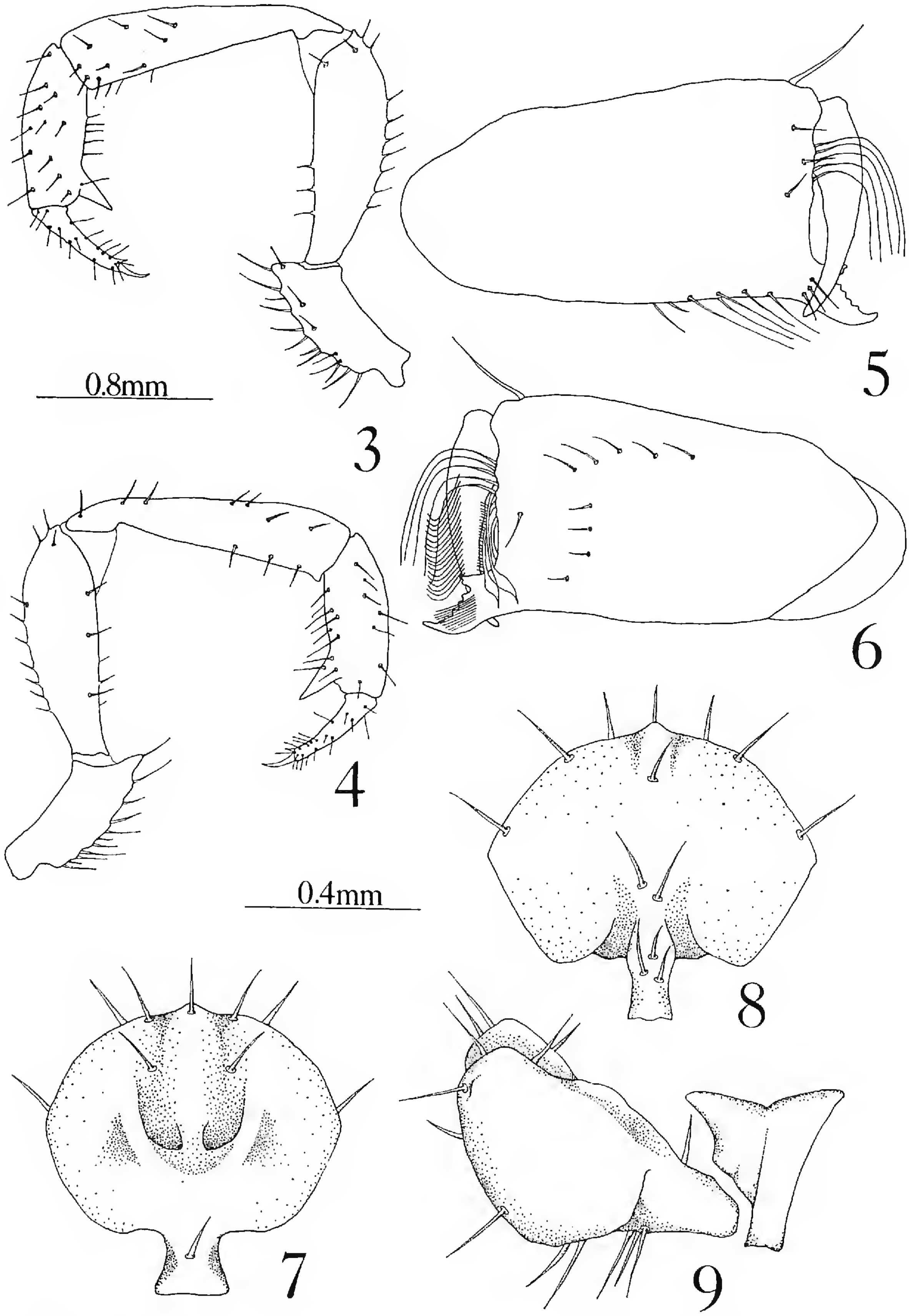


FIGS. 1–2. Male holotype, *Trithyreus joshuensis* Rowland, new species. FIG. 1. Ventral aspect, legs, pedipalps and setal pits omitted. FIG. 2. Dorsal aspect, legs and pedipalps omitted, setal pits shown.



FIGS. 3–9. Male holotype, *Trithyreus joshuensis* Rowland, new species. FIG. 3. Lateral aspect of pedipalp. FIG. 4. Mesal aspect of pedipalp. FIG. 5. Lateral aspect of chelicera. FIG. 6. Mesal aspect of chelicera. FIG. 7. Dorsal aspect of flagellum. FIG. 8. Ventral aspect of flagellum. FIG. 9. Lateral aspect of flagellum and 12th abdominal segment. 0.8 mm scale refers to Figs. 3–4. 0.4 mm scale refers to FIGS. 5–9.

Trithyreus joshuensis Rowland, new species

This description is based on the holotype male (chelicerae, pedipalps and first pair of legs detached), the allotype, and four paratypes (two males and two females) all in 80% ethyl alcohol.

MALE.—Total length (from anterior margin of first cheliceral segment to end of flagellum), 6.27–6.92 mm.

Cephalothorax.—Carapace (propeltidium, first cephalothoracic tergum) twice as long as wide, strongly convex, lateral margins nearly vertical, produced anteromesally as a sharp, conical process; eye spots vaguely distinct as elongate, oval, pale areas on anterolateral surface of carapace; mesopeltidia (second pair of cephalothoracic tergites) acutely triangular, gently curved, pointing nearly diagonally toward midline; metapeltidium (third cephalothoracic tergum) divided medially into two plates, medial margin of metapeltidial plates shorter than curving lateral margin, anterior margin nearly parallel with posterior margin of mesopeltidia, posterolateral angle of metapeltidial plates in close approximation with small, narrowly curved plate; anterior sternum triangular, pointing caudad, apex extending nearly to caudal limit of coxae II, anterolateral angles curved; posterior sternum (metasternum) indistinct.

Abdomen.—First abdominal tergum located equally between second abdominal tergum and metapeltidium, nearly chevron shaped; segments II–IX with pleural membrane dividing terga and sterna; terga X–XII fused wth sterna X–XII; segment XII with posterodorsal cone projecting horizontally over base of flagellum; lung books vaguely visible under second abdominal sternum; terga III–VII bearing slightly darkened apodemes of dorsoventral muscles, dorsoventral muscle insertions appearing as pale areas on sterna V–VII.

Flagellum.—Bulbous, horizontally compressed bearing 16 setae; dorsal surface concave medially with a pair of depressions giving rise medially to elevation culminating distally in small cone; transversely convex ventrally.

Chelicerae.—Lateral aspect of basal segment bearing three setae in vertical group below large dorsal seta, vertical group of five long, feathered setae flanking movable finger (second cheliceral segment), group of three shorter setae arranged basally on fixed digit, horizontal group of seven setae arising on or near ventral margin; mesal surface of basal segment bearing group of five setae arranged horizontally, lower group of four shorter setae arranged vertically, single seta directly below large dorsal seta, movable finger flanked by another vertical group of five long, feathered setae as on lateral surface, three large, elongate, distally enlarged setae originating just below previous group, fixed digit bearing 10 closely situated feathered setae; movable finger destitute of setae laterally, mesal aspect bearing vertical row of 16 long, feathered, distally curled setae near outer margin, another vertical row of 22 short setae or teeth near inner surface.

Pedipalps.—Trochanter produced distally beyond femoral socket; femur and patella narrow proximally, expanding distally; tibia with mesal, subapical spur; tarsus-basitarsus with small spur just above claw; length of segments given below.

Legs.—First leg antenniform, terminal segment without tarsal claw; coxa of second leg with anterolateral spur; third leg shorter than others; femur of fourth leg greatly expanded and laterally compressed; legs II–IV with three tarsal claws; length of segments given below.

	Pedipalp mm	I mm	II mm	III mm	IV mm
Coxa	0.66–0.80	0.63–0.75	0.53–0.56	0.41–0.48	0.39–0.47
Trochanter	0.47–0.64	0.37–0.41	0.21–0.26	0.25–0.31	0.42–0.45
Femur	0.65–1.06	1.52–1.72	1.02–1.17	0.95–1.05	1.46–1.56
Patella	0.77–1.29	–	0.59–0.64	0.41–0.50	0.64–0.69
Tibia	0.55–0.74	1.98–2.16	0.69–0.76	0.59–0.66	1.06–1.15
Basitarsus		1.50–1.62	0.58–0.67	0.64–0.76	0.94–1.02
	0.42–0.47				
Tarsus		1.13–1.27	0.45–0.46	0.47–0.49	0.55–0.59
Total	3.52–5.00	7.13–7.82	4.07–4.49	3.72–4.19	5.46–5.90

FEMALE.—Total length (from anterior margin of first cheliceral segment to end of flagellum), 6.52–6.85 mm.

Female allotype and paratypes differ from description of male holotype and paratypes as follows:

Pedipalps.—Femur, patella and tibia much shorter than in male; femur and patella not as narrow proximally; tibia without subapical spur; length of segments given below.

Legs.—First leg about one-tenth shorter than in male; length of segments given below.

Abdomen.—Segment XII not bearing the posterolateral cone projecting horizontally over flagellum.

Flagellum.—Four segmented, elongate cylindrical, terminal segment longer than previous three.

	Pedipalp mm	I mm	II mm	III mm	IV mm
Coxa	0.67–0.85	0.58–0.69	0.52–0.55	0.43–0.49	0.40–0.49
Trochanter	0.35–0.55	0.35–0.39	0.23–0.26	0.25–0.30	0.42–0.45
Femur	0.44–0.59	1.34–1.53	1.00–1.10	0.90–1.03	1.32–1.52
Patella	0.69–0.81	–	0.52–0.61	0.40–0.46	0.59–0.70
Tibia	0.53–0.63	1.60–1.86	0.64–0.75	0.54–0.63	0.98–1.09
Basitarsus		1.22–1.45	0.56–0.65	0.62–0.71	0.85–0.95
	0.34–0.36				
Tarsus		1.03–1.12	0.44–0.46	0.48–0.49	0.53–0.55
Total	3.02–3.79	6.12–7.04	3.91–4.37	3.62–4.07	5.09–5.75

Holotype male and allotype, 49 PALMS, JOSHUA TREE NATIONAL MONUMENT, SAN BERNARDINO COUNTY, CALIFORNIA, 20 February 1970 (J. M. Rowland and D. Harris). Paratype male and female at type locality, 22 February 1970 (J. M. Rowland and C. S. Rowland). Paratype male and female at type locality, 30 December 1970 (J. M. Rowland and P. J. Brashier). Collected in leaf litter. All types are deposited in the American Museum of Natural History, New York.

The descriptions of *Trithyreus belkini* and *T. borregoensis* incorporate inaccuracies which the authors have permitted me to rectify here. The third thoracic tergum described by them is actually the first abdominal tergum. Other members of the order show a greater proximity of this tergum to the second abdominal tergum (Hansen and Sorensen, 1905). Their description of the abdominal segments needs revision from 11 segments to 12 segments and all references to abdominal segments 1–11 should be changed to segments 2–12. In their respective descriptions of the legs they have included a measurement of the patella of the first leg, which, according to most current authorities, does not exist (Gertsch, 1940). The patella they have described is recognized as the tibia, the tibia described is recognized as the basitarsus, the basitarsus and tarsus described are recognized as the tarsus.

My thanks goes to Dr. John A. L. Cooke, American Museum of Natural History, and Dr. Paul H. Arnaud, Jr., California Academy of Sciences, for use of the type material of United States Schizomida. Special thanks goes to Dr. W. David Edmonds, California State Polytechnic College, for much appreciated assistance.

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SCIENTIFIC NOTE

New host and distribution records for three western wood-boring Hymenoptera (Syntexidae, Siricidae).—This is primarily being written so the data may be included in an economic work which is in preparation by another author.

On the afternoon of 3 August 1968, a small fire occurred on a hillside about four miles north of Klamath Falls, Klamath County, Oregon. Its extinguishment was greatly facilitated by an afternoon thundershower, but not before several *Juniperus occidentalis* Hooker were scorched or burned. This species occurs in a rather sparse stand at this locality. The day following the fire numerous *Syntexis libocedrii* Rohwer were observed, primarily on one large, completely scorched tree which was still smouldering at the base. One female siricid was also noted at this time. The dead tree was cut down two years later on 4 August 1970, and sections of the trunk brought to the laboratory and caged. Adult wasps emerged from mid-August to early November of the same year. A few individuals emerged from late June to mid-September 1971.

As a result of this project *J. occidentalis* can be listed as a new host for *S. libocedrii* (Syntexidae), *Sirex areolatus* (Cresson) and *Xeris tarsalis* (Cresson) (Siricidae). The parasite, *Ibalia gigantea* Yoshimoto, was also reared (during 1970), although its host(s) were not determined. This species has been confused under *I. ensiger* Norton in most collections. I have seen numerous specimens from Idaho and Oregon and all belong to the former species.

Since *S. libocedrii* is a rather rare insect, and is herein recorded from Oregon for the first time, it seems worthwhile to list additional Oregon records as follows: Crater Creek, Rogue River N. F., 4,500 ft.; Union Creek, 3,100–3,500 ft., Jackson Co.; Keno, Klamath Co., fresh burn; Saddle Butte, Sec. 23, T23S, R18E, Lake Co., burnt *J. occidentalis*; Idanha, Marion Co., on trunk of burnt *Pseudotsuga menziesii* (Mirb.) Franco; ovipositing in trunk of scorched *Thuja plicata* Donn. The latter would appear to represent another new host record, as neither *Libocedrus decurrens* Torr. nor *J. occidentalis* occur in the area. Dates of collection range from 5–30 August. Specimens are in the collections of the California Academy of Sciences, Oregon Department of Agriculture, Oregon State University and U. S. National Museum.

According to Dr. David R. Smith there are two specimens in the U. S. National Museum which bear the label "Biol. Survey No. 157557. Stomach of night hawk, Idaho." This represents a new record for that state, assuming the bird did not dine elsewhere.

My appreciation goes to Drs. Woodrow W. Middlekauff and David R. Smith for their help with records and determinations and to Mr. R. L. Penrose for assistance in the field and laboratory.—RICHARD L. WESTCOTT, *Oregon Department of Agriculture, Salem, 97310.*

SCIENTIFIC NOTE

Male aggregation site of *Cephenemyia jellisoni* (Diptera: Oestridae).— Little is known about the aggregating sites of bot flies. On 25 May 1966, a group of five *Cephenemyia jellisoni* Townsend males was encountered at an altitude of 7,000 feet, just beyond Morton Pass, on Wyoming State Highway 34, in what is commonly known as Wheatland Canyon. The flies were flying rapidly around in a large circle on top of a hill (Fig. 1). The circle encompassed two dwarfed juniper trees which stood about three to four feet. A loud buzzing noise was heard constantly. Occasionally a fly would alight for a short time on rocks near the base of the trees and then would resume flight. The flies were captured one at a time with an insect net as they flew in the circle. The capture of individual flies produced no visible behavioral change on those which remained. The fifth and last fly continued to circle even though its companions were gone at which point he was also captured. No females were observed in the area in the hour that the author was present. Because of the large number of hills of similar topography in the immediate vicinity, it is difficult to understand what distinguishes this hill from others in the area.—R. J. LAVIGNE, *University of Wyoming, Laramie, 82070.*

FIG. 1. Hill in Wheatland Canyon which served as aggregating site for *Cephenemyia jellisoni* males. Trees at apex are typical of those on many similar hills in area.

Obituary Notice

Edwin Ralph Leach,

3 May 1878 - 22 July 1971

Mr. Edwin R. Leach, of Piedmont, California, Honored Member of the Pacific Coast Entomological Society, died on 22 July 1971, at Merritt Hospital, Oakland after a brief illness. He was 93 years old. Mr. Leach was a professional mining engineer and had as avocations the study of Coleoptera and Natural History.

Mr. Leach was a member of the Pacific Coast Entomological Society for 55 years, having joined the society in 1916. He served as Treasurer from 1931 through 1942, became a Life Member in 1943, and was elected an Honored Member in 1948. He is survived by his wife Bertha Leach and a daughter Virginia Leach.—PAUL H. ARNAUD, JR., *California Academy of Sciences, San Francisco, 94118.*

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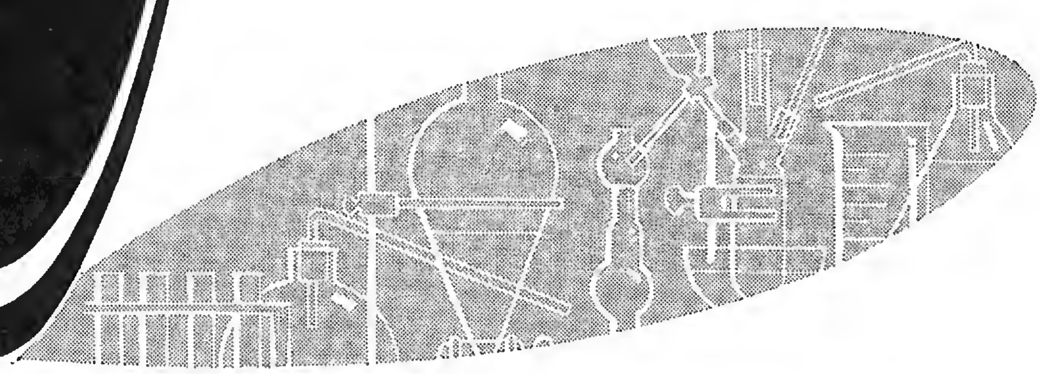

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