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FURTHER OBSERVATIONS ON BEES WHICH TAKE POLLEN FROM PLANTS OF THE GENUS SOLANUM

(Hymenoptera: Apoidea)

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Introduction. Two of the most common species of *Solanum* in the southwestern United States are *S. elaeagnifolium* Linnaeus and *S. rostratum* Dunal. The former (fig. 1) is known as silverleaf-nettle, bullnettle and Trompillo, and is a perennial species with purple flowers. The latter (fig. 2) is known as buffalo-bur and is an annual species with yellow flowers. Both are low-growing plants with prickly stems, which are especially notable in *S. rostratum.* Each makes its pollen available shortly after dawn as the buds begin to open and each is pollinated, insofar as presently known, primarly by large, heavy-bodied bees which are capable of inverting the flowers and vibrating the anthers in order to extract the pollen from the slits at their ends. Smaller bees are able to exploit residual pollen in the face of competition from the larger bees but the principal harvest is reaped by the latter—at least in the areas where our studies have been conducted.

Although the leaves and unripe fruit of *S. rostratum* and *S. elaeagnifolium* are reported to contain an alkaloid, solanin, highly toxic to vertebrates, there is no indication of toxicity of the pollen to bees—nor, for that matter of the leaves to the Colorado potato beetle, which feeds readily on *S. rostratum,* its presumed original host plant.

Previous Studies. Some observations on the activity of pollinators of *Solanum elaeagnifolium* have been reported previously for a small group of plants on the grounds of the Southwestern Research Station, 5 miles west of Portal, Arizona (Linsley, 1962). This site is at an elevation of 5400 ft. in the Chiricahua Mountains, and during the last week of July, the flowers began to open near 5 a.m., at which time the first pollinators appear. Air tempera-

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[1] The photographs accompanying this paper were very kindly taken for this purpose by Marjorie Statham of the American Museum of Natural History, New York. Miss Statham and Juanita M. Linsley ably assisted in the collection of field samples. Identifications of pollinators were made or confirmed by P. H. Timberlake, University of Calfornia, Riverside, of plants by Margaret S. Bergseng, University of California Herbarium, Berkeley. Robbin Thorp, Department of Entomology and Parasitology, University of California, Berkeley, aided in the identification and analysis of pollen loads and comparison of pollen-collecting structures. The authors are grateful to all concerned.

tures at this hour were in the vicinity of 56°-58° F, well above the minimum necessary for flight. The first active pollinators were *Ptiloglossa arizonensis* Timberlake, followed by *Bombus morrisoni* Cresson and *B. sonorus* Say, from 10 minutes to half an hour later. These were the only pollinators observed in this area, the *Ptiloglossa* females confining their activity largely to a 15 or 20 minute period which terminated considerably before sunrise, the *Bombus* continuing to work the flowers until they began to wilt (near mid-morning on a hot day, near mid-day when the sky was overcast). No similar data have been published for bees which take pollen from *Solanum rostratum*, although P. H. Timberlake found *Protoxaea gloriosa* (Fox), *Psaenythia mexicanorum* (Cockerell) and *Nomia tetrazonata* Cockerell visiting this plant at Sonoita Creek, near Patagonia, Santa Cruz County, Arizona.

Site of Present Study. In the summer of 1962, at a location one mile east of Douglas, Cochise County, Arizona, populations of both species of *Solanum* were in bloom and growing adjacent to one another. *S. rostratum* occurred as individual plants or in small groups of plants in a narrow wash dominated by the tall composite, *Verbesina enceliodes* (Car.) Benth. & Hook., var. *exauriculata* R. &. G. *S. elaeagnifolium* occurred in thin scattered patches on somewhat higher ground extending eastward from the wash, and was associated with *Hoffmanseggia densifora* Benth., *Baileya multiradiata* Harv. & Gray, *Bahia absinthifolia* var. *dealbata* Gray, *Mentzelia pumila* (Nutt.) Torr. & Gray, *Cucurbita foetidissima* H.B.K., *C. digitata* Gray, and a number of less conspicuous flowering plants. Scattered shrubs of *Larrea tridentata* (D.C.) Coville, and other desert perennials characterized the surrounding area. The physical proximity of individual plants of the two species of *Solanum* greatly facilitated a comparison of the pollinators which visited them. Further, the sound emitted by the bees while vibrating the anthers could be heard at a distance of several yards, a fact which contributed materially to the ease with which they could be located in the dim morning light.

Size, appearance, and geographical range of the pollinators. The most conspicuous of the *Solanum* pollinators is the bumblebee *Bombus sonorus* (figs. 3-5), the workers of which are large (our samples varying in length from 13-18 mm), robust, densely hairy, and black, with the pubescence of the dorsum of the thorax bright yellow, broken with a transverse black band across the middle,

Fig. 1. *Solanum elaeagnifolium Linnaeus.*

and that of the first three metasomal terga bright yellow also. It occurs in Mexico and southwestern United States from Texas to southern California and northward to Kansas. *Caupolicana yarrowi* (figs. 3-5) is also large (17-19 mm in length), robust, black, and densely hairy, the hairs of the face mostly white, those of the vertex of the head and dorsum of the thorax fulvous, and the metasoma transversely banded with white along apical margins of first four terga. It also occurs in Mexico, extending its range into southern Arizona, New Mexico and Texas. *Ptiloglossa jonesi* (figs. 3-5) is similar in size (16-19 mm) and the hairs of the face and dorsum of the thorax are similar, but the metasoma is greenish with the apical margins of the terga paler, superficially suggesting transverse pubescent bands. Thus far it is known only from southern Arizona and northern Mexico. *Protoxaea gloriosa* (figs. 3-5) is likewise similar in size to the preceding (15-18 mm in length), and is a robust black bee with reddish legs. The facial pubescence is mostly white, that of the vertex of the head, dorsum of the thorax, and the base, sides and apex of the metasoma fulvous. We have seen examples from Mexico, Texas, and New Mexico, as well as Arizona. All three species of *Centris* are robust, black bees with white facial hairs, and the pubescence of the vertex, dorsum of thorax, and base of metasoma fulvous. However, *C. caesalpiniae* (figs. 5, 6) has red eyes and a red clypeus and has about the same size range as *Protoxaea* (14-18 mm in length), and occurs in much the same area. *C. atripes* (fig. 6) is intermediate in size (10-14 mm in length) and has a bright yellow clypeus and labrum. It is known from northern Mexico, Texas, New Mexico and Arizona. The similar sized *C. rhodopus* (fig. 6) (11-13 mm in length) has the base of the antennae, eyes, clypeus, mouthparts and legs wholly or partially red. It overlaps the other two species in distribution but also occurs in southern California. *Psaenythia mexicanorum* (figs. 5, 6) and *Nomia mesillensis* depart from this pattern of large, robust, hairy bees with dense fulvous thoracic pubescence. (They range from 9-10 mm in length). The former is black with the lower face largely bright yellow and with transverse white pubescent bands at the base of metasomal terga, two to four; the latter has gold maculations with greenish tints apically on metasomal segments two to four. Both are southwestern species which extend their range into Mexico.

Nature of the pollen. The pollen of each of the species of *So-*

lanum is very fine, the equatorial diameter of the grains in our sample from *S. rostratum* ranging from 23-27μ, those from *S. elaeagnifolium*, from 32-37μ. As in other species of *Solanum*, pollen is shed from slits in the end of the five elongate anthers

Fig. 2. *Solanum rostratum* Dunal.

which surround the exerted stigma. The weight of the larger bees causes the flowers to invert as they alight, and the anthers are then vibrated and the pollen shaken out. In this process the venter of the bee often becomes covered with pollen, in addition to that which is packed into the specialized hairs which constitute the pollen-carrying scopa.

We have called attention previously (Linsley, 1962), to the high proportion of "aborted" pollen grains produced by *Solanum elaeagnifolium.* In samples taken from bees in the Chiricahua Mountains, in 1961, 64 per cent of the pollen grains were aborted (i.e., did not contain significant amounts of protoplasm). Samples from the Douglas site were almost identical (65.4 per cent), suggesting that the percentage of aborted grains is the result of some inherent factor, rather than a function of temperature as suggested by Stow (1927). *S. rostratum* produces aborted pollen also, but at Douglas, where the plants were intermixed with those of *S. elaeagnifolium,* the proportion of aborted grains was only 15.6 per cent.

Among the plant species which compete for the attention of some of the *Solanum* pollinators, *Mentzelia pumila* also produces fine pollen, with grains varying in diameter from 25-27μ, much as in *Solanum rostratum.* Its pollen is made available in the late afternoon and early evening, and is exploited at that time by *Bombus, Caupolicana,* and *Centris,* but not by *Ptiloglossa* or *Protoxaea.* On the other hand, *Hoffmanseggia densifora* produces a much coarser pollen, our samples ranging in diameter from 61-74μ. It is utilized during the day by the *Solanum* species of *Centris,* but not by *Ptiloglossa, Caupolicana,* or *Protoxaea.*

Devices for the collection and transport of pollen. In view of the small size of the pollen grains produced by the two species of *Solanum,* a brief comparison of the nature of the specialized devices for pollen-holding (scopae) present in the various species may be of interest.

Bombus sonorus, like other social bees, collects pollen in a corbicula consisting of a large, slightly concave, smooth, glabrous area on the outer surface of each of the posterior tibiae. The tibiae are wide and flattened, and the corbiculae are surrounded anteriorly and posteriorly by long, incurved, stiff black hairs which hold the moist pollen mass which is formed by mixing nectar with the pollen to provide consistency. At the inner distal end of each of the posterior tibiae there is a "rake" (rastellum) formed of short, stiff setae. The outer surface of the posterior basitarsi has a flattened "auricle" which functions to push pollen upward into the corbicula. The inner surface of the basitarsi has rows of stiff setae forming comb-like structures.

Ptiloglossa jonesi and *Caupolicana yarrowi* are essentially similar in the nature of the specialized pollen collecting hairs which are present on the trochanters, femora, tibiae and basitarsi of the hind legs and on the sides of the propodeum and first metasomal tergum. Except on the hind basitarsi, scopal hairs are long, white, and dense, with whorled branches. Those of the trochanters curl

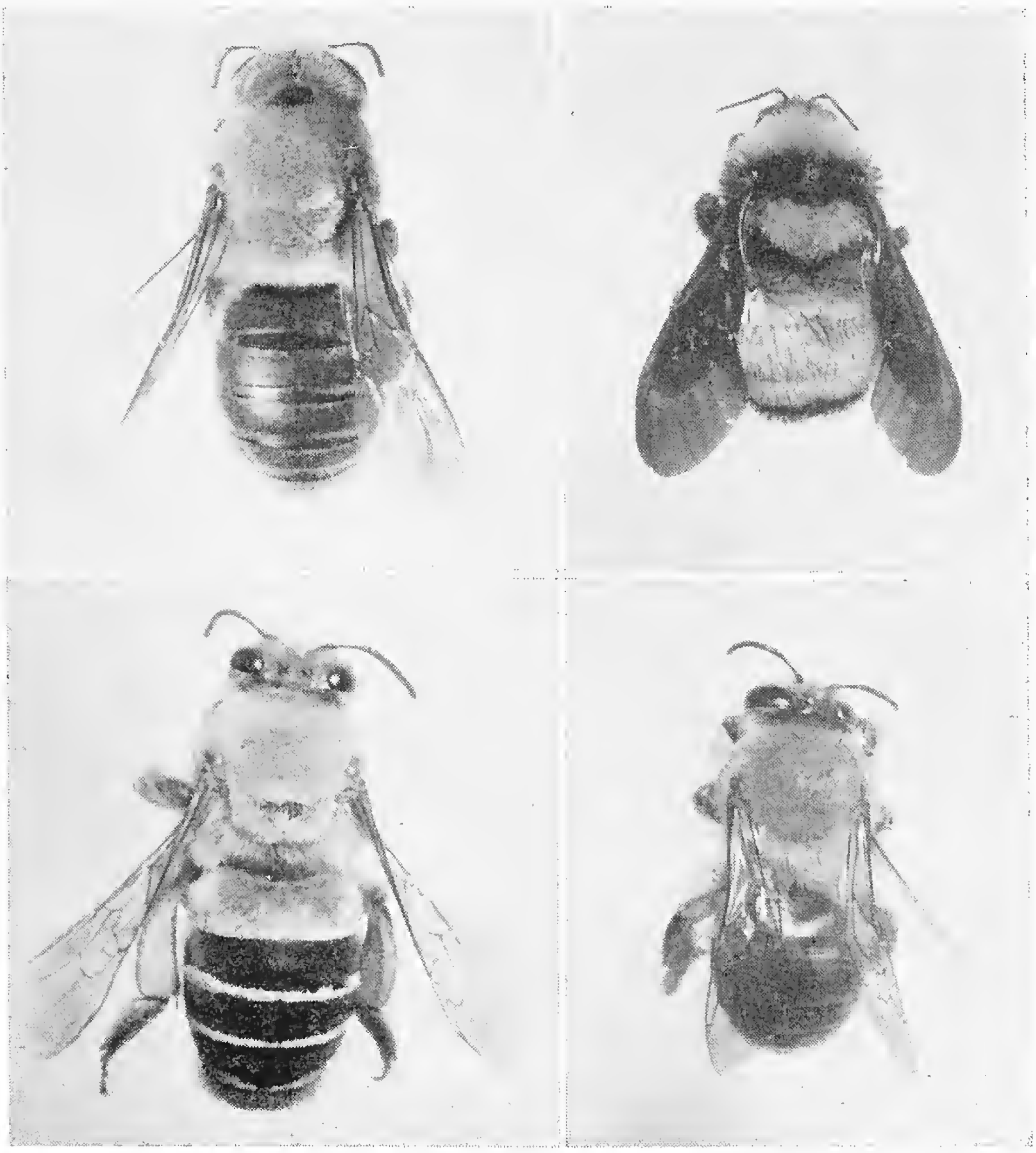

Fig. 3. *Solanum* pollinators, dorsal view. Upper left: *Protoxaea gloriosa* (Fox). Upper right: *Bombus sonorus* Say. Lower left: *Caupolicana yarrowi* (Cresson). Lower right: *Ptiloglossa jonesi* Timberlake.

ventrally and apically; those of the femora, ventrally; those of tibiae, ventrally and apically; those of the lateral face of the propodeum, posteriorly and ventrally; and those of the first metasomal tergite, ventrally. The hairs of the inner face of the hind tibiae, and the mid and hind basitarsi, are shorter, moderately dense, dark, simple, stiff, and directed ventrally. The pollen is packed dry.

Protoxaea gloriosa carries pollen in specialized scopal hairs on the posterior coxae, trochanters, femora, the anterior surface of posterior tibiae and dorsal one-fourth of anterior surface of posterior basitarsi, and the sides of the propodeum and first metasomal tergum, as well as the middle of the first metasomal sternum. The scopal hairs are long, pale yellow brown, dense, somewhat curved, with whorled branches. The hairs of the coxae are curled apically and become shorter toward the base; those of the trochanter are curled apically; those of the femora, ventrally and apically. Hairs of dorsal surface of tibiae and dorsal one-fourth of anterior surface of hind basitarsi, shorter, straight, and directed apically, those of ventral surface, longer, curled ventrally and somewhat apically. On the inner faces of the posterior legs, the hairs are very like those of *Ptiloglossa jonesi* and *Caupolicana yarrowi*. On the lateral face of the propodeum the scopal hairs are directed posteriorly and ventrally, on the sides of the first metasomal segment, ventrally, and on the middle of the first metasomal sternum, posteriorly. The pollen is packed dry.

Centris caesalpiniae, C. atripes, and *C. rhodopus* have essentially similar pollen collecting devices. The scopa is confined to the outer surface of the posterior tibiae and basitarsi, and is composed of dense, long, stiff, black hairs, both branched and simple. The two types of hairs appear to alternate and are represented in about equal numbers. The simple hairs are slightly longer and when the scopa is packed full of pollen, these may be the only hairs visible. The branches of the plumose hairs consist of two lateral rows on apical half of hair, and they do not subdivide further. The hairs of the inner surface of the posterior tibiae are short and simple, those of the inner surface of the posterior basitarsi are also simple, but longer, although not as long as those of outer surface. The pollen is presumably packed dry, although on several specimens it appears damp and matted, as though small amounts of nectar might be present.

In *Psaenythia mexicanorum* the scopa is confined to the posterior tibiae, which are long and narrow with the outer surface flattened. The hairs which comprise it are short, white, sparse and curved posteriorly. Those on the apical half of the tibiae are branched on the outer side. The anterior half of the inner surface of the posterior and mid basitarsi have dense, stiff, yellowish, simple hairs. The pollen is mixed with nectar and packed into the scopa moist.

Nomia mesillensis carries pollen in scopal hairs on the outer surface of the posterior tibiae, the inner surface of the posterior femora, the posterior trochanters, and on the side of the propodeum. Some pollen is also carried on the base of the posterior basitarsi and the apices of the abdominal sterna.

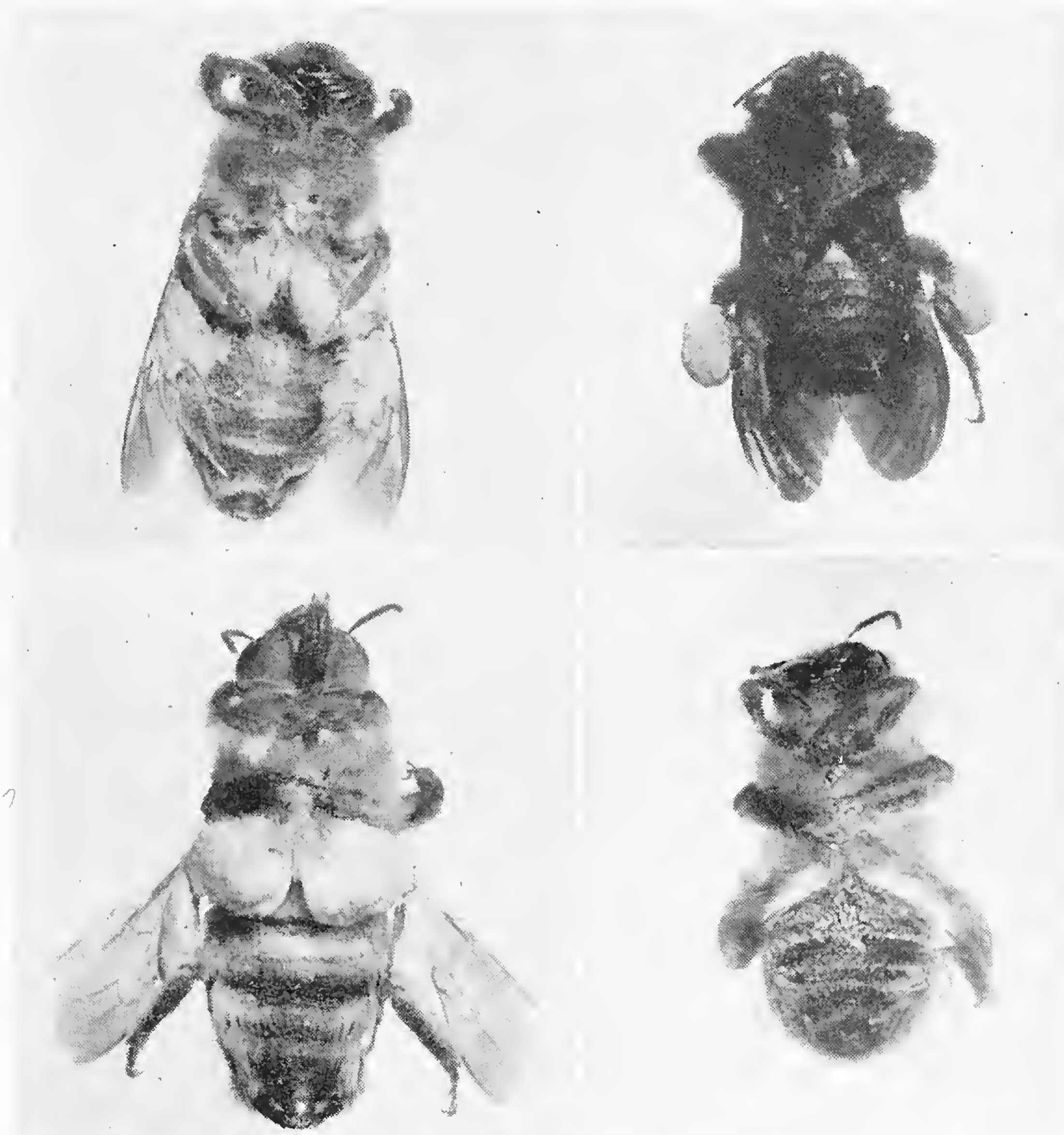

Fig. 4. *Solanum* pollinators, ventral view. Upper left: *Protoxaea gloriosa.* Upper right: *Bombus sonorus.* Lower left: *Caupolicana yarrowi.* Lower right: *Ptiloglossa jonesi.*

Constancy among the pollinators. All of the individuals of *Ptiloglossa jonesi* had pure loads of *Solanum* pollen except two individuals which, when they arrived at dawn, carried tricolporate grains from an unknown plant species on the legs, and two which carried pollens superficially resembling that of *Solanum* but probably different. On the other hand, nearly 70 per cent of the females of *Caupolicana yarrowi* already carried small to large quantities of an unidentified *Mentzelia*-like pollen when they began collecting from *Solanum*. *Caupolicana* collects pollen from *Mentzelia pumila* in the evening but the flowers of this plant are closed in the morning. Matinal activity of *Caupolicana yarrowi* has been recorded about flowers of *Datura* (Cockerell and Porter, 1899), *Larrea* (Linsley and Hurd, 1959) and *Melilotus* (Linsley, 1960), but except for the general statement of Michener (1961) that the species is not oligolectic, we have been unable to find direct or indirect references to its pollen-collecting activity.

All *Psaenythia mexicanorum* which were carrying pollen had pure loads; the remainder were parasitized and made no athempt to gather pollen. We have found this species taking nectar from *Verbesina* but have not observed it collecting pollen from any plants but *Solanum*. *Bombus sonorus*, a polylectic species, was remarkably constant when visiting *Solanum*; of 131 individuals examined, approximately 85 per cent had pure loads. Among the remainder, some of the early arrivals carried the unknown *Mentzelia*-like pollen or pollen believed to have been derived from some member of the Liliaceae; a few of the late arrivals had some pollen from Compositae probably *Verbesina encelioides*. *Protoxaea gloriosa*, another polylege, had a high proportion of mixed loads (approximately 53 per cent), the foundation of the loads having been derived from the undetermined plant with *Mentzelia*-like pollen. It is known to take pollen also from *Kallstroemia californica* (Linsley and Michener, 1962).

Of the three species of *Centris*, *C. caesalpiniae* exhibited the greatest amount of constancy (approximately 59 per cent), followed by *C. atripes* (37 per cent) and *C. rhodopus* (16 per cent). The mixed loads in all three species mostly involved pollen from *Hoffmanseggia densiflora*, or the unidentified plant with *Mentzelia*-like pollen, or both. Snelling (1956), in his synopsis of the taxonomy, distribution and flower records of the nine species of *Centris* which are known to occur within or extend their ranges into California, lists none as visiting *Solanum*. Nor does he give pollen sources for either *C. atripes* nor *C. rhodopus*. We have found the latter taking pollen from *Dalea spinosa,* and all three of the *Solanum*-visiting species taking nectar from *Verbesina encelioides,* in addition to the other pollen and nectar sources listed herein.

Fig. 5. *Solanum pollinators*, lateral view. Upper left: *Caupolicana yarrowi*. Upper right: *Psaenythia mexicanorum*. Center left: *Centris caesalpiniae*. Center right: *Bombus sonorus*. Lower left: *Protoxaea gloriosa*. Lower right: *Ptiloglossa jonesi*.

It is of interest that all of the large matinal pollinators of *Solanum* except *Ptiloglossa jonesi* and *Protoxaea gloriosa* also exploit the fine pollen grains of *Mentzelia,* when they are offered in the late afternoon. On August 20, for example, about two hours before sunset, many of the *Mentzelia* flowers were opening and were being visited by *Bombus* at 4:45 p.m. (air temp. 90° F). An hour before sunset, at 5:50 p.m., the first female *Caupolicana* was observed taking pollen, the last, 22 minutes after sunset[2], at 7:13 p.m. (air temp. 81° F); the first *Centris* was seen 17 minutes before sunset, at 6:34 p.m., the last, 16 minutes after sunset, at 7:07 p.m.; and the last *Bombus* at 7:02 p.m. No *Ptiloglossa* or *Protoxaea* were observed at *Mentzelia* on this evening nor any of the numerous others when *Mentzelia* samples were taken. Examination of the pollen loads of the individuals visiting *Mentzelia* revealed only pure *Mentzelia* pollen.

Effects of Physical Factors on Pollinator Activity. During the entire period in which observations were made of pollinator activity, the air temperatures were well above levels at which they might be expected to limit flight. The only behavioral variation noted that might have been influenced by differences in temperature was that the amount of time spent extracting pollen from a flower varied from 2.5-3 seconds at 68-72° F. to from 1-2 seconds at 80-84° F., for both *Ptiloglossa and Caupolicana.* Other species were not checked on this point.

The most critical factor noted by us was variation in light intensity, and particularly direct radiation from the sun. On clear warm mornings such as August 17 (Table I), *Ptiloglossa* and *Caupolicana* begin collecting pollen from both species of *Solanum* about an hour before sunrise, although they can be heard in exploratory or orientation flights somewhat earlier—usually at considerable distance above our heads. The first *Bombus* usually appear about 20 minutes later, and although *Ptiloglossa* and *Caupolicana* cease pollen collecting an hour or less after sunrise, *Bombus* continue until the flowers wilt in late morning. Occasional individuals of *Protoxaea* are active at flowers before sunrise, but the main period of pollen-collecting begins at sunrise and continues for from two to two and one-half hours. Pollen-gathering by *Centris* also begins at sunrise and reaches a peak about two

[2] *Caupolicana* females start flying at dawn and were active at flowers of *Solanum* almost an hour before sunrise at a much lower light intensity than that which prevails when they cease flight in the evening.

hours later. *Psaenythia* do not appear in numbers until mid-morning when the pollen supply is running low. At this time they are joined by *Nomia*.

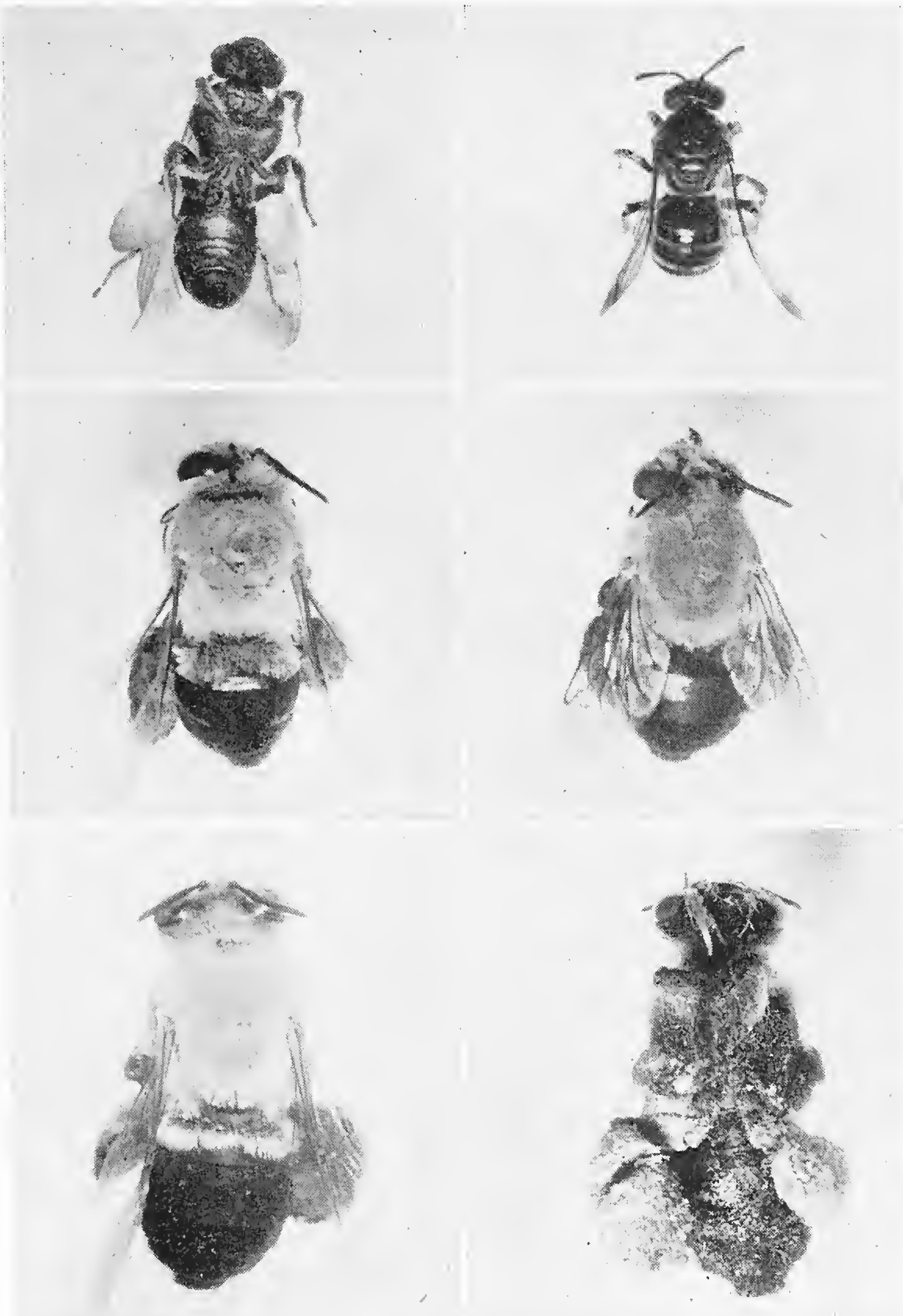

Fig. 6. *Solanum* pollinators. Upper left and right: *Psaenythia mexicanorum* (Cockerell). Center left: *Centris rhodopus* Cockerell. Center right: *Centris atripes* Mocsary. Lower left and right: *Centris caesalpiniae* Cockerell.

Table I. Pollen-collecting bees at plants of two species of *Solanum* at a site one mile east of Douglas, Arizona, August 17, 1962, under clear sky with temperatures ranging from 73° F. to 90° F. Sunrise: 6:00 a.m. MST.

	5:00 5:10	5:10 5:20	5:20 5:30	5:30 5:40	5:40 5:50	5:50 6:00	6:00 6:10	6:10 6:20	6:20 6:30	6:30 6:40	6:40 6:50	6:50 7:00	7:00 7:10	7:10 - 8:50 (No samples)	8:50 9:00	9:00 9:10	9:10 9:20	9:20 9:30	9:30 9:40	9:40 9:50	9:50 10:00	Totals
SOLANUM ROSTRATUM																						
Ptiloglossa jonesi	1	3	2	1	1	1		1	1		1											12
Caupolicana yarrowi		1	2	1	1			1	1		1											8
Bombus sonorus			1	1	2	4	4	2	7	2	6	5	4		5	4	4	6	3	4	2	66
Protoxaea gloriosa					1		1		1	2	2	3	2		1	2	1	1	1			18
Centris atripes									1				1		1	1	2	2	4	3	3	18
Psaenythia mexicanorum															1	1		2			1	5
SOLANUM ELAEAGNIFOLIUM																						
Ptiloglossa jonesi		3	2	1	2		1		1	1	1											12
Caupolicana yarrowi		1		3	1	1	1	1	1			2										11
Bombus sonorus				3	7	4	3	7	5	9	6	8	6		8	11	13	3	7	1	4	105
Protoxaea gloriosa							3		1	1	3	1	2		1	1		2				15
Centris caesalpiniae																1				1		2
Centris rhodopus																				2	1	3
Psaenythia mexicanorum																	2					2
Nomia mesillensis																		1				1

Table II. Pollen-collecting bees at plants of two species of *Solanum* growing together one mile east of Douglas, Arizona, August 18, 1962, under overcast sky from 5 to 7 a.m. and broken sky thereafter, with temperatures ranging from 64.3° F. to 86.3° F. Sunrise (behind clouds): 6:03 a.m.

	5:10	5:10 5:20	5:20 5:30	5:30 5:40	5:40 5:50	5:50 6:00	6:00 6:10	6:10 6:20	6:20 6:30	6:30 6:40	6:40 6:50	6:50 7:00	7:00 7:10	7:10 7:20	7:20 7:30	7:30 7:40	7:40 7:50	7:50 8:00	8:00 8:10	8:10 8:20	8:20 8:30	8:30 8:40	8:40 8:50	8:50 9:00	9:00 9:10	Totals
SOLANUM ROSTRATUM																										
Ptiloglossa jonesi	1	2	2	1	1	2	2	2	2	2	1	1	1	1		1										22
Caupolicana arrowi		1	2	3	2	1	1		1	2	1	1	1	3		1		4	1	1		1	1			28
Bombus sonorus						1	5	2	2	5	3	4	8	8	5	1	3	4	4	7	6	9	8	6	8	99
Protoxaea gloriosa												2	1	3	4	1	2	2	2	1	1	1	1	1		22
Centris caesalpiniae						1																				1
Centris atripes								1							3	1		1	4	2	1	2	3	5	3	26
Psaenythia mexicanorum													1				1		3		1		1		2	9
Anthophora urbana															1											1
SOLANUM ELAEAGNIFOLIUM																										
Ptiloglossa jonesi		2	3	1	1	2	1	1	1	1		2														15
Caupolicana yarrowi			1	2	2	1	1	1		1	2	1		1		1	2	4	1							22
Bombus sonorus				2	4	3	5	7	5	2	4	9	4	2	4	4	2	4	8	5	4	5	6	5	7	101
Protoxaea gloriosa					2							2			1	1	1		1		1		1			10
Centris caesalpiniae																	2	2	2	2	3	2	5	7	4	30
Centris rhodopus																		2	2	7	3	2	3	2	2	23
Centris atripes								1						1					1			1	1	2		7
Psaenythia mexicanorum																				1			1			2
Nomia mesillensis																					1					1

By contrast, on overcast mornings such as that of August 18 (Table II), the active period of pollen collecting for *Ptiloglossa* extends over a period of two and one-half hours, that of *Caupolicana* over three and one-half hours. *Protoxaea* initiates activity about an hour later than usual but terminates pollen collecting at about the same time as on a clear day. *Centris* spp. behave about the same as *Protoxaea*. On this particular day *Psaenythia* appeared somewhat earlier than usual but in numbers too small to judge whether or not this had any significance.

Summary

(1) Flowers of *Solanum elaeagnifolium* and *S. rostratum* open and expose the anthers shortly after dawn.

(2) The pollen is exploited primarily by large, heavy-bodied bees which invert the flower and vibrate the anthers, shaking pollen from slits in their ends.

(3) When allowance is made for slight differences in the growing sites of the two species of *Solanum*, it is clear that the same species of bees visit both about equally.

(4) Although individuals of some species appeared to be relatively pollen-species constant, others were seen to move from one *Solanum* to the other, in spite of the fact that to the human eye one is yellow, the other purple.

(5) The polen grains are fine, ranging in the two species from 23-37μ, and the principal pollinators are clothed with fine hairs and modified pollen carrying devices which permit their exploitation.

(6) Both *Solanum* species produce "aborted" pollen, amounting to about 65 per cent for *S. elaeagnifolium*, nearly 16 per cent for *S. rostratum*.

(7) Since "aborted" pollen grains lack protoplasm they presumably have no nutritional value for bee larvae.

(8) The modified hairs are useful for carrying other kinds of fine pollen, such as that of *Mentzelia*, which is also exploited by some of the *Solanum* visitors when it is made available in the late afternoon near sunset.

(9) The behavior pattern which results in vibration of the anthers of *Solanum* carries over to *Mentzelia*, where it is not obviously needed.

(10) Although individuals of *Bombus*, *Caupolicana*, and *Centris* learn to exploit pollen of *Solanum* near sunrise and *Mentzelia*

near sunset, this does not appear to be true of *Ptiloglossa* nor of *Protoxaea*.

(11) Restriction of pollen collecting activity to early morning hours (*Ptiloglossa* and to a lesser extent *Protoxaea*), or to early morning and late evening hours (*Caupolicana* and to a lesser extent *Centris* and *Bombus*) would appear to have obvious adaptive value in a desert environment.

(12) Composition of the pollinator populations and time periods and activity sequences was remarkably uniform on successive days, varying only in response to different weather conditions.

(13) *Psaenythia* and *Nomia* appear to be largely pollen scavengers, exploiting residual *Solanum* pollen after the main period of pollinator activity.

(14) The larger pollinators exhibit a striking similarity in coloration of the pubescense of the head and thorax, although it is not clear as to whether this convergence is coincidental or results from a common selective force.

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RECENT LITERATURE

BIOLOGICAL CHARACTERISTICS OF THE MUTILLID SUBGENUS PHOTOPSIS BLAKE AND THEIR SYSTEMATIC VALUES *(Hymenoptera)*. By William E. Ferguson. University of California Publications in Entomology, Vol. 27, No. 1, pp. 1-92, 7 pls., 2 figs. in text. April 25, 1962. $2.00.

A REVISIONAL STUDY OF THE BEES OF THE GENUS PERDITA F. SMITH, WITH SPECIAL REFERENCE TO THE FAUNA OF THE PACIFIC COAST. (Hymenoptera, Apoidea). Part V. By P. H. Timberlake. University of California Publications in Entomology, Vol. 28, No. 1, pp. 1-124, 13 pls., 2 figs. in text. April 30, 1962. $2.50.—Pages 87-107 comprise a "Supplement to Parts I to IV." Included are descriptions of new species, new keys to the males of the subgenus *Macroteropsis* and to the females of the subgenus *Epimacrotera*, and a revision of couplets 19 to 26 in the key to the *zonalis* group of the subgenus *Perdita*. —H. B. LEECH, *California Academy of Sciences, San Francisco.*

BOOK NOTICE

REVISION DES HYDROCANTHARES D'AFRIQUE (Coleoptera Dytiscoidea). By Félix Guignot. Annales du Musée Royal du Congo Belge, Sciences Zoologiques. Première partie, vol. 70, pp. 1-316, text figs. 1-293. January, 1959; price 260 francs. Deuxième partie, vol. 78, pp. 317-652, text figs. 294-572. December, 1959; 260 francs. Troisième partie, vol. 90, pp. 653-1000, text figs. 573-818. February, 1961; 230 francs. For sale by the Musée Royal de l'Afrique Centrale, Tervuren, Belgium.

This 3-volume monograph is essential for work on African hydrocantharids (Haliplidae, Hygrobiidae, Dytiscidae; the Gyrinidae have been treated elsewhere in detail by Brinck), and will have much wider use because of the keys and figures. There are a fair number of references to Nearctic species; most of these are in the footnotes—and of footnotes there are 844! There is a slip on p. 507 where the type species of the genus *Hydrocanthus* is cited as *H. tricolor* Say, a *lapsus calami* for *H. iricolor* Say, but there are remarkably few such errors. It is most unfortunate that Dr. Guignot did not live to see more than the first part of his work in print.—HUGH B. LEECH, *California Academy of Sciences, San Francisco.*

NEW SPECIES AND NEW RECORDS OF RARE SPECIES OF PYGOSTENINI FROM THE CONGO REPUBLIC[1]

(Coleoptera: Staphylinidae)

DAVID H. KISTNER

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The purpose of this paper is chiefly to describe some new species of Pygostenini which were collected on a field trip to the Congo during the summer of 1960. In addition, some other species which have been previously described from rather small series were captured during the trip and these will be cited here where additional descriptive notes or ecological notes might be useful for future determinations.

Among the purposes of the trip were: (1) to collect fresh material of the Tribe Pygostenini (subfamily Aleocharinae) to augment and test revisions of the tribe based on museum specimens published earlier (Kistner 1958); (2) to study the nature of host specificity and the intra-nest distribution of the various species; (3) to study the behavior of the various species with particular emphasis on the use of the conspicuously adaptive structures; (4) to attempt to learn more about the habits of the Pygostenini associated with the more subterranean subgenera of driver ants (Dorylini). We have data that are relevant to all of these purposes which will be published as they are ready. The problem of understanding the nature of myrmecophilous behavior is much broader than merely understanding the behavior of the Pygostenini. In this regard it would have been almost impossible to collect data on the Pygostenini and to ignore totally the rest and majority of the myrmecophiles. These data on the other myrmecophiles will also be reported as fast as accurate determinations are available.

The localities which are included in the paper are Eala, Equateau province and Yangambi, Oriental province. Eala is located about eight kilometers by road from Coquilhatville along the north bank of the Ruki river. It was the site of a *Jardin d'Essais* of the *Institut National pour l'Étude agronomique du Congo Belge* (I.N.E.A.C.). This was our first stop in the Congo and was chiefly important to us in that we found out which collecting and observation methods would not work. Yangambi is 101 kilometers by the shortest road from Stanleyville and is downstream along the north bank of the Congo River. It was the site of the *Centre de*

[1] This study has been financed in large part by the National Science Foundation (Grant No. G-12859).

Recherche of I.N.E.A.C. It was at Yangambi that we learned productive methods for sampling myrmecophiles and hence most of the new species reported here are from this locality.

Collecting myrmecophiles from driver ant nests is a rather specialized activity and since there are no methodological notes in the literature (so far as I know), a brief comment on what was and what was not productive might be useful. Our first thought about sampling myrmecophiles was to work with the nest itself. We made three attempts at this, all of which were unsuccessful. The first time we tried brute force by simply digging into a living nest. The nests have an enormous number of ants in them (15-22 million per nest for *Dorylus (Anomma) wilverthi* Emery according to Raignier and Van Boven's 1955 paper) and the physical discomfort resulting from even a small number of these ants swarming over one precludes any sustained scientific study. We then tried killing the nest using 10% powdered DDT and this was too slow. The nest was 4 days dying and by the time we could look for myrmecophiles we had a decaying tangle of ants which yielded no significant data. We then tried methyl bromide which killed the nest in about 20 hours but still the problem of sorting the myrmecophiles out from about a cubic yard of tangled dead ants was beyond budgetary consideration.

We then switched to working the columns. In raiding or in changing their nests from one location to another, the ants proceed in a rather orderly column or columns. The nest-changing columns are fortunate for the sampler in that everything in the nest is moved. Thus by watching the nest-changing columns, one can aspirate the myrmecophiles. After a little practice at this, one can aspirate the myrmecophiles with a minimal disturbing effect on the column. It also developed that most if not all of the myrmecophilts were also to be found in the raiding columns.

Throughout the field work, the collectors worked as a team. The collectors were an assistant, Mr. Robert Banfill, now at Montana State College, Bozeman; my wife; and myself. Once a column was located each collector took a position along the column and collected all the myrmecophiles he saw. Thus all the specimens in this paper were collected by and bear the label, "Coll. D. H. & A. C. Kistner and R. Banfill," unless otherwise cited. I shall have more to say about the sampling method in future papers but one measure of the success of the method is that in about three weeks at Yangambi we collected a little more than 13,000 myrmecophiles of which 3192 were Pygostenini.

The author is grateful to his wife and Mr. Banfill not only for the long hours of collecting in an uncomfortable situation but also for the equally long hours spent preparing the material for study. Thanks are given to Professor J. K. A. van Boven, Institut de Zoologie, Université de Louvain for the determinations of the ant hosts.

For help in the field and the use of facilities during this phase of our trip, we are greatly indebted to the following men, all of whom were formerly associated with I.N.E.A.C.: M. F. Jurion, Directeur general; M. J. Brynaert, Directeur general en Afrique; M. E. Bernard, Directeur du Centre de Recherche de Yangambi; M. E. Buyckx, Maitre de Recherche; M. J. Thiry, Conservateur de Jardin d'Essais d'Eala; M. J. Decelle and M. J. Dubois, Division de Phytopathologie et d'Entomologie agricole.

All specimens herein cited are retained in the collection of the author to be eventually deposited in the Chicago Natural History Museum unless stated otherwise.

Genus TYPHLOPONEMYS Rey

LUJAE GROUP

TYPHLOPONEMYS AFER Kistner

(Fig. 1)

Typhloponemys afer Kistner, 1958a, Explor. Parc Nat. Upemba, Miss. G. F. de Witte *et al*, 1946-1949, fasc. 49(4):37, figs. 5-9-Institut des Parcs Nationaux du Congo et du Ruanda-Urundi, Brussels, (Congo Republic: Parc National de l'Upemba, Lusinga, no host.)

This species was originally described from the unique holotype female. Since then we captured a male and a female both of which compared exactly with the data on the original specimen. Since the above specimen was the first male captured, the median lobe of its genitalia is here figured.

Material examined: 1 male, 1 female, Congo Republic, Yangambi, 29 June 1960, from the central part of a raiding column of *Dorylus (Anomma) wilverthi* Emery, nest No. 18.

BICOLOR group

Typhloponemys decellei Kistner, new species

(Figs. 2, 3)

Distinguished from all other species, including *T. bicolor* Wasmann to which it is most closely related, by the shape of the spermatheca and the shape of the median lobe of the male genitalia.

Color reddish brown. Pronotum and abdomen a little lighter than the rest of the body but sometimes evenly colored. Dorsal surface of the head, pronotum, and elytra smooth and shiny, very finely and evenly punctate. Larger punctures, containing very short, fine yellow setae scattered irregularly among the finer punctures. Macrochaetotaxy of abdominal tergites II-VIII:0,0,0,0,4,4,0. Macrochaetotaxy of abdominal segment IX as follows: dorsolateral plates, 7, most anterior chaeta smaller, thinner, and lighter in color than the more posterior ones; median dorso-lateral part, 5 of which 3 are dark and 2 are light in color; ventro-lateral part, 4 of which 1 is dark and 3 are light in color; median lobe, 7. Spermatheca shaped as in fig. 2. Median lobe of the male genitalia shaped as in fig. 3.

Measurements: Pronotum length, 0.40-0.57 mm; elytra length, 0.38-0.54 mm; interocular distance, 0.35-0.47 mm; head length, 0.24-0.35 mm. Number measured, 21.

Holotype female, No. 5311, CONGO REPUBLIC, YANGAMBI, from a nest-changing column, Coll. J. Decelle.

Paratypes (151 specimens): Congo Republic, Yangambi: 26 (3 males, 3 females), same data as holotype; 4, 23 June 1960, from a raiding column of *Dorylus (Anomma) wilverthi* Emery, nest No. 2; 7 (1 male), 24 June 1960, from raiding columns of *D. wilverthi,* nest No. 3; 5 (1 female), 25 June 1960, from the central parts of raiding columns of *D. wilverthi,* nest No. 7; 4, 26 June 1960, from central part of a raiding column, after dark, of *D. wilverthi* nest No. 11; (1 male, 1 female), 27 June 1960, from central part of a raiding column of *D. wilverthi,* nest No. 12; 2, 27 June 1960, from central part of a raiding column of *D. wilverthi,* nest No. 13; 8, 28 June 1960, from central part of raiding columns of *D. wilverthi,* nest No. 16; 1 male, 28 June 1960, from the end of a raiding column of *D. wilverthi,* nest No. 16; 37 (5 males, 4 females), 29 June 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 18; 9 (2 males), 1 July 1960, from the central parts of nest changing columns of *D. wilverthi,* nest No. 19; 1, 1 July 1960, from the end of a raiding column of *D. (A.) nigricans* ssp. *burmeisteri* var. *terrificus* Santschi, nest No. 20; 2, 1 July 1960, from the end of a raiding column of *D. nigricans* ssp. *burmeisteri* var. *ornatus* Santschi, nest No. 21; 1, 1 July 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 22; 6 (1 male), 2 July 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 23; 3 (1 female), 3 July 1960, from the central parts of raiding columns of *D. wilverthi,* nest No. 24; 8 (3 males, 1 female), 3 July 1960 from the end of a raiding column of *D. wilverthi,* nest No. 24; 1 male, 3 July 1960, from a raiding column of *D. wilverthi,* nest No. 26, Coll. J. Decelle; 1, 5 July 1960, from the end of a raiding column of D. *nigricans* ssp. *burmeisteri* var. *ornatus* Santschi, nest No. 27; 1, 5 July 1960, from the underground nest-changing column of *D. nigricans* ssp. *burmeisteri* var. *ornatus* Santschi, nest No. 29; 16 (2 males, 3 females), 7 July 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 31; 4 (2 males, 1 female), 9 July 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 35; 1 male, 1 female, September 1952, with *Dorylus* sp. Coll. J. Decelle, (Formerly classified as

T. bicolor Wasmann by Kistner 1958), (Collection of Musée Royal de l'Afrique Centrale, Tervuren and the author).

This species is named after my friend and colleague, M. J. Decelle formerly with I.N.E.A.C. at Yangambi, who helped us ever so much in the field and provided us with needed supplies, equipment, and space while we were at Yangambi.

FAUVELI group

Typhloponemys buyckxi Kistner, new species

(Figs. 4-7)

Distinguished from all other species including *T. fauveli* Wasmann to which it is most closely related and which is found in the same locality by the shapes of the spermatheca and the median lobe of the male genitalia.

Color variable from light yellowish brown to orange, but always uniformly colored. Dorsal surface of the head, pronotum, and elytra smooth and shiny, covered with numerous fine yellow setae, which is denser toward the lateral margins. Macrochaetotaxy of abdominal segments II-VIII: 0,4,4,4,4,4,0. Macrochaetotaxy of abdominal segment IX as follows: dorsolateral plates: 6, most anterior chaeta smaller, thinner, and lighter in color than the more posterior ones; median dorso-lateral part, 5 (3 black, 2 lighter); ventro-lateral part 4 (2 black, 2 lighter); median lobe 7. Spermatheca somewhat variable, shaped as in figs. 4, 5, and 6 with all intermediates seen. Those shaped as in fig. 4 are from larger specimens, those shaped as in fig. 5 from smaller specimens, and those shaped as in fig. 6 from the smallest specimens. Size of specimens is continuouly variable as has been shown for many species of Pygostenini and where the spermatheca has coiling and twisting, this has also been shown to be continuously variable in other species. Median lobe of the male genitalia shaped as in fig. 7.

Measurements: Pronotum length, 0.50-0.70 mm; elytra length, 0.47-0.70 mm; interocular distance, 0.40-0.52 mm, head length, 0.28-0.37 mm. Number measured, 19.

Holotype female, No. 7195, CONGO REPUBLIC, YANGAMBI, 28 June 1960, from the central part of a raiding column of *Dorylus (Anomma) wilverthi* Emery, nest No. 16.

Paratypes (36 specimens): Congo Republic: Yangambi: 2 females, same data as the holotype; 2 males, 21 June 1960, from the run-away area of *D. wilverthi,* nest No. 1; 1 female, 25 June 1960, from the end of a raiding column of *D. (A.) emeryi* ssp. *opacus* Forel, nest No. 5; 1 male, 25 June 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 6; 1 male, 27 June 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 12; 1 female, 27 June 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 13; 1 male, 28 June 1960, from the end of a raiding column of *D. wilverthi,* nest No. 16; 6 males, 29 June 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 18; 1 female, from the central part of a nest-changing column of *D. wilverthi,* nest No. 19; 7 males, 1 July 1960, from the end of a raiding column of *D. (A.) nigricans* ssp. *burmeisteri* var. *ornatus* Santschi, nest No. 21; 5 males, 5 July 1960, from the end of a raiding column of *D. nigricans* ssp. *burmeisteri* var. *ornatus* Santschi, nest No. 27; 2 females, 8 July 1960, from the central part of a raiding column of *D. (A.) kohli* var. *congolensis* Santschi, nest No. 32; 2 males, 9 July 1960, from the central part of a raiding column of *D. wilverthi*, nest No. 35; 4 males, 9 July 1960, from the end of a raiding column of *D. wilverthi*, nest No. 35.

Though *T. fauveli* Wasmann was taken in the same locality it was not taken from the same nests, but the numbers taken were too small to be truly significant. The only way the two species can be told apart is by dissecting out the genitalia. Data on *T. fauveli* Wasmann from Yangambi: 2 males, 1 female, 3 July 1960, from the end of a raiding column of *D. wilverthi*, nest No. 24; 1 female, 7 July 1960, from the central part of a raiding column of *D. wilverthi*, nest No. 31.

This species is named for M. E. Buyckx who was extremely helpful to us during our stay at Yangambi.

Typhloponemys bernardi Kistner, new species

(Figs. 8 & 9)

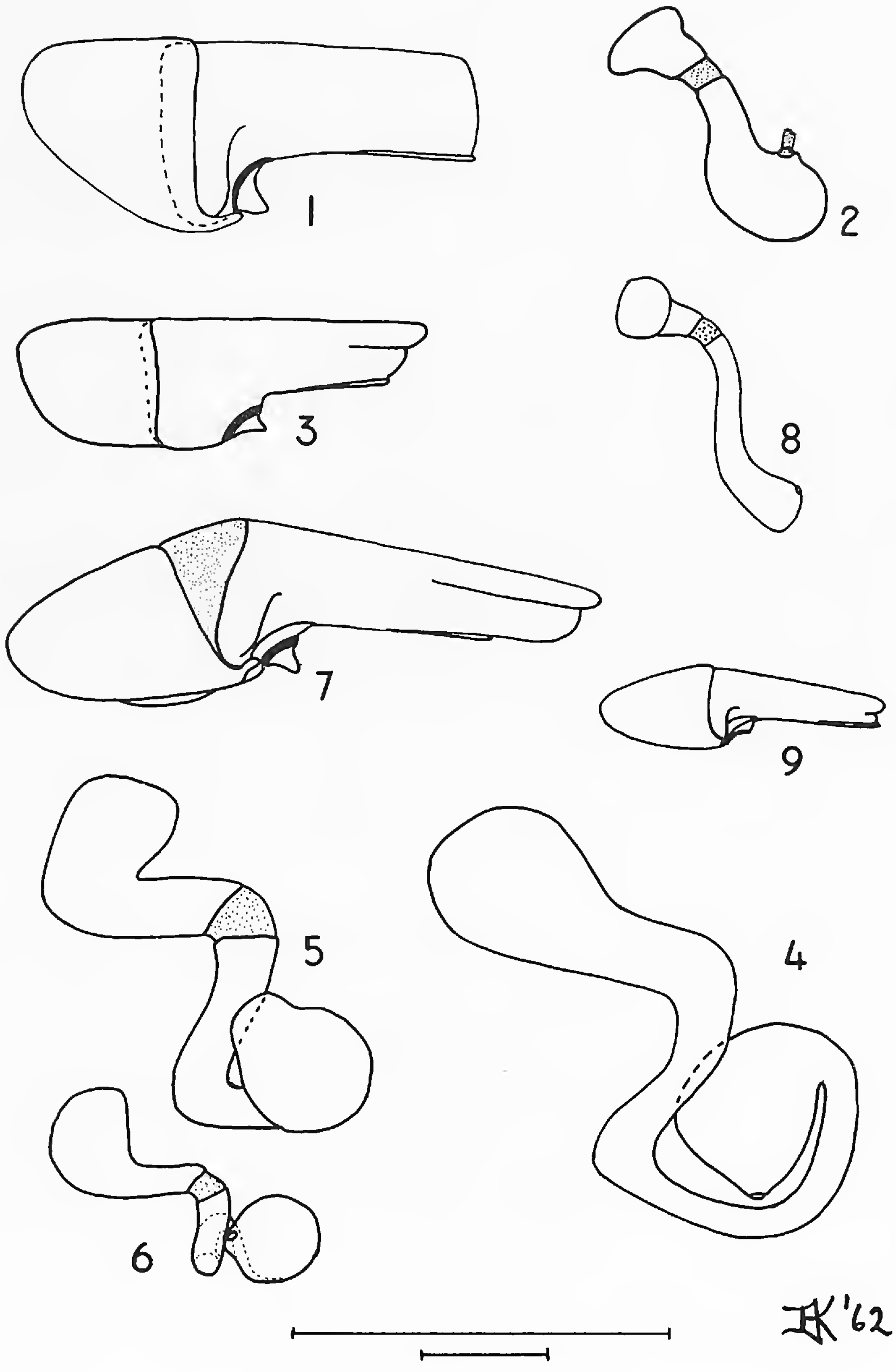
Distinguished from all other species, including *T. rufotestaceus* Bernhauer, to which it is most closely related, by the shape of the spermatheca and the median lobe of the male genitalia.

Color yellowish brown throughout. Head, pronotum, and elytra smooth and shiny; sparsely covered with fine yellow setae. Macrochaetotaxy of abdominal tergites II-VIII: 0,2,2,2,4,4,0. Macrochaetotaxy of abdominal segment IX as follows: dorsal-lateral plates, 6, most anterior chaeta smaller, thinner, and lighter in color than the more posterior ones; median dorsolateral part, 5 (2 black, 3 light); ventro-lateral part, 4 (2 black, 1 light). Spermatheca shaped as in fig. 8. Median lobe of male genitalia shaped as in fig. 9.

Measurements: Pronotum length, 0.27-0.35 mm; elytra length, 0.24-0.36 mm; interocular distance, 0.25-0.30 mm; head length, 0.15-0.21 mm. Number measured, 20.

Holotype female, No. 7160, CONGO REPUBLIC, YANGAMBI, 29 June 1960, from the central part of a raiding column of *Dorylus (Anomma) wilverthi* Emery, nest No. 18.

Paratypes (20 specimens): Congo Republic, Yangambi: 1 male, 2 females, same data as holotype; 1 female, 23 June 1960, from a raiding column of *D. wilverthi*, nest No. 2; 2 males, 2 females, 24 June 1960, from a raiding column of *D. wilverthi*, nest No. 3; 3 males, 25 June 1960, from the central part of a raiding column of *D. wilverthi*, nest No. 6; 2 (1 male), 27 June 1960, from the central part of a raiding column of *D. wilverthi*, nest No. 6; 2 (1 male), 27 June 1960, from the central part of a raiding column of *D. wilverthi*, nest No. 12; 1 male, 2 July 1960, from the end of a nest-



EXPLANATION OF FIGURES

Figs. 1-9: Median lobes of male genitalia: 1—*Typhloponemys afer* Kistner; 3—*T. decellei* n.sp.; 7—*T. buyckxi* n.sp.; 9—*T. bernardi* n.sp. Spermathecae: 2—*T. decellei* n.sp.; 4,5,6, Variations of T. *buyckxi* n.sp.; 8—*T. bernardi* n.sp. Large scale applies to figures of the spermathecae. Small scale applies to figures of the genitalia. Each represents 0.25 mm.

changing column of *D. wilverthi,* nest No. 19; 1 male, 5 July 1960, from the end of a raiding column of *D. nigricans ssp. burmeisteri* var. *ornatus* Santschi, nest No. 27; 1 male, 5 July 1960, from the central part of a raiding column of *D. nigricans* ssp. *burmeisteri* var. *ornatus* Santschi, nest No. 28; 1 male, 7 July 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 31; 2 males, 9 July 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 35; 1 male, 9 July 1960, from the end of a raiding column of *D. wilverthi,* nest No. 35.

This species is named for M. E. Bernard, former director of research at Yangambi, who was extremely helpful to us during our stay there. It is also named for his wife, a most courageous lady, who was one of the three European ladies to attend the Independence ceremonies at Yangambi.

WITTEI group

TYPHLOPONEMYS WITTEI Cameron

Pygostenus wittei Cameron, 1950, Explor. Parc Nat. Albert, Miss. G. F. de Witte, 1933-1935, fasc. 59:44 (Institut des Parcs Nationaux du Congo et Ruanda-Urundi, Brussels, (Congo Republic: Rutshuru, no host).

Typhloponemys wittei, Kistner, 1958, Ann. Mus. Roy. Congo Belge, Tervuren, Ser in 8to, Zool., 58:80; Kistner, 1958b, Explor. Parc Nat. Albert, Miss. G. F. de Witte, 1933-1935, fasc. 91 (1):4, figs. 2, 3, 4, and 9.

This species has not been taken previously with any ant host. Although only one specimen was captured at Yangambi, it was taken in a definitive way with an identifiable host so it is cited here.

Material examined: 1 male, Congo Republic, Yangambi, 8 July 1960, from the central part of a raiding column of *Dorylus (Anomma) kohli* var. *congolensis* Santschi, nest No. 32.

PUMILIO group

When this species group was first erected (Kistner 1958, p. 80), there were very few (33) specimens of three species available. Probably because of the paucity of material, the distribution of the species showed a geographic discontinuity which in fact does not exist. All of the Congo species will be revised here and a few new ones added.

The host situation of this group is not clear. Although material was taken in and around ant columns, the captures were not definitive. The species are all small and seem to fly or be blown through the air quite readily. Most of our captures were effected by the use of an aerial plankton net. Members of this species group are taken so readily with an aerial plankton net in comparison to species quite common in the ant columns which are only occasionally caught flying, that one wonders if they have any regular hosts at all. The capture of them hovering over broken termite nests could indicate that they are attracted to any massive array of dead insects and thus would be found near driver ant columns of any species. The members of the species group nevertheless have all the structural modifications of the rest of the genus.

KEY TO CONGO SPECIES

1. Macrochaetotaxy of abdominal tergites II-VIII: 0,0,0,0,0,2,0................ *basilewskyi* Kistner
   Macrochaetotaxy of abdominal tergites II-VIII not as above................ 2
2. Macrochaetotaxy of abdominal tergites II-VIII, 2,4,4,4,4,4,0.................... 3
   Macrochaetotaxy of abdominal tergites II-VIII, 2,2,2,4,4,4,0 or 2,2,4,4,4,4,0 4
3. Macrochaetotaxy of abdominal tergites with the middle two reduced on tergites III and IV, spermatheca shaped as in fig. 11......*banfilli* Kistner
   Macrochaetotaxy of abdominal tergites with all chaetae reduced on tergites II, III & IV; spermatheca shaped as in fig. 13........*gemina* Kistner
4. Macrochaetotaxy of abdominal tergites II-VIII, 2,2,2,2,4,4,0; spermatheca shaped as in fig. 15I (Kistner 1958)........................*pumilio* Bernhauer
   Macrochaetotaxy of abdominal tergites II-VIII, 2,2,2,2,4,4,0; spermatheca shaped as in fig. 15J (Kistner 1958)............................*morio* Kistner

TYPHLOPONEMYS PUMILIO Bernhauer

Pygostenus pumilio Bernhauer 1932, Rev. Zool. Bot. Afr., 22:159-Musée Royal de l'Afrique Centrale, Tervuren, (Congo Republic: Prov. Orientale, Haut Uele, Moto).

Typhloponemys pumilio, Kistner, 1958, Ann. Mus. Roy. Congo Belge, Tervuren, Sér. in 8to, Zool. 68:81 (figs. 15I; 16B)—(Congo Republic: Prov. Orientale, Haut Uele, Abimva).

An additional 12 specimens have been examined (there were only three originally) and no major deviations from the description given by Kistner (1958) have been noted.

Material examined: Congo Republic, Yangambi: 1 male, 25 June 1960, netted from vegetation surrounding raiding column of *Dorylus (Anomma) wilverthi,* nest No. 9, Coll. J. Decelle; 1 female, 1 July 1960, netted over a nest-changing column of *D. wilverthi,* nest No. 19; 1 female, 5 July 1960, aerial plankton net from car (P.M.); 1 male, 5 July 1960, aerial plankton net from car (A.M.); 2 males, 1 female, 6 July 1960, aerial plankton net over broken *Cubitermes* nest (No. 311) about 30 minutes after nest was broken; 1 male, 3 females, 6 July 1960, aerial plankton net from car; 1 female, 9 July 1960, aerial plankton net from car.

TYPHLOPONEMYS MORIO Kistner

Typhloponemys morio Kistner, 1958, Ann. Mus. Royal Congo Belge Tervuren, Sér in 8to, Zool, 68:81, (figs. 7M; 15J; 16C)—Musée Royal de l'Afrique Centrale, Tervuren, (Congo Republic, Kunungu and Kwamouth, no hosts).

An additional seven specimens have been examined (there were only two originally) and no major deviations from the description given by Kistner (1958) were noted. However, most of the specimens were somewhat smaller. The usual variation for *Typhloponemys* is in the neighborhood of 80% when large series are available and measured, so the appearance of smaller or larger specimens of rare species is to be expected.

Material examined: Congo Republic: Yangambi: 1 female, 2 July 1960, from the end of a nest-changing column of *Dorylus (Anomma) wilverthi*, nest No. 19; 2 males, 3 females, 6 July 1960, aerial plankton net over a broken *Cubitermes* nest (No. 311) about 30 minutes after nest was broken; 1 female, 6 July 1960, aerial plankton net from car (A.M.)

Typhloponemys basilewskyi Kistner

(Fig. 10)

Typhloponemys basilewskyi Kistner, 1958, Ann. Mus. Royal Congo Belge, Tervuren, Sér. in 8to, Zool., 68:82 (figs. 4C; 6G; 15K; 16D)—Musée Royal de l'Afrique Centrale, Tervuren, (Congo Republic: Sankuru, Komi, no definite host).

Five more specimens were examined. It was noted that there is considerable variation in the shape of the spermatheca. They vary from a relatively straight shape (fig. 10) to the fish-hook shape figure by Kistner (1958, p. 71, fig. 15K). The most constant part is the shape of the bulbous head. The male genitalia seem to be constant.

Material examined: Congo Republic: Yangambi: 1 female, 25 June 1960, netted from vegetation surrounding nest of *Dorylus (Anamma) wilverthi*, nest No. 9, Coll. J. Decelle; 1 male, 29 June 1960, on insectory screen, Coll. J. Decelle; 1 female, 4 July 1960, aerial plankton net over broken *Cubitermes* nest (No. 311) about 30 minutes after nest was broken; 1 male, 11 July 1960, aerial plankton net from car.

Typhloponemys banfilli Kistner, new species

(Figs. 11 and 12)

Distinguished from all other species by the shape of the spermatheca and the median lobe of the male genitalia. Most closely related to *T. pumilio* Bernhauer, from which it is distinguished by both of the above characteristics.

Color dark reddish brown throughout; head and pronotum somewhat darker than the rest of the body. Dorsal surface of the head, pronotum, and elytra smooth and shiny; finely and evenly punctate. Macrochaetotaxy of abdominal tergites II-VIII: 2,4,4,4,4,4,0, with the middle two on tergites III and IV greatly reduced in size. Macrochaetotaxy of abdominal segment IX as follows: dorso-lateral part, 6, most anterior chaeta smaller, thinner, and lighter in color than the more posterior ones; median dorso-lateral part, 5 (3 dark, 2 light); ventro-lateral part, 4 (2 dark, 2 light); median lobe, 7. Spermatheca shaped as in fig. 11. Median lobe of the male genitalia carinate, shaped as in fig. 12.

Measurements: Pronotum length, 0.39-0.51 mm; elytra length, 0.30-0.43 mm; head length, 0.20-0.26 mm; interocular distance, 0.39-0.46 mm. Number measured, 7.

Holotype female, No. 7222, CONGO REPUBLIC, YANGAMBI, 6 July 1960, aerial plankton net from car.

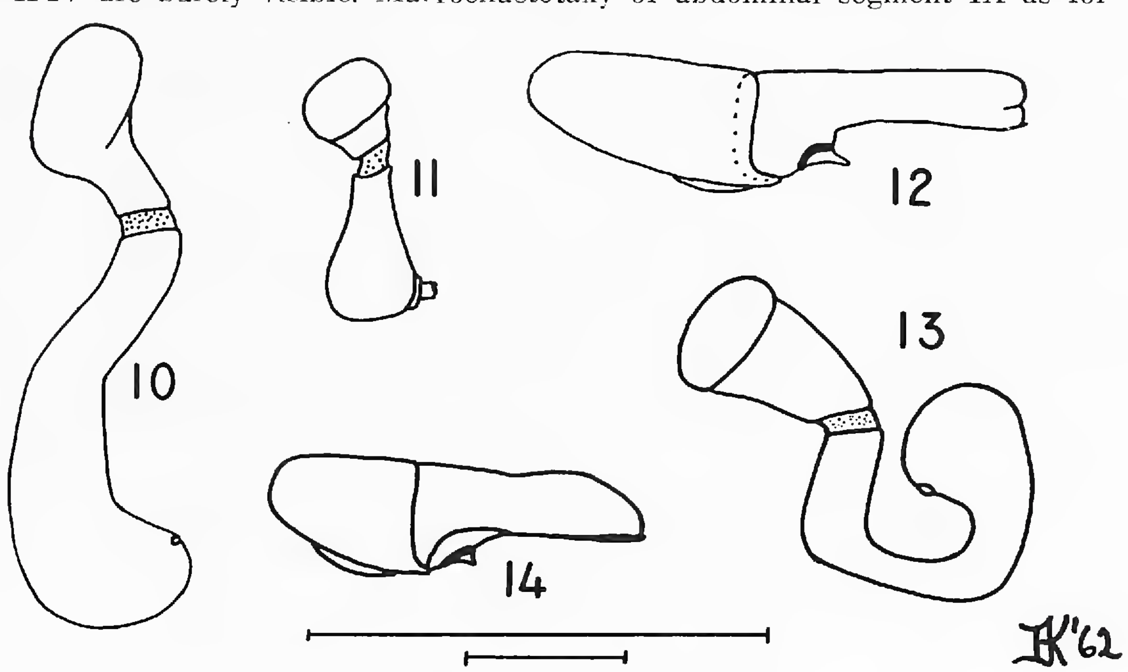
Paratypes (6 specimens): Congo Republic, Yangambi: 2 females, same data as holotype; 1 male, 5 July 1960, aerial plankton net from car (A.M.); 1 female, 6 July 1960, aerial plankton net over broken *Cubitermes* nest (No. 311) about 30 minutes after the nest was broken; 1 female, 6 July 1960, aerial plankton net over broken *Cubitermes* nest (No. 311), about 2 hours after the nest was broken; 1 male, 8 July 1960, aerial plankton net from car.

This species is named for our energetic assistant, Mr. Robert Banfill, now at Montana State College, Bozeman.

Typhloponemys gemina Kistner, new species
(Figs. 13 and 14)

Distinguished from all other species by the shape of the spermatheca and the median lobe of the male genitalia. Most closely related to *T. pumilio* Bernhauer from which it is distinguished by both of the above features.

Color dark reddish brown throughout. Head and pronotum a little darker than the rest of the body. Dorsal surface of the head, pronotum, and elytra smooth and shiny, finely and evenly punctate. Macrochaetotaxy of abdominal tergites II-VIII: 2,4,4,4,4,4,O; all of the macrochactae on tergites II-IV are barely visible. Macrochaetotaxy of abdominal segment IX as fol-



EXPLANATION OF FIGURES

Figs. 10-14: Median lobes of male genitalia: 12—*Typhloponemys banfilli* n.sp.; 14—*T. gemina* n.sp. Spermathecae: 10—*T. pumilio* Bernhauer; 11—*T. banfilli* n.sp.; 13—*T. gemina* n.sp. Large scale applies to figures of the spermathecae. Small scale applies to figures of the genitalia. Each represents 0.25 mm.

lows: dorso-lateral part 6, most anterior chaeta shorter, thinner, and lighter in color than the more posterior ones; median dorso-lateral part, 5, (3 dark, 2 light), ventro-lateral part, 4, (2 dark, 2 light); median lobe, 7. Spermatheca shaped as in fig. 13. Median lobe of male genitalia shaped as in fig. 14.

Measurements: Pronotum length, 0.43-0.59 mm; elytra length, 0.28-0.42 mm; head length, 0.22-0.29 mm; interocular distance, 0.33-0.44 mm. Number measured: 6.

Holotype female, No. 7223, CONGO REPUBLIC, YANGAMBI, 6 July 1960, aerial plankton net from car.

Paratypes (5 specimens): Congo Republic, Yangambi: 2 males, 25 June 1960, netted from vegetation surrounding nest of *Dorylus (Anomma) wilverthi* nest No. 9, Coll. J. Decelle; 1 male, 4 July 1960, aerial plankton net from car; 1 female, 5 July 1960, aerial plankton net from car (A.M.); 1 female, 9 July 1960, aerial plankton net from car.

Genus DORYLOXENUS Wasmann

Doryloxenus alzadae Kistner, new species

(Fig. 15)

Distinguished from all other species by the shape of the spermatheca. Most closely related to *Doryloxenus wasmanni* Cameron from which it can be distinguished by its somewhat smaller size and heavier shagreening as well as the character above.

Color dark reddish brown throughout. Dorsal surface of the head, pronotum, and elytra finely shagreened with short yellow setae scattered evenly but sparsely about. Macrochaetotaxy of abdominal tergites II-VIII: 2,4,4,4,4,4,0. Spermatheca shaped as in fig. 15.

Measurements: Pronotum length 0.55-0.57 mm; elytra length, 0.35-0.37 mm; head length, 0.28-0.30 mm; head width, 0.41-0.47 mm. Number measured, 3.

Holotype female, No. 4460, CONGO REPUBLIC, YANGAMBI, 24 June 1960, from a raiding column of *Dorylus (Anomma) wilverthi* Emery, nest No. 3.

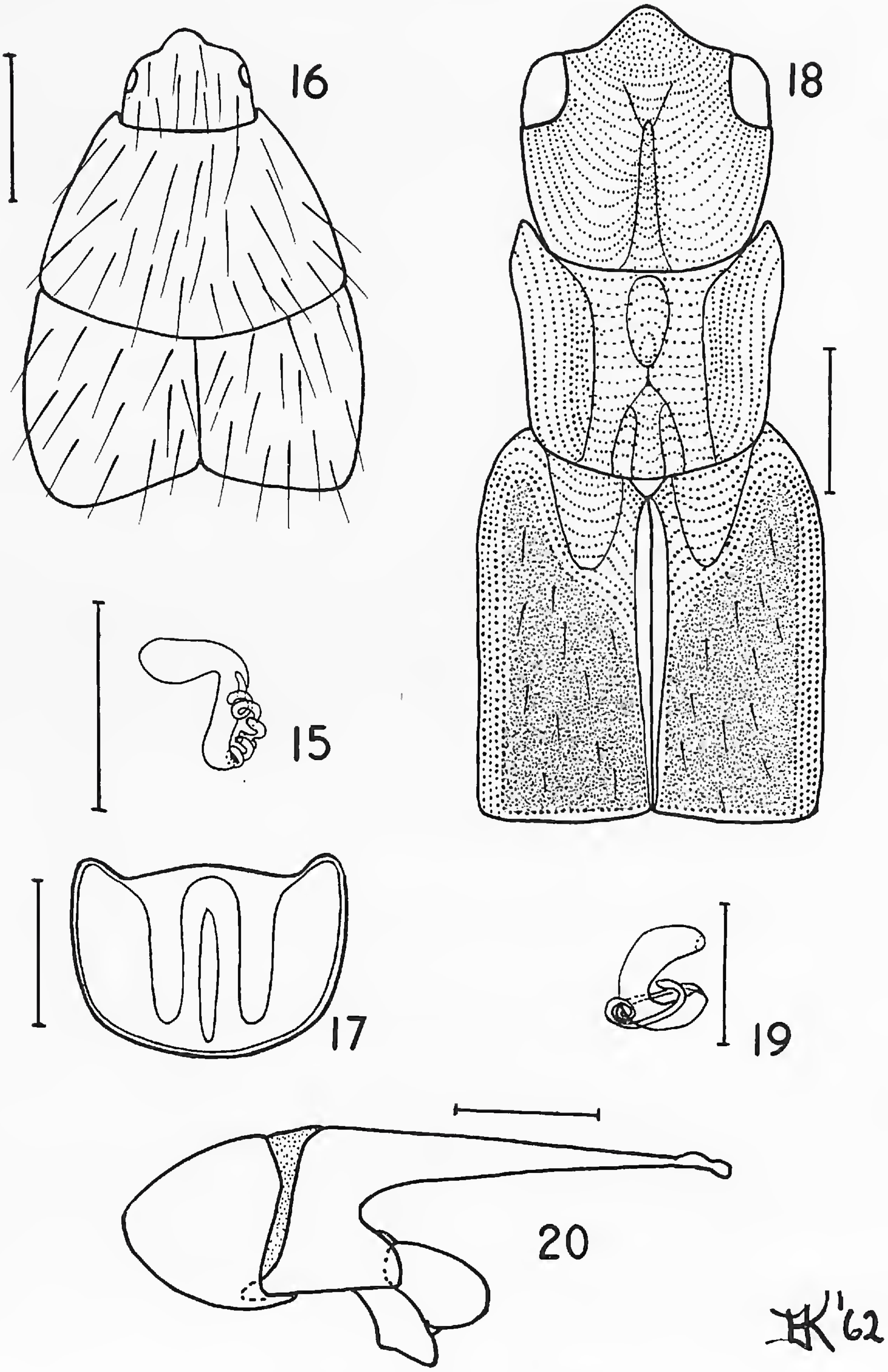
Paratypes (2 specimens): Congo Republic, Yangambi; 1 male, 27 June 1960, from the central part of a nest-changing column of *D. wilverthi,* nest No. 14; 1 female, 27 June 1960, from the central part of a raiding column of *D. wilverthi,* nest No. 12.

Doryloxenus superhirsutus Kistner, new species

(Fig. 16)

Distinguished from all other species by the presence of extremely long yellow setae distributed over the surface of the head, pronotum, and elytra. Most closely related to *D. eques* Wasmann from which it is distinguished by the characteristic above.

Color dark reddish brown throughout. Dorsal surface of the head, pronotum and elytra shiny and slightly shagreened with long golden setae scattered evenly over their surfaces as in fig. 16. Macrochaetotaxy of abdominal



EXPLANATION OF FIGURES

Figs. 15-20: Spermathecae: 15—*Doryloxenus alzadae* n.sp.; 19—*Sympolemon uhurui* n.sp. 16: Head, pronotum and elytra of *D. superhirsutus* n.sp. showing relative length and density of the long setae; 17: Pronotum, *Micropoleum mzuri* n.sp.; 18: Head, pronotum, and elytra of *S. uhurui* n.sp.; 20: Median lobe of male genitalia, *S. uhurui* n.sp. Each scale represents 0.25 mm.

tergites II-VIII: 0,0,0,0,0,0,0. Female unknown and male genitalia are not diagnostic in this genus.

Measurements: Pronotum length 0.32-0.37 mm; elytra length, 0.20-0.25 mm; head length, 0.17-0.20 mm; head width, 0.21-0.25 mm. Number measured, 2.

Holotype male, No. 4803, CONGO REPUBLIC, YANGAMBI, 7 July 1960, aerial plankton net from car.

Paratype: 1 male, Congo Republic, Yangambi, 9 July 1960, aerial plankton net from car.

Genus MICROPOLEMON Wasmann

Micropolemon mzuri Kistner, new species

(Fig. 17)

Distinguished from all other species including *M. tiro* Wasmann, to which it is most closely related, by the sculpture of the pronotum.

Color reddish brown throughout. Dorsal surface of the head, pronotum, and elytra deeply punctate with fine yellow setae scattered in regular sequence. Pronotum with three longitudinal grooves; neither the lateral ones reaching the posterior border nor the median one (fig. 17). Macrachaetotaxy of abdominal segment IX as follows: dorso-lateral plates, 4; median dorso-lateral part, 4; ventro-lateral part, 2; median lobe, 4 of which 2 are apical.

Measurements: Pronotum length, 0.26-0.31 mm; elytra length, 0.28-0.34 mm; head length, 0.28-0.30 mm; interocular distance, 0.27 mm. Number measured, 2.

Holotype male, No. 4436, CONGO REPUBLIC, EALA, 16 June 1960, ex yellow trays near a nest of *Dorylus (Anomma) wilverthi* Emery.

Paratype: 1 male, Congo Republic, Yangambi, 6 July 1960, aerial plankton net from car.

Genus SYMPOLEMON Wasmann

Sympolemon uhurui Kistner, new species

(Fig. 18, 19, 20)

Distinguished from all other species by the sculpture of the head and pronotum, the shape of the male genitalia, and the spermatheca. It can be easily discriminated from the other two species by means of the following key.

1. Elytra without grooves on the basal third.........*S. rufobrunneus* Tottenham
   Elytra with grooves on the basal third.......... 2
2. Median elevation of pronotum continuous, pronotum length 0.62-0.68 mm, dorsal surface of head smoothly rounded.........*S. anommatis* Wasmann
   Median elevation of pronotum broken into a small anterior hillock and a grooved posterior elevation, pronotum length 0.40-0.45 mm, head with a deep cleft in the dorsal surface..........*S. uhurui* Kistner

Color reddish brown throughout. Dorsal surface of the head and pronotum punctate with the punctures in rows following the sculpture. Head, pronotum, and elytra shaped as in fig. 15 with the following noteworthy sculpture: Head with a deep cleft on the median dorsal surface. Pronotum with an anterior median hillock and a posterior grooved hillock. Elytra with scalloped anterior grooves. Dorsal surface of the elytra with contoured punctures along the sides and front but with finer, more randomly placed punctures in the center portion (fig. 18). Macrochaetotaxy of abdominal tergites II-VIII: 0,0,0,0,4,4,0. Macrochaetotaxy of abdominal segment IX as follows: dorsal-lateral plates, 5 most anterior chaeta smaller, thinner, and lighter in color than the more posterior ones; median dorso-lateral part, 4; ventrolateral part, 4; median lobe, 4, with two at the apex. Spermatheca shaped as in fig. 19, the small thinly chitonized coiled part variable. Median lobe of the male genitalia shaped as in fig. 20. Males with a vestiture of extra-long golden setae on the inner side of antennal segments III-V. Females without this characteristic.

Measurementss Pronotum length, 0.40-0.45 mm; elytra length, 0.49-0.52 mm; eye length, 0.18-0.22 mm; interocular distance, 0.35-0.37 mm; head length, 0.42-0.49 mm. Number measured, 8.

Holotype male, No. 4370, CONGO REPUBLIC, YANGAMBI, 1 July 1960, from the central part of a nest-changing column of *Dorylus (Anomma) wilverthi* Emery, nest No. 19.

Paratypes (Seven specimens): Congo Republic: Yangambi: 4 males, 2 females, same data as holotype; 1 female, 25 June 1960, from the central part of a raiding column of *D. wilverthi*, nest No. 6.

The principal series of this species was taken on the first full day of Congolese independence. For this reason the species is named after the Kiswahili word for freedom, *uhuru*. This is the second species of Pygostenini where a clearcut secondary sexual characteristic is present. I checked through all the rest of species of *Sympolemon* that I have and none have the extra tufts of setae on segments III-V of the antennae of males. The other species is *Anommatoxenus clypeatus* Wasmann, in which females tend to be much larger (50%) than males.

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A NEW GENUS AND SPECIES OF MAYFLY FROM PERU

(Ephemeroptera: Leptophlebiidae)

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Among the specimens of mayflies collected by Drs. E. S. Ross and E. I. Schlinger during the California Academy of Science expedition to Peru are male imagoes of a remarkable new genus and species of the mayfly family Leptophlebiidae. The males, the only stage known, are immediately recognizable on the basis of the remarkable turbinate upper part of the eyes.

Genus **Miroculis** Edmunds, new genus

(Figs. 1-5)

Small mayflies with forewings four to five mm long. Eyes of the male divided, the upper portion stalked, with large ommatidia (fig. 4), the upper portion of the eyes separated from one another by a distance equal to their diameter. Forelegs of male nearly as long as forewings; the length of various segments in relation to the femur are as follows, tibia 1.53, tarsus one .045, tarsus two and three .6, tarsus four .3, and tarsus five .15. Tarsus five of forelegs expanded apically. Claws dissimilar, one claw truncate, the other with a digitate hook. (Middle and hind legs broken from the specimens.) Wings and venation as in figures 1 to 3. Costal angulation of hind wing acute.

Type species: *Miroculis rossi* described below.

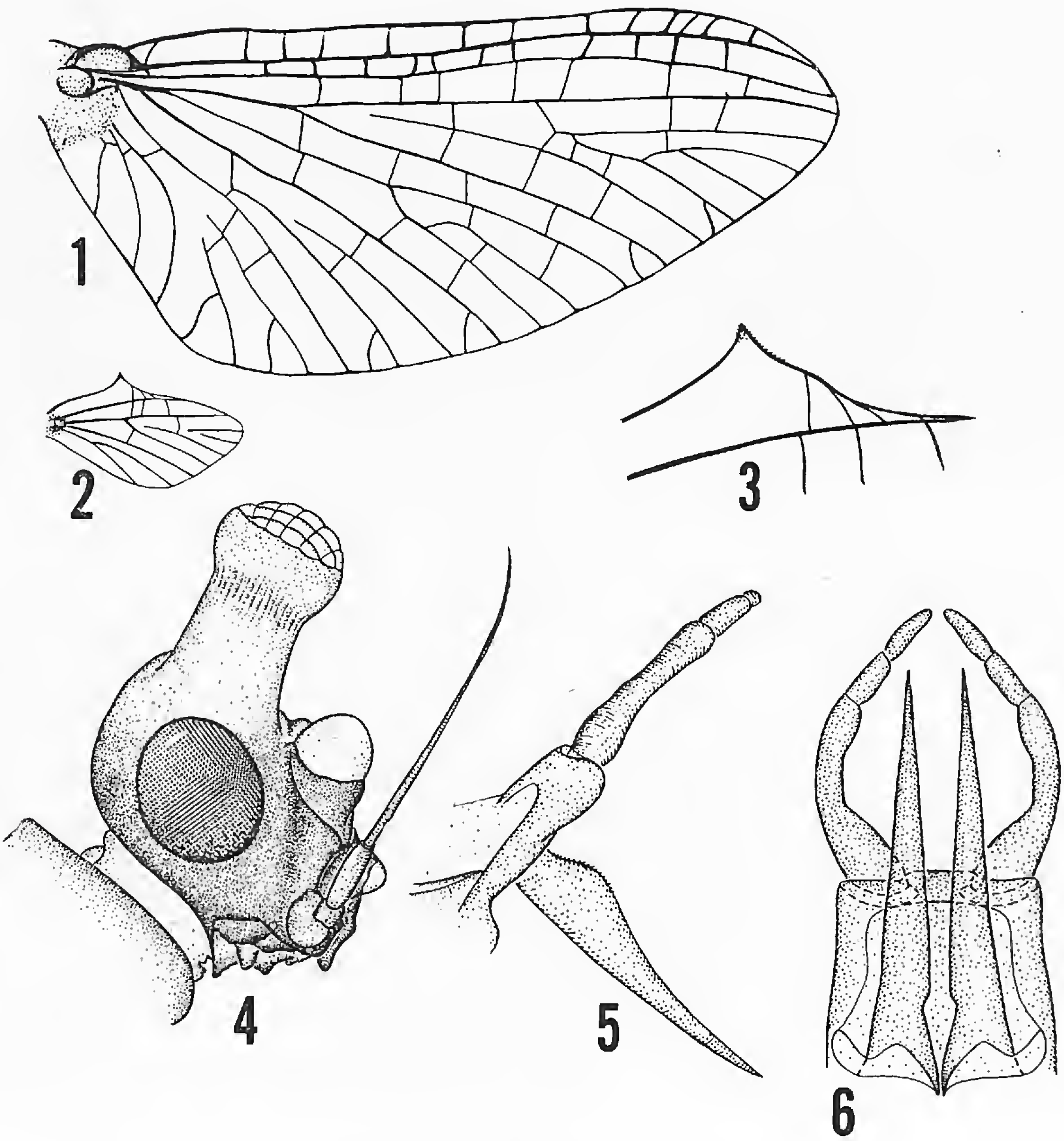
Miroculis rossi Edmunds, new species

Head dark brown, the upper half paler; antennae with scape and pedicel smoky, the flagellum pale yellowish brown; lower portion of eyes grey; the sides of the turbinate portion light brown at base, paler above; the facets of the turbinate portion light yellow brown, separated by dark brown grooves.

Thorax dark brown, with darker smoky brown markings at margins of pronotum, along the mesonotum next to the outer parapsidal furrows and on the pleura at leg bases; the scutellum darker brown, forewings with

[1] The research on which this paper is based was supported by a grant from the National Science Foundation.

venation as in figure 1, the stigmatic cross-veins variable in number from 5 to 9, cross venation somewhat variable, the marginal intercalaries constant in number in each interspace but variable in details of length and points of origin and destination; all veins medium brown; base of forewings suffused with brown; the stigmatic area sometimes lightly suffused with brown. Hind wings as in figures 2 and 3; venation brown; cross-veins variable, R_3 of radius complete or incomplete at base, terminus of subcosta variable. Forelegs light yellow brown; the femora smoky brown in the basal two-thirds, a fuscus subapical band about as broad as the width of the femur; distal one-fourth of tibiae smoky brown to fuscus. (Middle and hind pairs of legs missing on all specimens). Abdominal segments 2 to 7 semi-hyaline; seg-



EXPLANATION OF FIGURES

Figs. 1-6, *Miroculis rossi*, male paratype; Fig. 1, Forewing; Fig. 2, Hind wing, drawn to scale of forewing. Fig. 3. Costal projection of hind wing, enlarged. Fig. 4. Head. Fig. 5. Male genitalia, lateral view, showing normal position in preserved specimens. Fig. 6. Male genitalia, dorsal view, with penes appressed to styliger plate.

ments 1 and 8-10 opaque; abdominal terga yellowish brown; the posterior portion shaded with fuscus, this dark marking not reaching the lateral margins; on terga 2 to 4 the fuscus shading covers the posterior half of the segments, becoming broader on terga 5 to 8 so that two-thirds or more is dark on segment 8; terga 8, 9 and 10 largely fuscus; tracheal trunks smoky, the spiracles slightly darker; sterna yellowish brown with dark bands produced by segmental overlap. Forceps and penes medium brown. Genitalia as in figures 5-6. Caudal filaments medium brown, the joints usually darker in the basal half of each filament.

Female imago and nymph unknown.

Holotype male imago (in alcohol) from PERU, YURAC, 67 ROAD MILES EAST OF TINGO MARIA, IV-28-1954, E. S. Ross and E. I. Schlinger. Paratopotypes, 2 male imagoes. All specimens in collection of California Academy of Sciences, San Francisco. Dr. Schlinger informs me that this locality is in the tropical rain-forest zone at approximately 300 meters elevation. The specimens were taken along a creek near the cafe at Yurac.

The latin generic name is in allusion to the remarkable eyes of the male. The specific name is given in honor of Dr. E. S. Ross who has made his excellent collections of Ephemeroptera available to me.

The genus *Miroculis* is unique in the family Leptophlebiidae by reason of the turbinate eyes of the male. Some Baetidae (e.g. the Peruvian *Pseudocloeon binocularis* Needham and Murphy) have superficially similar eyes, but such a development is not even approached in the known Leptophlebiidae although males of several genera have divided eyes. The wing venation of *Miroculis* is similar to that of the Neotropical genera *Hermanella* and *Homothraulus* and the genitalia are similar to those of *Hermanella* (see Traver, 1959). Like many of the Leptophlebiidae, the relationships of *Miroculis* will remain uncertain until more is known of the nymphal stages of South American Leptophlebiidae, but it is probably a specialized derivative of *Hermanella*. Because of the remarkable adult eyes, late instar male nymphs of the genus would presumably allow association of the nymph and adult without rearing; no specimens identifiable as nymphs of this genus were found in the Peruvian nymphal collections from the area.

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SOME NEW NORTH AMERICAN CALLIDIINI WITH NOTES ON THE SYNONYMY OF PRONOCERA MOTSCHULSKY AND GONOCALLUS LECONTE

(Coleoptera:Cerambycidae)

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The conclusions reported here and the descriptions of new forms were developed in connection with a study, sponsored by the National Science Foundation, on North American Cerambycidae (NSF Grant No. 19959). Assistance from the following persons is gratefully acknowledged for efforts to make material available and for advice concerning Eurasian species: M. Hayashi, Osaka, Japan; L. Heyrovsky, Prague, Czechoslovakia; J. D. Lattin, Oregon State University; H. B. Leech, California Academy of Sciences; A. T. McClay, University of California, Davis; K. Ohbayashi, Nagoya, Japan; J. G. Rozen, American Museum of Natural History. I wish especially to thank E. G. Linsley, University of California, Berkeley, for his assistance and also for the use of his unpublished manuscript on the Callidiini.

When Le Conte (1873) proposed the genus *Gonocallus,* he was apparently unaware of the Eurasian genus *Pronocera,* which had been described earlier by Motschulsky (1859). The distinctness of *Gonocallus* from other North American *Callidiini* presented no problems in nomenclature or determination. This fact, together with the relative scarcity of North American specimens in collections, probably accounts for the acceptance of *Gonocallus* as a distinct genus. On the other hand, the old world species assigned to *Pronocera* have been subjected to a great deal of synonymy and generic changes. *Gonocallus* has not been recognized previously as a junior synonym.

The following generic synonymy reveals another example of an Eurosiberian-North American pattern of distribution in the Cerambycidae (see Linsley, 1939, 1958, 1962).

Genus PRONOCERA Motschulsky

Pronocera Motschulsky, 1859, Bull. Soc. Imp. Nat. Moscou, 32(2):494; Thomson, 1864, Systema Cerambycidarum, p. 270; Plavilstshikov, 1934, Bestimmungs-Tabellen der europäischen Coleopteren, 112:155,172; Plavilstshikov, 1940, Faune URSS, 22:234, 261; Gressitt, 1951, Longicornia, 2:217,219; Heyrovsky, 1955, Fauna CSR, 5:183,191.

Pronocerus Motschulsky, 1875, Bull. Soc. Imp. Nat. Moscou, 49(1):148.

Pseudophymatodes Pic, 1901, Echange, 17:12. (Type: *P. altaiensis* Pic, monobasic).

Protocallidium Csiki, 1904, Rov. Lapok, 11:99. (Type: *Callidium angustum* Kriechbaum, monobasic).

Potocallidium Reitter, 1912, Fauna Germanica, Käfer, 4:38. (error for Protocallidium).

Gonocallus LeConte, 1873, Smithsonian Misc. Coll., 11(264):171; (265): 296; LeConte and Horn, 1883, Smithsonian Misc. Coll., 26 (507): 281; Leng, 1884, Bull. Brooklyn Ent. Soc., 7:61; Knull, 1946, Ohio Biol. Surv. Bull. 39: 204 (Type: *Callidium collare* Kirby, monobasic). *New synonymy.*

Type species: *Pronocera daurica* Motschulsky (monobasic).

The genus *Pronocera* is distinguished by the slender femora, the form of the eyes which feebly embrace the antennal insertions, the elongate third segment of the antennae, and the appendiculate last antennal segment of the male.

As defined by Plavilstshikov (1940), this genus includes two Palearctic species. One of these, *P. angusta* (Kriechbaum), occurs in the region of south-central Europe; the other, *P. brevicollis* (Gebler), is found in a broad area including Mongolia, Manchuria, and southern Siberia. *P. collaris* (Kirby) is the only known New World representative of the genus, and occurs in the Boreal region of North America.

A comparison of series of *P. collaris* indicates that the species apparently segregates geographically into two distinct subspecies. The typical form, *P. collaris collaris* was originally described from, "North America, Latitude 54°," in eastern North America. It extends across the northern part of the continent, down the Rocky Mountains into New Mexico, over to British Columbia and northward to Alaska. A different population occurs in the Sierra Nevada of California.

Pronocera collaris lecontei Chemsak, new subspecies

Form and size of *collaris collaris* (Kirby), elytra strongly bluish; pubescence of head and pronotum long, fine, not dense; vertex of head usually coarsely, not densely punctate; disk of pronotum strongly shining, almost impunctate, punctures if present very small and sparse. Length, 9-14 mm.

Holotype male, allotype female, and 38 paratypes (11 males, 27 females) from MEADOW VALLEY, PLUMAS COUNTY, CALIFORNIA, 2500-4000 ft., VI-6 to 21-24 (E. C. Van Dyke), VI-21-24, 4000-5000 ft., VI-7-24 (W. H. Nelson); additional material not designated as paratypes as follows (all California): 5♂♂, 1♀, Hope

Valley, Alpine County, VII-9-48 (J. W. MacSwain, W. E. Kelson, L. W. Quate), VII-18-48 (O. E. Myers); 1♂, Lake Tahoe, VIII-1950 (R. M. Bohart); 1♂, 3♀♀, Sagehen, near Hobart Mills, Nevada County, VI-21 and 25-54 (R. H. Goodwin, J. A. Powell); 1♂, Hermit Valley, 7000 ft., VII-12-30 (J. K. Ellsworth); 1♂, 7 miles SE Truckee, Nevada County, VI-24-54 (J. Ross); 1♀, Echo Lake, 7400 ft., VII-10-25 (E. O. Essig); 1♀, Norden, Nevada County, 7000 ft., VII-4-55 (P. Raven); 1♀, Tahoe City, VIII-6-22 (Weld); 1♀, Tilden Lake, Yosemite National Park, VII-29-38.

This subspecies can be distinguished from *collaris collaris* by the almost impunctate, strongly shining pronatal disk. *P. collaris lecontei* additionally differs by the strongly bluish caste to the elytra, less densely punctate vertex of the head, and somewhat less numerous hairs of the head and pronotum.

The following new species and subspecies of *Phymatodes* are also described at this time to make the names available for other studies.

Phymatodes oregonensis Chemsak, new species

Male.—Form moderately small, subcylindrical, slightly depressed; color reddish brown to rufopiceous, appendages paler; elytra with a pair of oblique fasciae at middle. *Head* coarsely, densely punctate, sparsely clothed with long erect hairs; eyes deeply emarginate, dorsal and ventral lobes connected by one or two rows of facets; antennae shorter than body, basal segments sparsely clothed with long suberect hairs, scape shorter than third segment, second segment slightly less than half as long as third, fourth subequal to third, eleventh appendiculate. *Pronotum* slightly wider than long, sides broadly rounded, widest behind middle, base constricted; disk convex, moderately inflated, surface shining, moderately coarsely and densely punctate, lateral margins very densely, asperately punctate, subopaque, pubescence long, suberect, not dense; prosternum densely, rugosely punctate, subopaque; meso- and metasternum densely, shallowly punctate, sparsely pubescent. *Elytra* over twice as long as broad, subparallel, surface shining, coarsely, densely punctate at basal one-half, more finely at apical one-half; central white fasciae oblique, directed anteriorly along suture; pubescence short, sparse, suberect and subdepressed. *Legs* very sparsely punctate, sparsely clothed with long, suberect hairs; posterior femora not surpassing elytral apices; posterior tarsi with first segment about as long as two following together. *Abdomen* shining, very sparsely punctate and pubescent; fifth sternite broadly rounded and emarginate at apex. Length, 6-9 mm.

Female.—Antennae slightly surpassing middle of elytra; pronotal punctures more or less uniform throughout, not subopaque laterally; apex of fifth abdominal sternite more narrowly rounded, not emarginate. Length, 7-8 mm.

Holotype male from GRAVE CREEK, JOSEPHINE COUNTY, OREGON, V-30-52 (V. Roth); allotype female from Clackamus County near Springwater, Oregon, VII-5-55 (P. O. Richter, E. A. Dickason); paratypes as follows: 1♂, Cascadia, Oregon, V-19-35 (R. H. Schaefer); 1♀, Wheatland, Oregon, V-10-31 (J. Wilcox).

This species is apparently closely related to *P. ater* LeConte. The single, median, pale elytral fascia and distinctive pronotal punctation of the male of *oregonensis* will separate it from *ater*. Superficially, *oregonensis* resembles the dark forms of *P. vulneratus* LeConte but the elytral punctation differs greatly in the two species.

Phymatodes decussatus australis Chemsak, new subspecies

Form small, subcylindrical; color brownish testaceous with apical one-half of elytra (except fasciae) usually darker; elytra with anterior fasciae strongly angulate, posteriorly directed along suture and extending almost to suture, always extending to lateral margins, sutural oblique segment always narrower than lateral segment. Apical suture broad, oblique. Length, 5-8 mm.

Holotype male, allotype female, and two paratypes (male) from ENSENADA, BAJA CALIFORNIA, III-8-38, *Quercus agrifolia* (F. P. Keen); additional specimens not designated as paratypes as follows: 1♀, Tustin, Orange County, California, VI-14-38 (J. G. Shanafelt); 1♂, 1♀, Santa Ana Canyon, Orange County, California, III-32; 2♂♂, 2♀♀, Pasadena, California, May, June; 1♀, Poway, San Diego County, California (F. E. Blaisdell); 1♂, Mt. Wilson, California, II-25-28.

This subspecies can be distinguished from the typical form by its small size, generally paler color, and strongly arcuate anterior elytral fasciae which extend to the lateral margins. The broad, oblique posterior fasciae are also characteristic of *australis*.

Primary types of the species and subspecies herein described are deposited in the collections of the California Academy of Sciences.

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BOOK REVIEW

THE BEETLES OF THE PACIFIC NORTHWEST. PART III: PSELAPHIDAE AND DIVERSICORNIA I. By Melville H. Hatch, with the collaboration of Orlando Park, John A. Wagner, Kenneth M. Fender, William F. Barr, G. E. Woodroffe and C. W. Coombs. University of Washington Publications in Biology, Vol. 16, pp. ix + 503, Bound, Offset. Published March 1, 1962. Price $11.50, from the University of Washington Press. Seattle 5.

Volumes I and II of this comprehensive faunal work were reviewed by Mr. Hugh B. Leech in this journal (1956, 32: 138-142; 1960, 36: 141-142). Volume III covers the family Pselaphidae and part of the suborder Diversicornia, including the series Malacodermi, Clavicornes, Brachymera, and Ptinoidea. The Pselaphidae are treated by Orlando Park and John Wagner and include 21 genera (4 of them new) and 60 species (20 of them new). Kenneth M. Fender prepared the sections on the Lycidae, Lampyridae, Phengodidae, and Cantharidae, with 17 genera and 111 species, 15 of which are new. William F. Barr's treatment of the Cleridae includes 12 genera and 37 species, while the section on the genus *Cryptophagus*, adapted from Woodroffe and Coomb's current revision, contains 25 species. Dr. Hatch himself is responsible for the remainder of the families covered in the volume. The distribution of genera and species is as follows: Melyridae—23 genera (2 new), 80 species (26 new); Dascillidae—5 genera, 8 species (1 new); Cyphonidae—2 genera, 10 species (4 new); Eucinetidae—2 genera, 5 species; Byturidae— 2 genera, 2 species; Lathridiidae—10 genera, 44 species (1 new); Nitidulidae—17 genera, 60 species (1 new); Cybocephalidae—1 genus, 1 species; Coccinellidae—30 genera, 112 species (11 new); Ostomatidae—11 genera, 21 species (1 new); Sphindidae—2 genera, 2 species; Phalacridae—4 genera, 7 species (1 new); Cucujidae—15 genera, 24 spceies (1 new); Cryptophagidae—10 genera (1 new), 30 species (2 new); Languriidae—2 genera, 4 species; Erotylidae—2 genera, 6 species; Mycetophagidae—4 genera, 9 species (1 new); Cisidae—8 genera, 24 species (10 new); Endomychidae—8 genera, 10 species (1 new); Colydiidae—13 genera, 23 species (1 new); Rhizophagidae—6 genera, 15 species; Sphaeritidae—1 genus, 1 species; Histeridae—24 genera, 71 species (2 new); Derodontidae—3 genera, 5 species; Dermestidae—10 genera, 41 species; Byrrhidae—13 genera, 27 species (1 new); Ptinidae—6 genera, 15 species; Anobiidae—26 genera, 52 species (8 new); Bostrichidae—13 genera; 19 species; Lyctidae—4 genera, 10 species.

Page ii is a frontispiece containing photographs of John LeConte, George Horn, Thomas Casey, and Henry Fall. Pages 360-491 comprise 66 plates and their explanations.

In this volume Dr. Hatch continues the most ambitious work to appear in 50 years of American coleopterology and certainly the only one of its kind available in western North America. Although it is limited in scope to the beetles found in Oregon, Washington, Idaho, and British Columbia, it should also prove useful to entomologists in surrounding states; in the Cisidae, for instance, most of the California species are included in the keys, since the change in species composition between Oregon and California is one of gradual subtraction southwards, with no additions occurring except in the extreme southern portions of the state.

Volume III should be particularly useful to the economic entomologist because of the inclusion of a number of household and stored-products pests in the families Nitidulidae, Ostomatidae, Cucujidae, Cryptophagidae, Dermestidae, Anobiidae, Ptinidae. Bostrichidae, and Lyctidae. The treatment of the Coccinellidae with its important biological control agents will also be welcomed. In addition to the more well-known groups, this volume includes many of the smaller families (Sphinidae, Derodontidae, etc.) about which very little biological or distributional information is known. By enabling the amatur and professional alike to identify members of these groups, this work may provide the stimulus for future biological investigations.

One criticism that can be made about the book as a whole is the combination of keys and descriptions into one unit and the lack of spacing between descriptions. These devices, although they save space, make the keys more difficult to use and tend to conceal synonymical, distributional, and biological data. Dr. Hatch's conservative classification may also be criticized, since many generally accepted changes have been ignored.

The illustrations by Helen Houk and others are on the whole good, but they vary considerably in quality, and some have lost detail in the reproduction. It is unfortunate that only 14 of Dr. Hatch's 76 new species have been figured; this is probably due to a limitation on space and a desire to illustrate the more commonly encountered species.

In spite of these general criticisms and some others which could be added on the treatment of individual families, this volume and its two predecessors are welcome additions to the shelves of western coleopterists. We are looking forward to the final two volumes of this useful and informative work.—JOHN F. LAWRENCE, *University of California, Berkeley.*

CONE BEETLES OF THE GENUS CONOPHTHORUS IN CALIFORNIA

(Coleoptera: Scolytidae)[1]

HERBERT RUCKES, JR.[2]

Beetles of the genus *Conophthorus* characteristically attack and kill pine cones in which the broods are produced and the species perpetuated. The species in this group of beetles appear to be restricted to North America as there are no records of *Conophthorus* from Europe, Asia, or South America. Schwarz, in 1895, was the first to describe a species in this group as *Pityophthorus coniperda* from the cones of the eastern white pine, *Pinus strobus* L. Hopkins (1915) described the remainder of the presently recognized species, designating *coniperda* as the genotype.

Hopkins separated his species of *Conophthorus* primarily on the basis of host. However, this study demonstrated that at least three of the six species can be reared from egg to adult on cone tissues other than the selected host (Table I).

The gallery made by the attacking parent adult beetle falls into one of two classes, depending upon the type of host cone. Those cones which have a peduncle, such as sugar pine, western white pine, are attacked in the peduncle or stem of the cone, while those cones which are sessile, such as ponderosa pine, lodgepole pine, or monterey pine, are attacked in the base of the cone proper.

Attack of the cone is made by the female beetle, the male joins the female at a later date and apparently does little in constructing the gallery. Copulation probably occurs within the cone, after which the male leaves or dies within the cone. The cone is killed soon after entrance by the beetle; the gallery may consist of a simple mine in the center of the cone stem or a spiral gallery girdling the axis of the cone where there is no peduncle. After entering and killing the cone, the female extends her gallery parallel with and adjacent to the axis of the cone and not through the axis of the cone as suggested by Keen (1958) and Chamberlin (1958). The eggs are deposited in niches made in the seeds contiguous to the main gallery, usually two to each seed. Upon eclosion, the larvae feed first upon the seed in which the eggs have been deposited and then feed indiscriminately on adjacent cone tissues, destroying much of the interior of the cone.

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1 Study performed under partial support from the California State Division of Forestry, the T. B. Walker Foundation, and various forest industries.

2 Formerly Assistant Research Entomologist, University of California, Berkeley.

The adult female attacks one-year old cones in the spring. Pine cones require two years to mature. An attacked cone may be recognized by the presence of a pitch mass at the entrance hole in the peduncle or cone base. The eggs hatch in a few days following oviposition and the larvae complete development in about two weeks. The mature larva prepares a pupal cell between two scales or in the cone axis and pupates. The pupal period lasts about a week and the teneral adult period about a week. Depending on the species, mature adults may overwinter in this brood cone one or more seasons, may emerge and mine twig tips of the host, overwintering there, or may attack other cones. Details of individual species behavior is discussed below.

The egg first deposited is ovoid in shape and hyaline, turning milky white as the embryo develops. The head capsule of the larva is evident just prior to eclosion. The average size is 1.00 mm long and 0.60 mm wide, with minor variations depending on the species.

The larva is a typical scolytoid, legless larva with a distinct light brown head capsule, the remainer milky-white. Head capsule measurements and rearing studies indicate that there are only two instars (Table 2).

The pupa is white when newly formed and as it matures the mandibles, eyes, and tips of the elytra are the first to darken.

The mature adult is a shiny, cylindrical beetle with short, erect, sparsely-placed hairs on the elytra and pronotum. The elytra are striate-punctate with interstrial punctures generally smaller and

Table 1. Laboratory Rearings of *Conophthorus* eggs on unnatural host cone material.

Species of Beetle	Normal Host	Laboratory Host
C. lambertianae	*Pinus lambertiana Dougl.*	*Pinus pondorosa Laws* *Pinus attenuata Lemm.*
C. ponderosae	*Pinus pondorosa*[3] *Laws.*	*Pinus radiata D. Don* *Pinus lambertiana Dougl.* *Pinus radiata D. Don*
C. radiatae	*Pinus radiata D. Don*	*Pinus lambertiana Dougl.* *Pinus attenuata Lemm.* *Pinus ponderosa Laws.*

[3] *P. attenuata* was not used in this series as there are field collection records of *C. ponderosae* breeding in the cones of *P. attenuata*.

more sparsely placed than those of the striae. An elytral declivity is present but often poorly defined. The head is not visible from above and the anterior portion of the pronotum is granulose with the granules becoming punctures toward the posterior. The color varies slightly between species and at times within species, making color an unreliable character for species separation.

Little information is available on the parasites of bark beetles. Only one larval parasite was recovered during this study, a small bethylid wsp, *Cephalonomia utahensis* Brues (Ruckes, 1956). This parasite was found in all California *Conophthorus* species with the exception of *C. monticolae*. A chalcid parasite, *Tomicobia tibialis* Ashmead, was recovered from the overwintering adults of *C. lambertianae*.

Table 2. Larval Instar Head Capsule Widths.

Species[4]	Instar	Range in mm.	Average in mm.
C. radiatae	I	.336 - .424	.382
	II	.552 - .683	.612
C. ponderosae	I	.372 - .442	.419
	II	.629 - .714	.669
C. lambertianae	I	.340 - .425	.383
	II	.493 - .697	.627
C. monophyllae	I	.368 - .440	.404
	II	.618 - .701	.659

[4] *C. contortae* and *C. monticolae* omitted due to insufficient material.

Unidentified nematodes have been recovered from the Malpighian tubules in the larvae of *C. ponderosae, C. lambertianae,* and *C. monophyllae* and also in the body cavities of the adult beetles. It has not been determined what role these organisms play in the biology of the cone beetles.

Miller (1915) reporting on *C. lambertianae* states: "In many of the cones the brood reaches the stage of full-grown larvae, pupae, or even new adults, and then dies. On an area near Sisson[5], Calif., in 1913, over 50 per cent of the cones contained dead broods. On one area near Colestin, Oreg., in 1914, the brood developed in only 57 per cent of the attacked cones. The mortality of the developed broods amounted to 62 per cent, so broods finally successful in but 21.6 per cent of cones attacked. While the cause appeared to be an entomophagous fungus it has not yet been reported definitely." A similar high incidence of brood mortality had been ob-

[5] Now Mt. Shasta City

served during several years throughout California. No evidence of disease was found in 1956 or 1957 in broods which suffered this high mortality.[6]

Experiments were conducted in 1958 to determine the temperatures attained in aborted sugar pine cones. Thermocouples were inserted into cones *in situ* and on the ground and the temperature was recorded on a 16-point recording potentiometer. While the data were limited to a few days observations, it was then determined that cones in full sunlight on the ground for four hours during the middle of the day were heated to 125-130° F. As brief exposure to temperatures of 115-120° F will kill western pine beetle (Miller, 1931) it is possible that the high brood mortalities found were caused by extreme high temperatures.

Mortality appears to occur when the aborted cones are on the ground as no cones containing dead broods were collected from trees.

A Key to the California Species of Conophthorus Hopkins

(Adult Characters)

1. Elytral declivity with striae 1, 2, and 3 punctured and parallel; declivity slightly impressed, interspace 1 feebly granulate, interspace 3 punctate with each punctate surrounded by a raised annulus...*C. monophyllae* Hopkins

   Elytral declivity with striae 1 not punctured or feebly so, striae 2 and 3 punctured, with 2 approaching 3 at apex of declivity and forming the lateral margins of the declivity. Interspace 2 feebly or obviously granulate. Interspace 3 annulate-punctate...2
2. Elytra with punctures of striae 1 and 2 interspace 2 of equal size. Declivity slightly impressed.................................*C. ponderosae* Hopkins

   Elytra with punctures of interspace 2 obviously smaller than the punctures of striae 1 and 2...3
3. Elytra with distinct and parallel rows of strial punctures on lateral area; declivity strongly impressed, punctures of stria 2 in declivity numerous and close together, granules of interspace 1 lacking or very faint...*C. lambertianae* Hopkins

   Elytra with strial punctures in obscure rows or confused on lateral area 4
4. Declivity strongly impressed; punctures of striae 2 in declivity numerous and close together, granules of interspace 1 lacking or very faint.. *C. monticolae* Hopkins

   Declivity slightly impressed or not at all; granules of interspace 1 present and obvious 5
5. Interspace 1 of declivity granulate at apex only.........*C. contortae* Hopkins

   Interspace 1 of declivity obviously granulate for entire length ....*C. radiatae* Hopkins

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[6] Per communication Dr. E. A. Steinhaus, Dept. Insect Pathology, University of California.

CONOPHTHOREUS MONOPHYLLAE Hopkins

Description.—A black, shining, cylindrical beetle, 3.0 - 3.5 mm long. The elytral declivity with striae 1, 2, and 3 punctured and parallel, with striae 2 passing through the declivity and not forming the lateral margin as in the other California species of *Conophthorus.* This character is suitable for separating this species from the others.

Host.—Singleleaf pinyon, *Pinus monophylla* Torr. & Frem.

Type.—Female, Hopkins 1904. Hopk. U. S. No. 2784, U.S.N.M. Cat. No. 7474.

Type locality.—Ventura County, California.

Distribution.—Probably throughout the range of the host trees.

Seasonal History.—Initial attacks are made early in the spring. Freshly attacked cones were observed during the first week of May, 1956, in Los Angeles County, California, at an elevation of 5000 feet. There appear to be two generations a year as it has been observed that in late fall the smaller cones contain adults and adult emergence holes. The larger cones showed evidence of fresh attack and larva were found in them. However, in cones of all sizes, the overwintering stage is the adult.

CONOPHTHORUS PONDEROSA Hopkins

Description.—A dark brown or black, shining, cylindrical beetle, 3.5—4.2 mm long. Generally the beetles have a black head and pronotum, with reddish brown elytra; however, many specimens have been collected which were totally shiny black. The character which separates this species from the others is the similarity in size of the punctures of striae 1 and 2 and those of interspace 2.

Host.—*Pinus ponderosa* Laws, *P. jeffreyi* Grev. & Balf., *P. washoensis* Mason & Stockwell and rarely the cones of *P. attenuata* Lemmon.

Type.—Female, Sergent 1913. Hopk. U. S. No. 10807a, U.S.N.M. Cat. No. 7479.

Type locality.—Ashland, Jackson County, Oregon.

Distribution.—Commonly throughout the Pacific Coast range of ponderosa pine, occasionally in Jeffrey pine in the Modoc National Forest and eastside Sierra forests, and rarely in *Pinus attenuata* on the northwest California coast in Del Norte County. This species has also been reared from the cones of *Pinus washoensis* in Washoe County, Nevada, adjacent to the California border.

Seasonal History.—The adult attacks on the cones occur during the middle of May and extend into late June. Upon completion of the gallery and egg deposition, the female turns around and leaves the cone by the entrance hole. The entrance hole is then plugged with frass. The behavior of the female after leaving the cone has not been determined. Additional attacks on other cones may occur, or the beetle may die. Brood development is complete by the end of July. The brood adults remain in the cone for the remainder of the season and overwinter in this stage. There appears to be only one generation a year. Living adults were recovered in 1958 from cones attacked in 1956, indicating that some brood adults remain in the brood cone for more than one year. This suggests a possible means of survival during years of poor or non-existent cone crops.

CONOPHTHORUS LAMBERTIANAE Hopkins

Description.—A black, shining, cylindrical beetle. 3.0—4.5 mm long, rarely with reddish-brown elytra. The well-defined and parallel rows of strial punctures on the lateral areas of the elytra separate this species from the others found in California.

Host.—Sugar pine, *Pinus lambertiana* Douglas. Keen (1958) reports that the twigs and cones of *Pinus monticola* Douglas are attacked by this beetle.

Type.—Female, Sergent 1913. Hopk. U. S. No. 10833a2, U.S.N.M. Cat. No. 7478.

Type locality.—Hilt, Siskiyou County, California.

Distribution.—Throughout the range of sugar pine in Oregon and California.

Seasonal history.—Beetle attack occurs during the spring, the time varying from early May to mid-June (Table 3).

Two generations of beetles may occur during heavy cone crop years. Usually, however, the brood adults leave the cones after maturation and mine the twig tips of adjacent sugar pines, overwintering there (Ruckes, 1957).

Table 3. Beetle emergence and first appearance of aborted cones in California 1956-58.

Emergence from cages cones	First appearance of aborted cones	Location
V-7-56	V-16-56	Pinecrest, Tuolumne Co.
V-24-57	VI-2-57	Pinecrest, Tuolumne Co.
no data	VI-12-57	Miami R. S., Mariposa Co.
no data	VI-19-57	Hat Creek, Lassen Co.
VI-8-58	VI-19-58	Pinecrest, Tuolumne Co.

CONOPHTHORUS MONTICOLAE Hopkins

Description.—A shining, cylindrical, beetle, 3.2—3.8 mm long. Usually with black head and pronotum with reddish-brown or black elytra. The declivity of the elytra is strongly impressed and the punctures of striae 2 in the declivity are numerous and close.

Host.—Western white pine, *Pinus monticola* Don.

Type.—Female, Fromme 1906. Hopk. U. S. No. 6541a, U.S.N.M Cat. No. 7477.

Type locality.—Priest River, Boundary County, Idaho.

Distribution.—Probably throughout the range of western white pine. The species has been collected in Idaho (type locality Priest River), Washington, Montana, western Canada (Cowitchan Lake) and northern California (Lassen Volcanic National Park) (Ruckes, 1959).

Seasonal history.—Nothing is known of the habits of this species. It is assumed that they are similar to other species attacking pedunculate cones, such as *C. lambertianae*.

CONOPHTHORUS CONTORTAE Hopkins

Description.—A black, shining, cylindrical beetle, 2.9—3.5 mm long. The declivity with a few (1-3) granules at the apex.

Host.—Shore pine, *Pinus contorta* Dougl. ex Loud. and lodgepole pine, *P. murrayana* Grev. & Balf. (Ruckes, 1959).

Type.—Female, Hopkins 1899. Hopk. U. S. No. 88. U.S.N.M. Cat. No. 7481.

Type locality.—Newport, Lincoln County, Oregon, in the cone of *Pinus contorta* var. *contorta* Engelm.

Distribution.—Probably throughout the range of the host, but has not been collected from shore pine in California.

Seasonal history.—The observations reported here were made on the beetles in the cones of the lodgepole pine which occurs at higher elevation where there is a shorter growing season. Beetle flight and attack occurs in late June and July after the snow has melted from the ground. The pupa is the overwintering stage. Development in shore pine was not observed.

CONOPHTHORUS RADIATAE Hopkins

Description.—A black, shiny, cylindrical beetle, 3.1—4.1 mm long. The declivity of the elytra is slightly impressed and interspace 1 of declivity has many granules the length of each interspace.

Host.—Monterey pine, *Pinus radiata* Don.

Type.—Female, Miller 1913. Hopk. U. S. No. 10861a. U.S.N.M. Cat. No. 7481.

Type locality.—Pacific Grove, Monterey County, California.

Distribution.—This species has only been collected from the type locality but probably occurs throughout the host range.

Seasonal history.—The attack and oviposition habits are similar to the other species of cone beetles which attack sessile cones. Adult beetles attack the green developing second-year cones in the spring and oviposit in them. Development is complete by fall and they may overwinter in the brood cone or they may emerge and enter first-year conelets to overwinter. One generation of beetles completed development in 44 days under laboratory conditions.

Acknowledgments

I am indebted to Dr. S. L. Wood, Brigham Young University, for his determinations of the *Conophthorus* species and to C. B. Eaton, Pacific Southwest Experiment Station, Nelson B. Drury, California Division of Beaches and Parks, and to Mr. and Mrs. Ernest Schneider of Pinecrest, California, for their cooperation.

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A NEW BAT BUG FROM SOUTHERN CHILE

(Hemiptera: Cimicidae)

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In 1960 Mr. Luis Peña sent several nymphs of Cimicidae collected from bat roosts in a hollow tree in southern Chile. On the basis of nymphal characters alone, it appeared that these specimens belonged to the unique subfamily Primicimicinae—known only from the single genus and species *Primicimex cavernis* Barber of Texas and Guatemala. Several attempts to obtain adults and establish laboratory colonies were unsuccessful so Mr. Peña offered to serve as guide on a field trip in search of this and other unique southern Cimicidae. Travel was by jeep from Santiago south to Chiloe Island during the southern summer month of January, 1962. Thanks are due to Mr. Peña and his assistant, Guerrardo, for enthusiastic support at all times and for much of the success of the project. Financial assistance was received from the United States Public Health Service through Grant No. E-1496-(C4). Dr. Jacques Carayon of the Laboratoire d'Entomologie Agricole Tropicale in Paris studied the internal reproductive organs and made available his voluminous notes and illustrations. Norihiro Ueshima at the University of California in Berkeley made cytological preparations and studied the chromosomes. Dr. Seth Benson of the University of California Museum of Vertebrate Zoology identified the bats. Mrs. Celeste Green made the drawings in the style of previous Cimicid illustrations.

Bucimex Usinger, new genus

Size large, 6.8 mm. (dried) to 9.6 mm. (slide mounted). Body suboval, flattened above. Bristles dense and long, the individual bristles curved, minutely notched at tip and serrate on outer side.

Clypeus not widened anteriorly, the sides subparallel. Labrum over twice as long as wide, gradually tapering to rounded tip. Antennae about half again as long as width of pronotum, the second segment three times as long as first, one-eighth longer than third, the fourth two-thirds as long as third. Rostrum short, reaching only to base of head or a little onto prosternum.

Pronotum transverse, the disk convex at middle, depressed sublaterally, the sides rounded. Hemelytral pads broadly suboval. Metasternum not platelike, forming a subrounded lobe between middle coxae.

Spermalege located ventrally between third and fourth visible ventral segments on right side, the ectospermalege sac-like, longer than wide, extending forward from narrow opening at intersegmental membrane.

Legs with hind femora four times as long as wide, the tibiae with mottled markings (pseudojoints) and the front and middle pair with small but distinct apical pads or fossae in both sexes. Tarsi with 3 stout spines at inner apex of third segment in apposition to claws.

Type species: Bucimex chilensis Usinger, n. sp.

Bucimex chilensis Usinger, new species

Color brown with pale yellowish at base and sides of head, on either side of middle and in a transverse fascia behind middle of pronotum, on either side of scutellum at basal two-thirds, at point of articulation of hemelytral pads, and more or less on appendages and underside.

Head as long (expanded slide mounted specimen) as wide including eyes, 1.05 mm, the latter less than one-third the width of interocular space, 0.2 mm x 0.6 mm, small and round in outline. Sides of clypeus subparallel, a little sinuate, the apex truncate. Sides of head narrowed immediately behind eyes and then widened near base. Clypeus beset with long, erect bristles except on either side of base, the rest of head smooth and without bristles except adjacent to clypeus and forward near anterior margins of eyes to antenniferous tubercles. Postocular area with one prominent bristle behind each eye. Antennae about half again as long as width of pronotum, 3.3 mm, the proportion of segments 8:24, 21:14, first and second segments stout and beset with short bristles, apical segments slender with short bristles. Rostrum short, reaching only to base of head in slide mounted specimens (attaining apex of prosternum in dried specimens), proportion of segments 6:10:5; width narrow, about equal to thickness of first antennal segment. *Pronotum* about twice as wide as long at middle, 2.1 mm x 1.1 mm, the disk convex, rough and beset with long bristles, depressed sublaterally and narrowly before hind margin, the margins thickened and slightly reflexed. Lateral margins evenly arcuate, anterior "angles" rounded, anterior margin roundly emarginate behind head. Disk glabrous along two vertical pale marks at middle and laterad at about basal fourth. Lateral bristles very long, about as long as first antennal segment, 0.4 mm.

Scutellum more than half as wide as pronotum, 24:42, the exposed part in slide mounted specimens about half as long as wide. Disk smooth or minutely granular on semilunate yellow areas on either side of middle, the middle brown, feebly punctured, and with some bristles; posterior and lateral areas dark brown to black, coarsely rugose and beset with longer bristles; apex moderately swollen or inflated; lateral margins constricted at apical third. *Hemelytral pads* transversely suboval, nearly straight at contiguous inner margins, broadly, evenly rounded postero-laterally, the articulations at sides of scutellum smooth, conspicuous, yellow; length 1.3 mm, ratio of length to width 26:35; disk coarsely punctured and beset with long bristles, antero-lateral margin thick, the disk depressed submarginally. *Abdomen* above widened, the ratio of width across 4th (3rd visible) segment:hemelytral pads:pronotum:head including eyes—88:70:42:22. Hind margins of abdominal segments sinuate, thin, translucent, disk rugosely punctate and with numerous erect bristles; segments 4, 5, and 6 (visible) each with two pale spots at middle possibly corresponding to the paired nymphal scent gland openings, though the latter are at anterior margin of each segment whereas the pale spots in adults approach the middle of each segment. Under surface with many bristles; prosternum not produced as a point between front coxae; mesosternum with hind margin thickened and arcuate; metasternum a somewhat inflated lobe, separating middle coxae

Fig. 1. *Bucimex chilensis* Usinger, new species. Lonquimay, Malleco, Chile, showing dorsal (right) and ventral (left) surfaces of female and detail of male genital segment and paramere.

by a distance approximately equal to width of a coxa. Scent gland evaporating area without special structures, consisting of a dull area over most of metapleuron. Female genital segments ventrally consisting of lateral spiracle-bearing plates and two sublateral plates of the 8th segment which narrow toward the middle and are subcontiguous. Behind this are two longitudinal plates that taper to apices and a pair of gonopophyses that are slightly inflated apically and densely beset with long bristles. Male genital segment slightly wider across base than long, 28:24, bent slightly to left, the paramere as long as segment, curved and slightly sinuate at tip, tapering gradually to acute apex which reaches an open pocket at left side of asymmetrical 8th segment.

Legs rather long and slender, the hind femora 2.8 mm long, four times as long as wide, 56:14; hind tibiae one-fourth longer than femora, 80:56, distinctly curved and mottled (pseudojoints) on apical half. Hind tarsi one-third the length of tibiae, the second and third segments subequal, third segment with 3 stout spines on inner apex, claws angulately produced subbasally.

Length (slide mounted female) 8.6 mm, width of pronotum 2.05 mm; male, length 9.6 mm, width of pronotum 2.15 mm. Dry pinned specimens: female, length 6.8 mm, width (pronotum) 2.15 mm.

Holotype female, 10 KM SOUTH OF LONQUIMAY, MALLECO, Chile, January 11, 1962, R. L. Usinger collector; allotype, male, same data as holotype; paratypes, 12 specimens, same data as type and 6 males and several nymphs near Dalcahue, Chiloe I., Chile, January 22, 1962, R. L. Usinger collector. Nymphs only were taken at Tolhuaca, Curacautin, Malleco, Chile, January 11-25, 1959, and Dalcahue, Chiloe I., Chile, February 10-12, 1954, by Luis E. Peña.

At Tolhuaca in 1959 Luis Peña found small nymphs in the hollow trunk of an Araucaria tree in a dense moist forest of tall trees. These specimens were associated with the bat, *Myotis chiloensis* (Waterhouse). Unfortunately, local inhabitants of the region built a fire in the hole and destroyed the colony. Near Lonquimay a hollow *Nothofagus* tree was found with bats present and bugs hiding in cracks inside the hollow trunk. Near Dalcahue bats and bugs were found beneath a piece of loose bark of a large *Nothofagus* tree. The area had been burned several years earlier and the open type of country was quite dry. Nymphs, adults, cast skins and eggs were found in a compact cluster about 15 feet from the ground. A third collection was made beneath loose bark of a *Nothofagus* tree about 25 km north of Dalcahue. Under bark near the latter place the bat *Histiotus montanus magellanicus* (Philippi) was taken.

The relationships of *Bucimex* are most perplexing. The large size, short rostrum, narrow clypeus, long slender labrum, long, fine, serrate bristles, suboval hemelytral pads, mottled tibiae and stiff spines at inner apex of third tarsal segment suggest affinity with *Primicimex*. Also there is a long lone bristle behind each eye in both of these genera. On the other hand, *Primicimex* lacks a spermalege and usually receives sperm between the 5th and 6th (4th and 5th visible) tergites on the left side, there being a transverse pigmented area at that point. *Bucimex* differs radically from this, having a distinct sclerotized ectospermalege between the 4th and 5th (3rd and 4th visible) ventral segments on the right side. The organ is sac-like, enlarged apically and bent toward the middle of the body. Through the cooperation of my colleague, Dr. Jacques Carayon, I am able to report that the mesospermalege is very large and sac-like, exceeding the size of an ovary. Dr. Caryon also studied the mycetomes, finding that *Bucimex* possesses a pair situated in the middle of the fat tissue near the dorsal membrane of the abdomen at the level of the fourth visible abdominal segment. *Primicimex* is unique among the Cimicidae in lacking discrete mycetomes. The chromosome number was found by Mr. Ueshima to be 13 + XY (1st metaphase, n ♂). This is close to certain colonies of *Cimex lectularius* and differs from most other Cimicidae. The chromosome number of *Primicimex* is unknown.

To summarize, *Bucimex* appears on external characters to belong to the Primicimicinae whereas its internal reproductive system and mycetomes would perhaps place it closer to the Cimicinae.

BOOK NOTICE

A LIST OF THE APHIDS OF NEW YORK, by Mortimer B. Leonard, Washington, D.C. Proceedings of the Rochester Academy of Science, Vol. 10, No. 6, pp. 289-, 428, 4 plates, Feb. 1963. Paper covers. For sale at $1.50 by the Librarian, Rochester Academy of Science, Rush Rhees Library, University of Rochester, Rochester, N.Y.

The life histories, economic importance, method of feeding, production of winged forms, productivity, role as vectors of plant viruses, and other pertinent information are discussed as introductory material. Detailed records of the distribution of about 350 species of aphids known to occur in New York are given and a list of over 700 food plants on which they occur.

A NEW SPECIES OF THE GENUS TRACHUSA FROM CALIFORNIA WITH A KEY TO THE KNOWN SPECIES

(Hymenoptera: Megachilidae)

ROBBIN W. THORP
University of California, Berkeley

The genus *Trachusa* Panzer has been represented previously by three species, one from Eurasia, one from California and one from Arizona and Sonora, Mexico (Michener 1941, 1948). A new species is described here from California to make the name available for use in comparative ecological studies.

Trachusa gummifera Thorp, new species

Female—Integument black; pubescence pale, ferruginous medially on face, vertex, dorsum of thorax, inner surfaces of basitarsi, medially on apical depression of metasomal tergum 6, and abdominal scopa, whitish near eyes, on genae, thoracic pleura, and forming medially interrupted bands on apical depressed margins of metasomal terga 1-5. *Head,* except clypeus and supraclypeal area, finely, closely punctate; clypeus and supraclypeal area rather coarsely punctate, region of suture separating these sclerites somewhat elevated and impunctate, median longitudinal line of clypeus somewhat elevated, impunctate basally, punctate apically; apical margin of clypeus with about seven or eight small denticulations; labial papi with third segment longer than fourth (ratio of 4:3). *Mesosoma* finely and closely punctate; reddish dorsal pubescence short, uniform and dense; whitish pleural pubescence long and dense, increasing in length ventrally; propodeal enclosure punctate above, impunctate but minutely tessellate below. *Metasoma* with margins of terga 3-5 strongly and abruptly depressed, less strongly abruptly depressed on terga 1 and 2; punctures on basal area of second tergum uniformly separated by one puncture diameter, punctures on terga 3-5 tending to be closer on succeeding segments; punctures of apical depression of terga 2-5 about same size as those of basal area but almost contiguous; fifth tergum with posterior margin feebly and broadly emarginate medially; sixth tergum with wide, basal, transverse, strongly and abruptly elevated ridge with median emargination; posterior margin of sixth tergum produced medially as a horizontal flange, feebly emarginate medially; whitish pubescence long dorsolaterally on tergum 1, short in medially interrupted apical bands of terga 1-5; ventral scopa with long, dense, reddish, stiff, simple hairs. Length approximately 14 mm. Forewing length 10 mm.

Male—Integument black, except facial maculations; pubescence pale, ferruginous on vertex, thoracic dorsum and inner surfaces of basitarsi, whitish on rest of head, thoracic pleura and apical depressed margins of metasomal terga 1-5. *Head* with punctation as in female; clypeal maculation cream colored grading to brownish peripherally; clypeus not entirely maculate but with depressed, thin, black border laterally with punctures fine and contiguous, black border increasing in width basomedially from anterior tentorial pit with punctures large and contiguous, maculation along the median longitudinal raised area almost reaching fronto-clypeal suture; lateral facial maculations (absent in some male paratypes) each consisting of a small brownish spot about the size of larger clypeal punctures and located about one-fourth the distance from anterior mandibular articulation to base of antenna; mandibles with apical tooth rather stout, its tip farther from tip of second tooth than latter is from third; labial palpi with third segment longer than fourth (ratio of 4:3). *Mesosoma* and metasomal terga 1-5 similar to female. *Metasoma* with sixth tergum with posterior margin broadly rounded, the entire margin produced as a flange, delimited basally by the subapical, transverse, feebly nodulose keel, which curves anteriorly at the sides and gives off medially a short, subtriangular posterior projection not nearly reaching posterior margin of segment; seventh tergum with longitudinal median ridge dorsally, posterior margin a heart-shaped fold with broad lateral lobes and shallow median emargination; sterna 2-4 with apical margins straight, not provided with long hairs; fifth sternum with lateral margins broadly convex, feebly emarginate medially; sixth sternum with apical margin broadly rounded and folded ventrad with a small median, anteriorly directed, truncate tooth; eighth sternum elongate, posterior margin with short, narrow, parallel-sided, apically emarginate, median process, the posterolateral borders broadly rounded. Length approximately 13 mm. Forewing length 9.5 mm.

Holotype female and allotype (California Academy of Sciences, San Francisco), from CARSON RIDGE, MARIN COUNTY, CALIFORNIA, June 11, 1960 (J. F. Lawrence); and 42 paratypes as follows: same locality 30 ♀, 3 ♂, vi-11-60 (J. F. Lawrence and J. R. Powers; C.I.S., G.I.S.),[1] 2 ♀, 1 ♂, v-30-59 (C. W. O'Brien and J. R. Powers; G.I.S.), 3 ♀, vi-15-62 (P. D. Hurd and R. W. Thorp; C.I.S., R.W.T.), 2 ♀, vi-30-62 (R. W. Thorp; R.W.T.). San Francisco Co.: San Francisco, 1 ♀, vi-22-57 (D. Rentz; G.I.S.).

This species is related to *T. perdita* Cockerell and may be separated from this and other species of *Trachusa* by the following key. The female of *T. manni* Crawford is not known and I have not seen the male types. Therefore, I have relied on the original description (Crawford, 1917) and the redescription and key presented in Michener (1941).

MALES

1. Mandibles largely yellow; propodeal enclosure impunctate or only narrowly punctate above; sixth and seventh terga simple, without subapical folds or ridges. (Palearctic)..................... *(serratulae)=byssina* (Panzer)

[1] The abbreviations for the collections are as follows: California Insect Survey, University of California, Berkeley (C.I.S.); Gerald I. Stage, Berkeley (G.I.S.); R. W. Thorp, Berkeley (R.W.T.).

Mandibles black; propodeal enclosure with broad punctate band above; sixth tergum with transverse subapical carina, seventh with a median longitudinal ridge and (except in *gummifera*) a variously modified subapical fold. (Nearctic) ....2.

2. Sixth tergum with posterior margin produced and subtruncate medially; mandible with distance from end of apical tooth to end of second tooth less than distance between apices of second and third teeth. (S. Arizona and Sonora, Mexico) ....*manni* Crawford

Sixth tergum with posterior margin evenly rounded; mandible with distance from end of apical tooth to end of second tooth greater than distance between apices of second and third teeth. (Cismontane California) ....3.

3. Cream colored facial maculations covering entire clypeus and sides of face truncate below level of antennae; labial palpus with segments 3 and 4 subequal in length; seventh tergum with a transverse, subapical, elevated fold enclosing a median, apical depressed, smooth, brown plate; eighth sternum with trilobed apex. (South Coastal, Transverse and Peninsular Ranges) ....*perdita* Cockerell

Cream colored facial maculations not covering entire clypeus nor lower sides of fact; clypeus with thin, black border laterally, increasing in width basally, lateral facial maculations when present, consisting of brownish spot on each side, about the size of larger clypeal punctures; labial palpus with third segment longer than fourth (ratio 4:3); seventh tergum without subapical fold or median, apical, depressed plate; eighth sternum with only a single median apical lobe. (San Francisco Bay area) ....*gummifera* Thorp

Females

1. Sixth tergum simple; propodeal enclosure impunctate or only narrowly punctate above ....(*serratulae*) = *byssina* (Panzer)

Sixth tergum with strong basal elevation; propodeal enclosure with broad punctate band above..2.

2. Labial palpus with segments 3 and 4 subequal in length; basal elevation of sixth tergum separated by vertical or overhanging fold from produced flange-like margin..*perdita* Cockerell

Labial palpus with third segment longer than fourth (ratio 4:3); basal elevation of sixth tergum with shallow median emargination....................
.... *gummifera* Thorp

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PACIFIC COAST ENTOMOLOGICAL SOCIETY

R. M. BOHART	LAURA M. HENRY	H. V. DALY	R. C. MILLER
President	*Vice-President*	*Secretary*	*Treasurer*

PROCEEDINGS

Two Hundred and Seventy-eighth Meeting

The 278th meeting was held Friday, 23 February 1962, at 8:00 P.M., in the Morrison Auditorium of the California Academy of Sciences, San Francisco, with President Bohart presiding.

Members present (36): C. Armin, F. L. Blanc, R. M. Bohart, J. S. Buckett, H. V. Daly, J. G. Edwards, W. E. Ferguson, D. Giuliani, R. H. Gonzales, R. H. Goodwin, A. A. Grigarick, Hilary Hacker, R. E. Hall, W. G. Iltis, M. E. Irwin, M. T. James, D. W. Jamieson, U. Kinet, R. L. Langston, H. B. Leech, D. D. Linsdale, P. Lounibos, C. D. MacNeill, J. W. and Jane MacSwain, H. L. McKenzie, A. E. Michelbacher, W. W. Middlekauff, J. A. Powell, D. C. Rentz, L. M. Smith, J. S. Snell, G. I. Stage, J. R. Stewart, J. W. Tilden, Nancy Twomey.

Visitors present (27): Margaret E. Bohart, R. M. Brown, W. M. Chaudhri, M. Collins, Stephanie Ferguson, W. A. Foster, G. W. Frankie, Mrs. R. H. Gonzalez, J. A. Hendrickson, D. H. and Karen Janzen, W. Knabke, V. V. Linsdale, J. B. and E. Lounibos, R. L. MacDonald, Martha Michelbacher, D. Miller, Ellen Y. Montgomery, Frances Powell, Judy M. Ross, Kaye Stage, R. H. Steinbruck, Jr., Catherine Toschi, G. G. Weaver, R. L. Westcott, Patricia Woolever.

The minutes of the meeting held 16 December 1961 were summarized.

Two new members were elected: A. A. Grigarick, Davis, California; J. R. Stewart, Berkeley, California.

Mr. L. Blanc presented slides and specimens of an introduced species of beetle, genus *Ceratophyus*, which produces undesirable tumuli near Lompoc, California.

Mr. Leech reported that Mr. Gordon Stace Smith of Creston, British Columbia, had died on February 19 and gave the following comments:

"A miner by profession, and largely self-educated, Mr. Stace Smith started to collect beetles seriously in the twenties, while living at Copper Mountain, B.C., and made the largest and best collection in the province. It is now at the University of British Columbia, Vancouver. His much smaller but important collection from the vicinity of Duparquet, Quebec, is in the California Academy of Sciences. Unfortunately he published very little, but many new species have been described from his material, especially by W. J. Brown. Mr. Stace Smith also gained recognition as a poet, and had two volumes of his poems published."

Dr. J. W. Tilden exhibited a photograph of the eggs of a wingless mecopteran.

Mr. Leech exhibited two photographs donated by Dr. E. C. Zimmerman, for the Historical File of the Pacific Coast Entomological Society. One shows the Brazilian entomologist Father T. Borgmeier, the other his laboratory.

The principal speakers for the evening were J. S. Buckett, D. Miller, and G. W. Frankie, undergraduate students in the Department of Entomology and Parasitology, University of California, Berkeley and Davis. Their presentation, illustrated with slides, was "Observations and Insect Collecting on the 49 Course at White Mountains in Eastern California."

A coffee social in the entomology rooms followed the meeting.—HOWELL V. DALY, *Secretary*

Two Hundred and Seventy-Ninth Meeting

The 279th meeting was held Friday, 30 March 1962, at 8:00 P.M., in the Morrison Auditorium of the California Academy of Sciences, San Francisco, with President Bohart presiding.

Members present (28): P. D. Ashlock, R. M. Bohart, H. V. Daly, C. J. DeMars, R. L. Doutt, J. Drew, J. G. Edwards, W. E. Ferguson, G. W. Frankie, J. K. Fujii, R. H. Gonzalez, P. A. Harvey, Laura M. Henry, M. Irwin, U. Kinet, H. Lange, R. L. Langston, H. B. Leech, J. A. Litsinger, C. D. MacNeill, H. L. McKenzie, J. A. Powell, F. E. Skinner, L. M. Smith, W. Stanger, J. R. Stewart, J. W. Tilden, Catherine Toschi.

Visitors present (17): Margaret E. Bohart, F. Catalano, Barbara B. Daly, Otilia Gonzalez, C. B. Huffaker, D. H. Janzen, E. Jessen, Alain Kinet, Pauline S. Lange, R. L. MacDonald, Y. Miyatake, F. Raney, Judy Ross, Edna Smith, Mrs. W. Stanger, Mrs. J. Stewart.

The minutes of the meeting held 23 February 1962 were summarized.

Four new members were elected: Catherine Toschi, G. W. Frankie, and J. K. Fujii, Berkeley, California; W. Stanger, Sacramento, California. In addition, Berta Kessel, San Francisco, California, was re-instated to membership.

Dr. R. L. Usinger announced that the Publications Committee was investigating a method for supporting the Pan-Pacific Entomologist by page charges.

Mr. H. B. Leech announced the death of Mr. J. B. Wallace on 14 March. Mr. Leech also noted that a letter from Mr. W. H. Edwards to Mr. W. G. Wright has been deposited in the historical file.

Dr. J. A. Powell displayed the adult moth, *Laspeyresia deshaisiana* (Lucas), which had been reared from commercial Mexican Jumping Beans.

Dr. C. Don MacNeill reported the occurrence of the lycaenid *Callophrys fotis* Strecker in the San Bruno Mountains and gave the following comments:

"This butterfly has not been known to occur in the Bay Area; it was known previously in the Coast Ranges only south of Monterey Bay. A female captured by D. C. Rentz first attracted attention to the population which was at that time apparently associated with the succulent *Echeveria*. Subsequent work in the area has indicated, however, that the insect is definitely associated with *Sedum*, which is the recorded larval food plant for the populations of this species on Vancouver Island."

Dr. H. Lange showed slides and gave an informative talk on the damage to range lands by crane flies.

The principal speaker of the evening was Dr. L. M. Smith, Department of Entomology, University of California, Davis. His illustrated lecture was on "A discussion of the family Japygidae."

A coffee social in the entomology rooms followed the meeting.—HOWELL V. DALY, *Secretary.*

Two Hundred and Eightieth Meeting

The 280th meeting, the annual field day, was held Saturday, 12 May 1962, on the northeast slope of Mt. Diablo at Russelmann Park, Contra Costa County, California, with President Bohart presiding.

Members present (12): P. D. Ashlock, R. M. Bohart, Lois R. Breimeier, H. V. Daly, W. E. Ferguson, R. L. Langston, H. B. Leech, A. E. Michelbacher, W. W. Middlekauff, C. W. O'Brien, F. E. Skinner, W. Stanger.

Visitors present (20): Margaret Bohart, Barbara and Diane Daly, Kathy Engelbert, Rick and Robin Ferguson, Ann and Bruce Langston, Martha Michelbacher, Phyllis and Dave Middlekauff, Jean, Roger, David and Susan Skinner, Mildred Stanger, N. Ueshima, Mr. and Mrs. Villanueva.

The facilities of this private recreational area were reserved for the use of the Society including picnic tables, swimming pool, and a sports field. The members hunted vigorously for a wingless mecopteran alleged to be common in the tall grass on the nearby slopes. Three were caught.—HOWELL V. DALY, *Secretary.*

Two Hundred and Eighty-First Meeting

The 281st meeting was held Friday, 12 October 1962, at 7:45 P.M., in the Morrison Auditorium of the California Academy of Sciences, San Francisco, with President Bohart presiding.

Members present (29): R. P. Allen, R. M. Bohart, D. J. Burdick, W. M. Chaudhri, H. V. Daly, J. G. Edwards, W. M. Gilbert, R. H. Goodwin, M. E. Irwin, D. H. Janzen, U. Kinet, T. H. Lauret, J. F. Lawrence, H. B. Leech, C. D. MacNeill, P. M. Marsh, H. L. McKenzie, A. S. Menke, W. H. Nutting, C. W. and Lois O'Brien, F. D. Parker, J. A. Powell, D. C. Rentz, C. J. Rogers, J. Snell, G. I. Stage, L. A. Strange, J. W. Tilden.

Visitors present (35): P. Allen, W. M. Brooks, Barbara Daly, J T. Doyen, S. W. Earnshaw, Mrs. J. G. and Janie Edwards, Dr. and Mrs. F. A. Ellis, B. P. Gabriel, Kathleen Hale, J. A. Hendrickson, Jr., Karen Janzen, Alain Kinet, E. W. Kirchbaum, T. E. and L. Magarian, M. and S. Marquis, P. C. Mayer, Virginia B. McKenzie, Karen Menke, Ellen Montgomery, Irene Pogojeff, Mr. and Mrs. A. Raske, P. A. Rude, Jr., D. Sanders, E. Slobodchikoff, Kaye N. Stage, Mr. and Mrs. L. D. Thurman, D. Veirs, V. Vesterby, R. L. Westcott.

The minutes of the meeting held 12 May 1962 were summarized.

Six new members were elected: C. Johnson, Socorro, New Mexico; S. F. Cook, Jr., Lakeport, California; W. M. Horner, W. M. Chaudhri, W. Gilbert, Davis, California; D. H. Janzen, Berkeley, California. In addition, P. P. Cook, Seattle, Washington, and S. Piazza, San Jose, California, were reinstated to membership.

Dr. J. G. Edwards displayed a vial containing 47 specimens of a very rare little beetle, *Brathinus* sp. (Family Brathinidae) and gave the following comments:

"These beetles, along with several dozen more, were packed into pits and galleries in a dead, floating piece of branch in an eddy with lots of froth. This is the first record known for this family in Wyoming. The larvae of the family are unknown, and the male genitalia have not been described. He hopes to return to Yellowstone next summer and collect larvae. The habitat in which these beetles are usually collected is among grass roots near the edge of streams. Two species are known from eastern United States and one from California, Washington, Oregon, and Idaho. Superficially they resemble Anthicidae, but have slightly abbreviated elytra, prominent ocelli, and are very active runners when disturbed. They are said to lack the ability to fly, but in *these* specimens the rear wings appear to be very well developed."

The recent death of Mrs. Ralph Hopping, of Vernon, British Columbia, was reported by Mr. Leech with the following comments:

"It was by her generosity that the California Academy of Sciences was given the important R. Hopping collection of beetles in May, 1948."

Mr. Leech also mentioned the recent gift of a valuable collection of beetles from Burdette E. White, a former student under Dr. E. C. Van Dyke at Berkeley, and now District Superintendent of the Perris Union High School District. The beautifully prepared material received to date is especially rich in Buprestidae.

Leaflets were distributed bearing the announcement of "Pacific Insects Monograph 4. Taxonomy, Zoogeography, and Evolution of Indo-Australian *Theronia* (Hymenoptera: Ichneumonidae)" by V. K. Gupta. The publication, consisting of 142 pages, 29 figures, and 15 maps, is $3.50, in the bound form, from the Entomology Department, Bishop Museum, Honolulu 17, Hawaii.

Jerry A. Powell presented the following note and exhibited specimens of the cocoons and insects reared:

"During a search of *Quercus agrifolia* in San Francisco and Berkeley last January, Don MacNeill and I found numerous cocoons attached to the bark. These were quite cryptic in appearance and color and were of two types. The first, a hardened, cylindrical, blunt cocoon, was extremely common on some trees and was found to be that of the tenthredinid, *Periclista linea* Stannard (det. W. W. Middlekauff). Upon emergence the sawfly cut a circular hole at one end of its cocoon, leaving a ready made shelter for other organisms. In the habitat thus created, we found remains of various alien cocoons, gelechiid moth pupal shells, a pupating larva of *Hemerobius*, cleroid beetle larvae, *Byturus* beetles, pseudoscorpions, unidentified eggs, etc. The cocoons must be very persistent since nearly all showed emergence holes, and only one *P. linea* was reared from the unopened ones collected. Others contained dead adults or larvae. The second type of cocoon, which proved to be that of the nolid moth, *Celama minna* Butler, was much less common and evidently less persistent, since most of those found contained living pupae. These cocoons were of a more pliable nature and were less symmetrical in shape, with the margins more closely appressed to irregularities in the bark. Both types were frequently covered, along with surrounding areas of the bark, by a one-celled green alga, *Pleurococcus* (det. I. I. Tavares), which added to the cryptic concealment of the cocoons."

The principal speakers of the evening were L. Stange and F. D. Parker, graduate students in the Department of Entomology and Parasitology, University of California, Davis. Their subject, illustrated with slides, was "Problems and Rewards of Collecting Insects in Mexico."

A coffee social in the entomology rooms followed the meeting.—Howell V. Daly, *Secretary*.

Two Hundred and Eighty-Second Meeting

The 282nd meeting was held Friday, 16 November 1962, at 7:45 P.M., in the Morrison Auditorium of the California Academy of Sciences, San Francisco, with President Bohart presiding.

Members present (29): R. M. Bohart, D. C. Brodahl, W. M. Brooks, H. V. Daly, R. L. Doutt, J. G. Edwards, W. E. Ferguson, N. E. Gary, R. H. Goodwin, R. E. Hall, D. H. Janzen, U. Kinet, R. Langston, H. B. Leech, C. D. MacNeill, J. W. and Jane MacSwain, D. C. Rentz, C. J. Rogers, F. E. Skinner, C. Slobodchikoff, G. I. Stage, H. E. Stark, J. Stewart, Catherine Toschi, Nancy Twomey, C. A. Vickery, D. Viers, V. B. Whitehead.

Visitors present (17): H. C. Brodahl, L. E. Caltagirone, M. Collins, Barbara and Diane Daly, L. A. Falcon, E. H. Feinberg, Kathleen A. Hale, Karen Janzen, E. Jessen, Alain Kinet, Evelyn Langston, Irene Pogojeff, Judy Ross, Kaye N. and Monica D. Stage, M. Tauber.

The minutes of the meeting held 12 October 1962 were summarized.

Six new members were elected: W. M. Brooks, D. Veirs, Berkeley, California; N. E. Gary, Davis, California; C. Slobodchikoff, San Francisco, California; C. A. Vickery, Jr., Santa Clara, California; V. B. Whitehead, Albany, California.

Appointments to two committees were made: nominating, W. E. Ferguson, Chairman, R. L. Doutt and C. D. MacNeill; and auditing, J. A. Powell, Chairman, and H. B. Leech.

Mr. Leech gave notice of the death, on October 28, of Georg Pronin and made the following comments:

"Mr. Pronin arrived in this country early in 1951, via Germany, as a refugee from Russia. He held a degree in forest engineering, entomology, from the University of Prague, and had operated an entomological field station near Lutzk, Poland. He was skillful at rearing Lepidoptera, and during the summers of 1951 and 1952, while employed by the California Academy of Sciences, had working space at the U.S.D.A. forest entomology laboratory at Hat Creek, Shasta County."

The principal speaker of the evening was Dr. Norman E. Gary, Department of Entomology and Parasitology, University of California, Davis. His presentation, illustrated by a movie, was "Mating Behavior of the Honeybee."

A coffee social in the entomology rooms followed the meeting.—Howell V. Daly, *Secretary*.

Two Hundred and Eighty-Third Meeting

The 283rd meeting was held Friday, 14 December 1962, at 7:45 P.M., in the Morrison Auditorium of the California Academy of Sciences, San

Francisco, with President Bohart presiding.

Members present (51): L. C. Armin, P. H. Arnaud, Jr., W. F. Barr, R. M. Bohart, D. J. Burdick, H. V. Daly, R. L. Doutt, J. G. Edwards, W. E. Ferguson, G. W. Frankie, N. E. Gary, R. H. Goodwin, P. A. Harvey, P. D. Hurd, Jr., M. E. Irwin, D. H. Janzen, U. Kinet, D. H. Kistner, H. B. Leech, D. D. Linsdale, P. Lounibos, C. D. MacNeill, J. W. and Jane MacSwain, P. M. Marsh, H. L. McKenzie, A. S. Menke, C. W. and Lois O'Brien, F. D. Parker, J. A. Powell, D. C. Rentz, C. J. Rogers, T. N. Seeno, W. E. Simonds, F. E. Skinner, C. Slobodchikoff, S. D. Smith, R. R. Snelling, G. I. Stage, L. A. Stange, W. Stanger, H. E. Stark, J. R. Stewart, J. E. Swift, J. W. Tilden, Nancy Twomey, R. L. Usinger, C. A. Vickery, Jr., D. Veirs, V. B. Whitehead

Visitors present (20): Barbara Barr, L. E. Caltagirone, Stephanie Ferguson, G. B. Frei, B. P. Gabriel, Joyce Gary, Kathleen Hale, J. B. Lounibos, Marilyn McCormack, Virginia McKenzie, Karen Menke, Ellen Montgomery, Trudy Noller, Irene Pogojeff, F. C. Raney, Nancy Rechen, Judy Ross, R. L. Westcott, R. H. Whitsil, Judith Williamson.

The minutes of the meeting held 16 November 1962 were summarized.

Two new members were elected: M. A. Cazier, Tempe, Arizona; G. Grodhaus, Berkeley, California. In addition, B. Keh was reinstated to membership in the Society.

The reports of the Treasurer and the auditing committee were read by J. A. Powell. The financial records of the past year were in order. Both reports were accepted by the Society.

W. E. Ferguson, chairman of the nominating committee, presented the names of the nominees, and the following people were elected as Society officers for 1963: President, Richard M. Bohart; Vice-President, Jerry A. Powell; Secretary, Howell V. Daly; Treasurer, Robert C. Miller.

R. L. Usinger announced that the Executive Board of the Society had instituted a procedure for page charges. (The details of the arrangement are printed inside the front cover of this issue.)

J. A. Powell gave the following note and exhibited accompanying specimens.

"On October 21, 1962, while burning some rather green eucalyptus and elm branches and leaves at Walnut Creek (foot of shell ridge), Contra Costa County, I noticed *Melanophila* beetles flying about. Ten specimens were taken by hand within three feet of the small, smoky fire, alighting on the ground and on my clothing inside an hour after the fire was started, between 3:00 and 4:00 p.m. (P.D.T.). A hygrothermograph nearby recorded the air temperature as 71-73° F and the relative humidity as 45-47 per cent during this period. The collection includes two species (members of the subgenus *Melanophila)*, nine specimens of *M. consputa* LeConte and one of *M. acuminata* DeGeer (det. P. D. Hurd, Jr. and H. B. Leech). Both species are pine feeders which have been recorded as involved in attraction by burning trees, smelters, etc. Most of these reports have concerned very hot fires or large amounts of smoke, and there has been some debate in the literature as to whether the attraction is by heat or smoke. In the present case there was very little in the way of a blaze but considerable smoke, which was carried off close to the ground by a light, steady breeze. A similar fire was burned on October 28 (62-64° F and 60-66% R.H.), but no beetles were observed."

W. E. Ferguson displayed specimens and presented the following note on the behavior of nocturnal male mutillid wasps:

"Males of the nocturnal Mutillidae rarely have been observed except when attracted to lights. Especially in the deserts, when nocturnal temperatures are well above 70° F, males may swarm around lights with species of *Brachycistis* and other noctural Tiphiidae. For many years I have searched for these nocturnal wasps during the day in areas where they were found abundantly at night. These areas usually have been sandy or gravelly and have not contained many rocks more than an inch or two across. I have always turned over wood, bricks, pieces of concrete, and other natural or unnatural objects, without exposing mutillids. At several localities I have also searched through leaf litter beneath shrubs with negative results. I recently summarized our knowledge of the behavior of nocturnal Mutillidae (1962. Univ. Calif. Publ. Ent., 27 (1):1-92) with the speculation that the adults must spend the day in burrows or cracks in the soil.

"A recent observation suggests that at least under some circumstances the males normally do spend daylight hours concealed under leaf litter close to the trunks of desert shrubs. On October 6, 1962, I stopped shortly before dusk to collect along U.S. Highway 466, at Lost Hills, 20 miles west of Wasco, Kern County, California. No mutillids were found crawling on the smooth bare ground although they were constantly searched for, and none were swept from any of the desert shrubs. However, at dusk, during the fifteen minutes or so before darkness (light insufficient to see details on the vegetation), a single male *Odontophotopsis* was found motionless on the end of a twig. The specimen was captured and other shrubs were examined quickly in the failing light. As many as five specimens were found on some shrubs, while none could be found on others. When darkness came (observation almost impossible), some of the males moved to new positions on the plants and flew away without first being disturbed. Those which still were motionless flew immediately if I touched the twigs on which they rested.

"Four aspects of the observations bear emphasis: (1) although extensive bare soil surrounded each shrub, no mutillids were seen on the ground; (2) the small shrubs, of *Atriplex polycarpa* (determined by C. W. Sharsmith), were about three feet in height and had a relatively open growth form and sparse leaves, thus facilitating examination for insects; (3) the brownish-colored mutillids were easily found because they contrasted in color with the whitish leaves and twigs in fruit, but they were most obvious on the fine terminals of dead branches; and (4) the period of time when mutillids were seen on the plants was very brief, thus greatly limiting the chance of observing them.

"In the first hour of darkness, after it was impossible to see insects, the air temperature was favorable for flight, and additional specimens were collected at the automobile headlights. Only two species of *Odontophotopsis* were found in this locality: 27 specimens of the common and widespread

O. cooki Baker, and 17 specimens of an unidentified species.

"On July 7, 1961, 2 miles west of Carson City, Nevada, at the mouth of King's Canyon, I also collected two specimens of a nocturnal tiphiid at dusk from low plants with sparse foliage.

"Apparently, at dusk, when insects scarcely can be seen, the nocturnal male mutillids and tiphiids crawl from their diurnal hiding places in leaf litter among the trunks of shrubs and climb to terminal branches. There they wait motionless until the sky is dark enough to stimulate them to fly and begin searching for the females."

The address by President Bohart was entitled "Fashions and Fancies in the Realm of Systematics."

A coffee social in the entomology rooms followed the meeting.—HOWELL V. DALY, *Secretary.*

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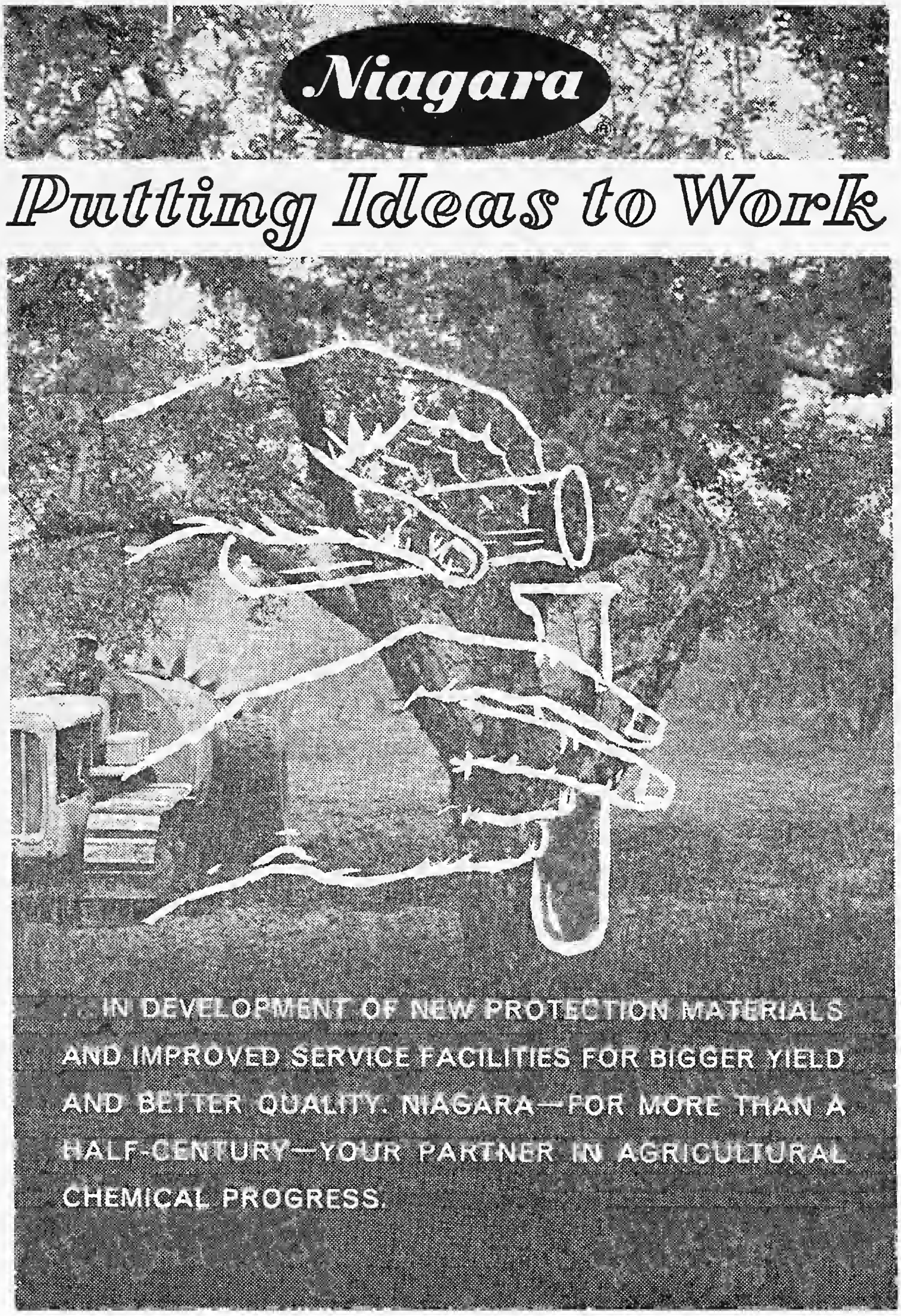
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Vol. XXXIX APRIL, 1963 No. 2

THE PAN-PACIFIC ENTOMOLOGIST

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SAN FRANCISCO, CALIFORNIA • 1963

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THE PAN-PACIFIC ENTOMOLOGIST

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The annual dues, paid in advance, are $5.00 for regular members or $6.00 for subscriptions only. Single copies are $1.50 each or $6.00 a volume. Make checks payable to ***Pan-Pacific Entomologist.***

Application for membership in the society should be addressed to Dr. H. V. Daly, Secretary, 112 Agriculture Hall, University of California, Berkeley 4.

PAGE CHARGES

At the last meeting of the Executive Committee it was decided that all papers of more than one printed page are to be charged at the rate of $10.00 per page. This is in addition to the usual charges for illustrations and reprints. The compelling reasons for this decision are the large backlog of manuscripts and the severe restrictions of a relatively fixed income based on subscriptions and the constantly rising costs of printing.

It is not intended that page charges be paid by individuals. Publication is now generally recognized as an integral part of the research process and should be charged to the institution or grant that supported the research. Private investigators should note on their bill "No budgeted funds," "No grant funds," or "No institutional support." This notation will suffice as an application to the Society for a personal grant which will be made automatically from a special fund set aside for this purpose. The Publication Committee wishes to emphasize that articles are accepted or rejected only on the basis of merit. The editor's decision to publish will always be made before the page charge is assessed.

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The Pan-Pacific Entomologist

Vol. XXXIX April, 1963 No. 2

KEY TO DIPLOTAXIS OF BAJA CALIFORNIA

(Coleoptera:Scarabaeidae)

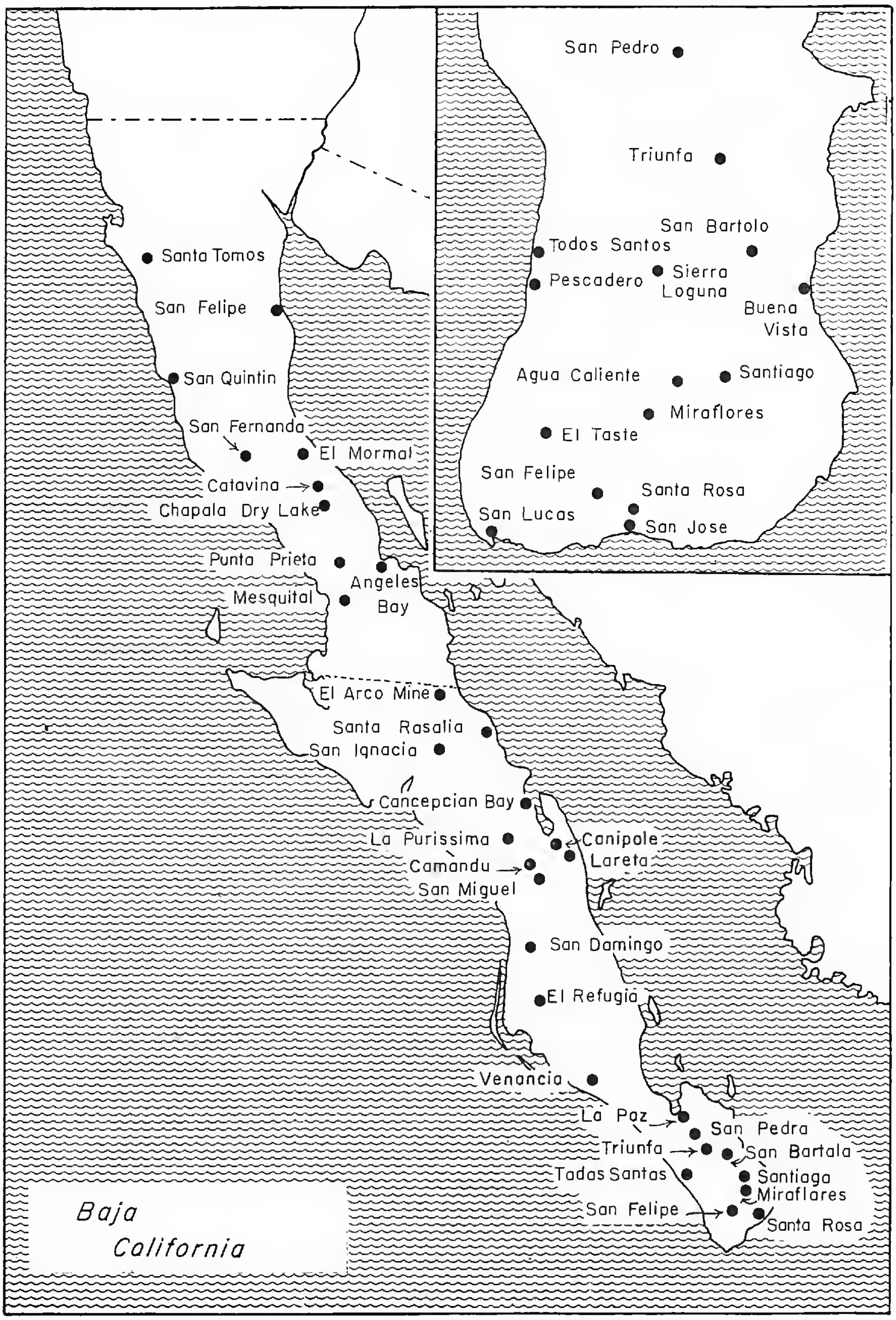
Patricia Vaurie

American Museum of Natural History, New York

Fifteen of the 220 species of this New World genus of scarab beetles occur in the peninsula of Baja California, Mexico (fig. 1). They are included in my recent monographic study (Vaurie, 1958, 1960), but are presented here separately because I believe that regional keys are useful in a genus as large and as difficult as this one.

These species, moreover, are of special interest because they are highly endemic, nine of the 15 being restricted to Baja California *(academia, anthracina, australis, confusa, flexa, mascula, parpolita, polita, punctulata)*, and *missionaria* virtually so, as it is found sparingly outside of Mexico only just across the border in San Diego County, California. Four of the above have not been recorded from north of the Cape region, and two not north of the southern territory of the peninsula. It is interesting, secondly, that none of the "hairy" species is represented in Baja California (species with dorsal pubescence on the elytra and/or on the pronotum), all the species being glabrous except for six that have the clypeus alone hairy. Thirdly, one of the most unusual species of the genus occurs exclusively in Baja California, a species *(anthracina)* in which males are unique in possessing a huge inner claw on the front tarsus that is twice the size of the outer claw.

Of the remaining five species, one *(fimbriata)* occurs also in California, and four *(knausii, moerens, pacata, subangulata)* occur in California as well as in a number of the other southwestern states; *subangulata,* which has a larger range, is found also in the northwestern states and in Canada and, at the other extreme, in northern Chihuahua, Mexico. However, *fimbriata, knausii,* and *pacata* descend into Baja California in the most northern portion only. The species *moerens* is apparently polytypic, the nominate race occurring in the western United States, Sonora, and the northern half of the peninsula, and *moerens peninsularis* in the southern part from Concepcion Bay to the Cape region. These five species are in the *frondicola* and *moerens* species groups, whereas the endemic species are in the *planidens, punctulata,* and *trapezifera* groups, but all these groups contain species found also outside of the region, there being about 37 groups in the genus. Of the six species of the *trapezifera* group in Baja California *(academia, confusa, flexa, mascula, parpolita, polita)*, which are often diffi-



Explanation of Figures

Fig. 1, Localities where *Diplotaxis* have been collected.

cult to identify without examination of the male genitalia, two *(mascula* and *parpolita)* are known so far from males only.

Nearly twice as many species are recorded from the state of Sonora across the gulf, but they are not restricted to Sonora (with the possible exception of *D. obregon,* known from two specimens only). Sonora, of course, receives the majority of its species from Arizona, which has about 55 species recorded, whereas only four Arizona species reach Baja California. The same four occur in California and Baja California (California has about 20 species of *Diplotaxis*). These estimates of the number of species in various states and of the geographic ranges are based on a total of some 50,000 specimens examined, 3,200 of which were from Baja California. Except for some 1000 *subangulata* from Santo Tomas, the Baja California material is from the collection of the California Academy of Sciences in San Francisco.

Although there are many secondary sexual characters present throughout the genus (see Vaurie, 1958, p. 278; 1960, p. 178), and although sexual dimorphism is strong and constant in a few species, there is no single external character that distinguishes the sexes for all species. In general, and in the majority of the Baja California species, males differ from females in one or more of the following ways: by having a longer and narrower first segment on the hind tarsus (as long as, or longer than, the longest spur on the tibia), narrower hind femora, a shorter fifth segment of the abdomen (shorter at middle than the fourth, see figs. 2, 3), and a broader, more transversely oval, not at all pointed, pygidium. In Baja California, males of the *trapezifera* group have the clypeus shaped differently from that of females, it being either more emarginate in front in males or having sharper, angulate, not rounded, lateral angles.

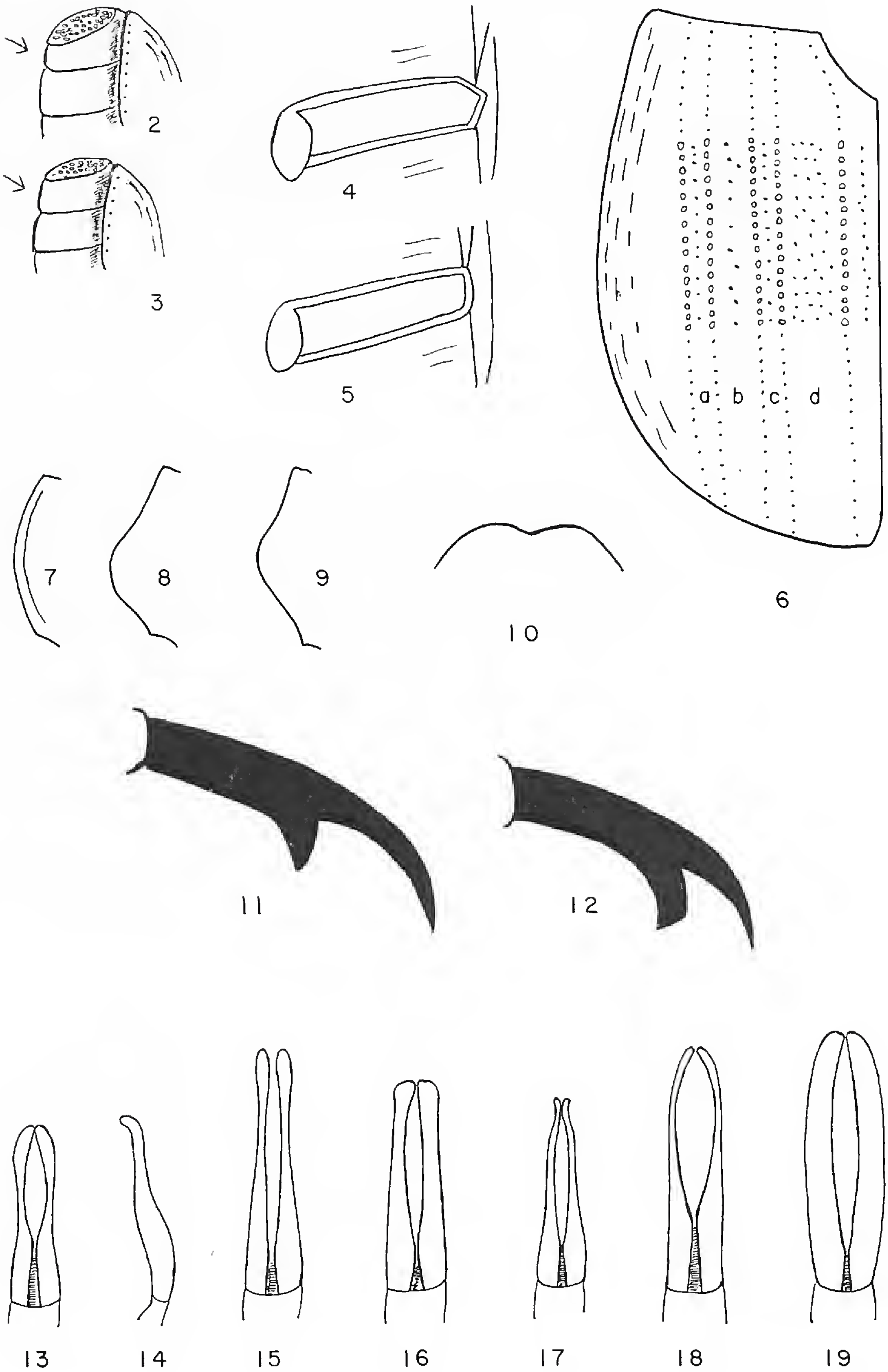
KEY TO SPECIES OF *Diplotaxis* IN BAJA CALIFORNIA

1. Labrum deeply cleft at middle, forming two lobes........ 2
   Labrum flat or concave, not forming lobes........ 3
2. Front of head at middle deeply, triangularly impressed; extreme northern part........ *knausii* Schaeffer
   Front of head not impressed; southern territory........ .... *moerens peninsularis* Fall
3. Clypeus with disc (viewed best in profile) with erect hairs (hairs may be worn except at front edge); lateral angles of clypeus angulate in males 4
   Clypeus without discal hairs, angles and front usually rounded........10

4. Front of head directly behind clypeus triangularly impressed or concave at middle; occurring throughout peninsula....5
   Front of head slightly convex to clypeus or with transverse "frown" over clypeus; restricted to Cape region (except for *academia)*.... 6
5. Marginal hairs of elytra (in fresh specimens) distinctly longer than scutellum; pronotal sides bulging abruptly at or behind middle (fig. 9); elytral punctuation coarse, dense, deep; male genitalia as in fig. 15; San Fernando in north, south to Cape region....*confusa* fall
   Marginal hairs of elytra not much longer than width of a sutural interval; pronotal sides strongly, but usually evenly arcuate; elytral punctuation shallow, rather sparse, fine; male genitalia as in figs. 13, 14; San Quintin in north, south to Cape region ....*academia* Vaurie (in part)
6. Usually less than 7 mm. long and pale; elytra rather sparsely punctate, second interval (fig. 6b) with one row, often irregular, of punctures ....*academia* Vaurie (in part)
   Usually at least 7 mm. long (to 10 mm.) and darker; elytra crowded with punctures, second interval usually with two rows of confluent punctures 7
7. Pronotum (viewed from above) with lateral margin at base interrupted and partially concealed because of bending down and under of hind angle; hind coxal plate with sides angulate, angles fitting over edge of elytral margin (fig. 4); male genitalia as in fig. 18....*flexa* Vaurie
   Pronotum with leateral margin at base readily visible at hind angle; hind coxal plate with sides rounded or truncate (fig. 5).... 8
8. Genitalia of male with basal piece of same length as lateral lobes, lobes very wide (fig. 19, but length of basal piece not shown) ....*parpolita* Vaurie
   Genitalia of male with basal piece longer than lobes.... 9
9. Genitalia of male as in fig. 16....*polita* Fall
   Genitalia of male as in figs. 14, 17....*mascula* Vaurie
10. Sides of pronotum gently or scarcely arcuate and/or broadly impressed along edge, especially toward base (fig. 7)....11
   Sides of pronotum strongly arcuate or sinuate and bulging at or behind middle (fig. 8), not broadly impressed along edge....15
11. Elytral surface between large punctures covered densely with tiny punctulations; size from 13 to 17 mm.; Comondu in southern territory south to Cape region....*punctulata* Horn
   Elytral surface virtually impunctate between large punctures; usually smaller than 13 mm. 12

Explanation of Figures

Figs. 2-19, Some anatomical characters of *Diplotaxis*. Fig. 2, abdomen of male. Fig. 3, abdomen of female. Figs. 4, 5, angulate and truncate hind coxal plate. Fig. 6, left elytron, a and c, striae; b, second interval; d, first interval. Figs. 7-9, pronotal margins. Fig. 10, bisinuate clypeus. Fig. 11,



tarsal claw toothed near middle. Fig. 12, tarsal claw cleft subapically. Figs. 13-19, male genitalia of *trapezifera* group. 13, *D. academia,* dorsal view; 14, *D. academia* and *D. mascula,* profile; 15, *D. confusa;* 16, *D. polita;* 17, *D. mascula;* 18, *D. flexa;* 19, *D. parpolita.*

12. Marginal hairs of pronotum and elytra short, inconspicuous; clypeus bisinuate (fig. 10); labrum strongly concave throughout; northern border south to San Ignacio................*moerens moerens* LeConte
    Marginal hairs of pronotum and elytra at least as long as scutellum; clypeus truncate or rounded or broadly emarginate; labrum flat or convex, at least in front..13
13. Tarsal claws with ungual tooth near middle (fig. 11); males with tarsal segments normally hairy; northern quarter......*fimbriata* Fall (in part)
    Tarsal claws cleft subapically (fig. 12); males with first two or three tarsal segments densely bristly; Punta Prieta in north, south to Cape region..14
14. Larger (9 to 13 mm.); inner edge of eye flush with front of head; males with inner front claw twice as large as outer....*anthracina* Fall
    Smaller (7 to 9 mm.); eyes sunk below level of front of head; males with front claws equal in size........*australis* Vaurie (in part)
15. Tarsal claws with ungual tooth near middle (fig. 11)........................16
    Tarsal claws cleft subapically (fig. 12).. 18
16. Front of head transversely swollen or tumid so that, in profile, it overhangs clypeus; northern border south to El Refugio........ ....*subangulata* LeConte (in part)
    Front of head uniformly convex, not transversely tumid; northern quarter 17
17. Last segment of larger (maxillary) palpi distinctly impressed at base; marginal hairs of elytra usually twice as long as scutellum; pronotum coarsely, densely, deeply punctate, its margins evenly arcuate from base to apex (fig. 7); generally longer than 9 mm...................................*fimbriata* Fall (in part)
    Last segment of maxillary palpi flattened at base, but not impressed; marginal hairs of elytra not or scarcely longer than scutellum; pronotum generally finely, shallowly, sparsely punctate, its margins abruptly bulbous behind middle, thence sinuate to apex (fig. 8); less than 9 mm.......................................*pacata* Fall
18. Elytra with second interval (fig. 6b) usually with single row of punctures; front of head strongly transversely tumid; males with normally hairy soles on hind tarsus (apex of each segment with 7 to 9 or fewer long bristles); south to El Refugio............ ....*subangulata* LeConte (in part)
    Elytra with second interval usually with double row of punctures; front of head not or but weakly tumid; males with soles of at least basal segment of hind tarsus with so many long bristles that segment beneath is scarcely visible...................................19
19. Southern territory (Santa Rosalia to Cape region); clypeus emarginate between blunt prominent angles; each eye nearly one-fourth of width of head across front; males with dense bristles on soles of at least first three segments of all tarsi.................. ....*australis* Vaurie (in part)

Northern part (south to Santa Rosalia); clypeus not or scarcely emarginate between blunt not prominent angles; each eye one-fifth or one-sixth of width of head; males with dense bristles on first, occasionally on second, segment of hind tarsus only........ .... *missionaria* Vaurie

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1958. A revision of the genus *Diplotaxis* (Coleoptera, Scaraeidae, Melolonthinae). Part 1. Bull. Amer. Mus. Nat. Hist. 115:267—396.

1960. [Same title.] Part 2. *Ibid.*, 120:165—433.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

NOTICE OF PROPOSED USE OF PLENARY POWERS IN CERTAIN CASES (A. [N.S.] 57)

In accordance with a decision of the 13th International Congress of Zoology, 1948, public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following cases, full details of which will be found in *Bulletin of Zoological Nomenclature*, Vol. 20, Part 2 to be published on 11 April 1963.

(2) Suppression of certain Aphid names of Rafinesque (Insecta, Hemiptera). Z.N.(S.) 327;

(3) Designation of a type-species for *Mymar* Curtis, 1829 (Insecta, Hymenoptera). Z.N.(S.) 479;

(5) Validation of *Psylla* Geoffroy, 1762 and suppression of *Chermes* Linnaeus, 1748 (Insecta, Hemiptera). Z.N.(S.) 1515.

Any zoologist who wishes to comment on any of the above cases should do so in writing, and in duplicate, as soon as possible, and in any case before 11 October 1963. Each comment should bear the reference number of the case in question. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature*. Those received too late for publication will, if received before 11 October 1963, be brought to the attention of the Commission at the time of commencement of voting.

All communcations on the above subject should be addressed as follows: The Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London, S.W. 7, England.—W. E. CHINA, *Acting Secretary to the International Commission on Zoological Nomenclature.*

NOTES ON A COLLECTION OF TIMEMA BOHARTI TINKHAM

(Phasmodea: Timemidae)

David C. Rentz
California Academy of Sciences, San Francisco

E. R. Tinkham (1944) described *Timema boharti* on the basis of two specimens from Borrego, California in his review of the genus. Only once subsequently has anything appeared in the literature concerning this interesting and relatively archaic orthopteroid group. H. F. Strohecker (1951) described the large *T. knulli* from Monterey County, California. My visit to the Pinyon Flats area in Riverside County, California during the latter part of April 1962 yielded a large series of *T. boharti.*

The Pinyon Flats area is in the Santa Rosa Mountains. The habitat is xeric pinyon-juniper with chaparral intrusions, and the *T. boharti* were taken at approximately 3,000 feet. The entire series of specimens was taken at night. Mating pairs as well as last instar nymphs, some molting, were found. Heretofore, this species was known only in the grey color phase. This timema, however, is dichromatic as are most other species of the genus. Green and grey color phases were taken with no indications of intermediates. It was of particular interest that mating pairs were segregated by color.

Specimens were found on *Yucca schidigera, Y. whipplei,* Pinyon Pine *(Pinus parryana),* and a single pair was taken *in copulo* on *Eriogonum fasciculatum.* The majority of specimens was taken on *Y. whipplei.* The acrid odor commonly released by timemas when handled was quite noticeable, and seemed to me to be similar to that of *T. californica* Scudder, the species with which the author is quite familiar.

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Strohecker, H. F.
1951. Three new species of North American Orthoptera. Ann. Ent. Soc. Amer. 44:169-172.

Tinkham, E. R.
1944. A new Californian species of *Timema* with zoogeographical notes. Bull. S. California Acad. Sci., XLI (2):72-79.

SOME UNDESCRIBED NORTH AMERICAN MALTHINI[1]

(Coleoptera:Cantharidae)

KENNETH M. FENDER

Linfield Research Institute, McMinnville, Oregon

A small selection of Malthini recently received from Dr. J. N. Knull of Ohio State University, contained representatives of three undescribed species of the genus *Malthinus* and one of the genus *Malthodes*. Dr. and Mrs. Knull seem to have a faculty for collecting the rare and novel species in this tribe. They collected the types of one species of *Malthinus* and six of *Malthodes* as well as numerous paratypes of other species included in my original study of this tribe. Types of the four species described here are to be deposited in the Knull collection.

The key to the species of the genus *Malthinus* is herein revised to accomodate the new species described below.

Malthinus chisosensis Fender, new species

(figs. 1, 2)

Black, head in front of eyes dark brown, prothorax reddish orange, elytral apices dark olivaceous, abdominal sternites 3 to 5 rather widely testaceous apically and at sides, more widely so towards the sides, pubescence cinerous, fine, sparse and sub-decumbent. Length of male: 3 mm.

Male.—Head feebly shining, wider than pronotum, finely sparsely punctured, eyes prominent, antennae moderately slender, segments 2 to 4 progressively longer, intermediate segments about 4 times as long as wide; pronotum shining, transverse, about a third wider than long, anterior margin arcuate and narrowly beaded to the feebly produced and obliquely truncate anterior angles, sides feebly arcuate, nearly parallel, hind angles obtusely rounded, basal margin more strongly arcuate than anterior margin, guttered, more strongly so towards the sides, disc finely rather closely punctured; scutellum finely punctured, apex triangularly notched; elytra abbreviated, extending to apices of the metacoxae, apically narrowed and dehiscent, coarsely, confusedly rugose punctate to the tumid and finely punctured apices; body beneath finely closely punctured, a little more sparsely, coarsely so on abdominal sternites; male terminal abdominal segments: apical margin of fifth sternite broadly emarginate, apex of the emargination truncate, sides sinuate; sixth sternite widely, deeply, concavely emarginate; seventh sternite narrowly deeply emarginate, apex of the emargination arcuate, as viewed ventrally, two overlapping plates in the emargination of the seventh sternite, above this a long, slender, apically forked ventral accessory process, forks narrowly separated, the tips acute; ultimate tergite longer than broad, narrowed medially, subtruncately rounded apically; as viewed laterally, ventral acces-

[1] Supported by National Science Foundation grant #NSF-G15881.

[2] Malthini of North America. Fender, Amer. Midl. Nat., 1951, 4(3):513-629.

sory process arcuately ascending, above this a slender, straight, rod-like appendage directed distad, the tip rounded, ultimate tergite ovate.

Female.—Unknown.

Holotype male from CHISOS MTS. TEXAS, July 8, 1955, was collected by D. J. & J. N. Knull.

Malthinus knulli Fender, new species

(figs. 3, 4)

Head rufous, clypeus brunneous, eyes, antenna and palpi black, a wide arcuate black interocular fascia, prothorax rufous, scutellum, elytra, rest of body beneath the legs black, pubescence aureous, short, fine and sparse. Length of male: 4 mm., female 4.5 mm.

Male.—Shining, head wider than pronotum, suborbicular, arcuately narrowed behind eyes to neck, finely sparsely punctured in front of eyes, more coarsely so behind and on neck, eyes prominent, antenna moderately slender, extending to tip of abdomen, second segment about three fourths the length of third, third and fourth segments equal, intermediate segments about four times as long as wide; pronotum transverse, about a third again as wide as long, anterior margin arcuate and widely beaded, anterior angles rounded, sides deflected, narrowly arcuate to feebly prominent and obtusely rounded hind angles, basal margin arcuate towards sides, shallowly emarginate medially, widely beaded, disc smooth, sparsely micropunctuate; scutellum finely punctured, apex widely shallowly emarginate; elytra short, apically dehiscent, extending to apices of metacoxae, coarsely, sparsely, confusedly rugose-punctate, apices rounded and finely, more closely punctured; body beneath finely, moderately closely punctured, sixth sternite wide, deeply, arcuately emarginate at apex, seventh sternite oval, apex narrowly, triangularly nicked, ultimate tergite truncate, ventral accessory process narrow, arcuately ascending apically, apical third furcate, the forks divergent, the tips acute.

Female.—Similar to male, eyes smaller and less prominent, (antennae missing in allotype); elytra extending to middle of second visible abdominal sternite; abdominal sternites piceous, sixth sternite shallowly emarginate, seventh sternite strongly narrowed apically, the apical margin with a moderately wide, moderately deep median notch.

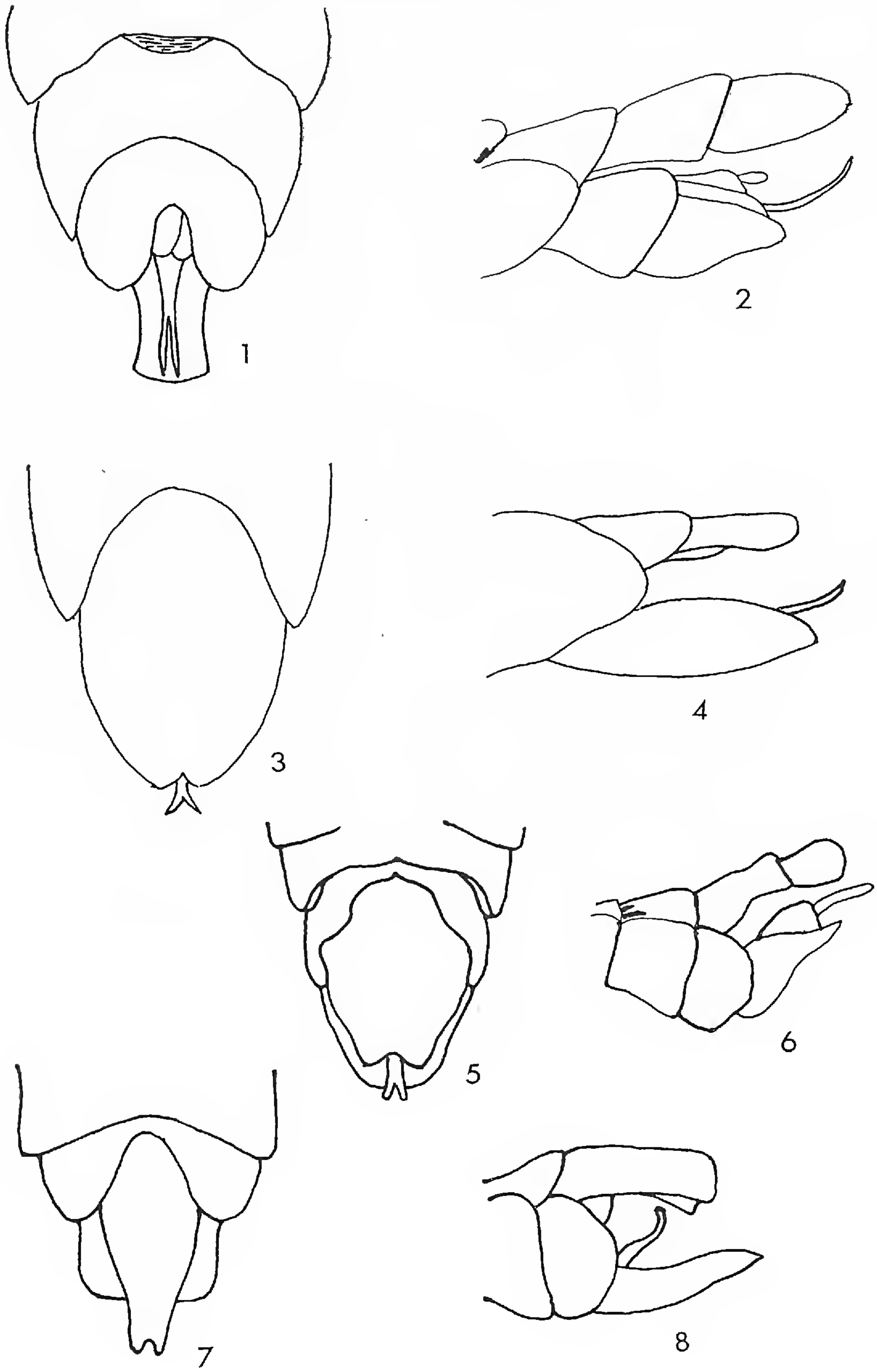
Holotype male from DAVIS MTS., TEXAS, June 9, 1954, was collected by D. J. & J. N. Knull. Allotype female same locality and collectors but collected on July 14, 1957.

Similar to *Malthinus bicolor* LeConte from which it can be separated by the arcuate black interocular fascia and the characters of the male terminal abdominal segments.

Malthinus fjellandi Fender, new species

(figs. 5, 6)

Head orange with an arcuate black interocular fascia extending medially back onto neck, a narrower longitudinal lateral stripe, on each side, extending from behind eye to the neck, eyes and antennae black, basal antennal segment paler beneath, prothorax orange, scutellum and elytra black, elytral apices creamy yellow, body beneath piceous, thoracic sutures, apices of abdominal sternites, apices of coxae and femora and bases of femora paler, pubescence



EXPLANATION OF FIGURES

Figs. 1-8, Male terminal abdominal segments (odd numbers = ventral aspect; even numbers = lateral aspect): figs. 1, 2. *Malthinus chisosensis;* figs. 3, 4. *Malthinus knulli;* figs. 5, 6. *Malthinus fjellandi;* figs. 7, 8. *Malthodes rhadinus.*

cinerous, fine and sparse. Length male: 3.5 mm.

Male.—Head shining, wider than pronotum, finely scabrose throughout, antennae slender, extending beyond tip of abdomen, segments two to four progressively longer, intermediate segments about four times as long as wide, eyes prominent; pronotum transverse, about three fourths as long as wide, anterior margin feebly arcuate, anterior angles rounded sides sinuate, feebly convergent to obtusely rounded basal angles, basal margin more strongly arcuate than anterior margin and widely deeply beaded, more strongly so towards sides, disc finely closely punctulate, middle of each lateral half with a moderately large but low tumid area; scutellum finely punctured, apex deeply notched, the notch apically truncate; elytra abbreviated and dehiscent, extending to base of third visible sternite, coarsely, sparsely, confusedly punctured to the tumid and finely punctured apices, a subsutural and one discal costa feebly evident; body beneath finely punctured, abdominal sternites more coarsely so; fifth sternite apically emarginate, the emargination in the form of a printer's brace, sixth sternite widely deeply trifoliately emarginate, seventh sternite elongate, sides sinuately convergent to shallowly emarginate apex, apex of the emargination rounded, the tips rounded; in lateral view, seventh sternite subtriangular, apex acute, penultimate tergite elongate, apically truncate, ultimate tergite shorter, narrowed towards base, the apex subtruncately rounded, ventral accessory process directed caudad, slender, the tip rounded.

Holotype male from HUACHUCA MTS., ARIZONA, August 7, 1953 was collected by D. J. & J. N. Knull.

Named for Mr. Frank Fjelland, whose friendship and insistent help in mundane tasks have facilitated these studies.

KEY TO NORTH AMERICAN SPECIES OF MALTHINUS

1. Elytra coarsely striate-punctate 2
   Elytra more finely, confusedly punctate 4
2. Elytra black with the apical tumidities dark olivaceous .... *atripennis* LeConte
   Elytra testaceous with the suture more or less widely infuscate 3
3. Male seventh sternite entire, ovate .... *occipitalis* LeConte
   Male seventh sternite narrowly deeply incised at the apex .... *difficillis* LeConte
4. Pronotum finely closely granulate .... *granicollis* Fender
   Pronotum finely sparsely punctured 5
5. Pronotum piceous with four discal spots and the anterior and posterior margins narrowly pale .... *quadrimaculatus* Fender
   Pronotum pale, sometimes with a narrow median dark stripe 6
6. Head, except mandibles, dark .... *chisosensis* Fender
   Head, besides mandibles, at least in part pale 7
7. Head black behind the antennae .... *subcostatus* Schaeffer
   Head at least partially pale behind the antennae 8

8. Head red with a black transverse, subtriangular interocular fascia that medially may extend well down on the neck 9
   Head, except eyes and antennae, entirely pale 10
9. Elytra black .... *knulli* Fender
   Elytral apices creamy yellow .... *fjellandi* Fender
10. Elytral apices pale creamy yellow, body beneath testaceous .... *tricolor* Fender
    Elytral apices dark olivaceous, body beneath piceous 11
11. Male seventh sternite elongate, produced .... *bicolor* (LeConte)
    Male last sternites short, transverse .... *huachucae* Fender

Malthodes rhadinus Fender, new species
(figs. 7, 8)

Black, clypeus testaceous, pronotum fuscotestaceous, lateral margins narrowly black, abdomen fuscous, basal sternites paler, all coxae and bases of all tibiae piceous, pubescence cinereous, fine, short and inconspicuous. Length 3.5 mm.

Male.—Shining, head wider than pronotum, finely sparsely punctured in front of eyes, coarsely closely so behind and on neck, eyes large and prominent, separated by less than their combined widths, antennae slender, extending to tips of wings in repose, second segment shorter than third, third and fourth segments equal, intermediate segments about four times as long as wide; pronotum transverse, anterior margin arcuate and coarsely beaded, anterior angles obliquely rounded, sides nearly straight, feebly convergent to the narrowly reflexed, obtuse hind angles, basal margin arcuate and coarsely beaded, disc rather coarsely punctured, becoming finely scabrose towards hind angles, a broad longitudinal median impression anterior to and near the middle of each lateral half; scutellum apically subtruncate, finely sparsely punctured; elytra rugose punctate; thorax beneath sparsely coasely punctured, more finely closely so on abdominal sternites; sixth sternite broadly, deeply, arcuately emarginate, seventh sternite elongate, broad basally, sides sinuately convergent to shallowly, arcuately notched apex, tips rounded, ultimate tergite broad, apically truncate; in lateral aspect, seventh sternite arcuately ascending apically, rather thick, tip acute, ultimate tergite elongate, laterally arched and apically truncate, ventral accessory; process unevenly sinuately ascending apically, the tip rounded.

Holotype male and one male paratype from 5 miles east of Mineral, Tehama County, California, June 20, 1960, were collected by D. J. & J. N. Knull.

This species belongs to my group I of the genus where it runs to *Malthodes basalis* LeConte and *M. pictithorax* Fender. These species have the pronotum finely sparsely granulose, the sides of the seventh sternite (as viewed ventrally) arcuate and do not have visible ventral accessory processes. In addition, *M. basalis* has the basal two antennal segments pale.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

Notice of Proposed Use of Plenary Powers in Certain Cases (A. [n.s.] 58)

In accordance with a decision of the 13th International Congress of Zoology, 1948, public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following cases, full details of which will be found in *Bulletin of Zoological Nomenclature,* Vol. 20, Part 3 to be published on 26 April 1963.

(1) Validation of *Pemphigus* Hartig, 1839 (Insecta, Hemiptera). Z.N.(S.) 431;

(2) Validation of *Bironella gracilis* Theobald, 1905 (Insecta, Diptera). Z.N.(S.) 1244;

(5) Designation of a type-species for *Ctenophthalmus* Kolenati, 1856 (Insecta, Siphonaptera). Z.N.(S.) 1523;

(7) Validation of *Xylocopa* Latreille, [1802-1803] (Insecta, Hymenoptera). Z.N.(S.) 1527;

(12) Validation of emendation of *Rhynchium* of *Rygchium* Spinola, 1806 (Insecta, Hymenoptera). Z.N.(S.) 1540;

(13) Suppression of *Eulachnus* Del Guercio, 1909 (Insecta, Hemiptera). Z.N.(S.) 1541.

Any zoologist who wishes to comment on any of the above cases should do so in writing, and in duplicate, as soon as possible, and in any case before 26 October 1963. Each comment should bear the reference number of the case in question. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature.* Those received too late for publication will, if received before 26 October 1963, be brought to the attention of the Commission at the time of commencement of voting.

All communications on the above subject should be addressed as follows: The Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London, S.W. 7, England.—W. E. China, *Acting Secretary to the International Commission on Zoological Nomenclature.*

MEETING NOTICE

The XVI International Congress of Zoology will be held in Washington, D.C. on August 20 through 27, 1963.—*Editor.*

THE NORTH AMERICAN GENERA RELATED TO GAUROTES WITH A KEY TO THE MEXICAN COMPONENT SPECIES

(Coleoptera: Cerambycidae)

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The generic name *Gaurotes* was proposed by LeConte (1850) for *Leptura cyanipennis* Say, a metallic species then unique among North America lepturines in having a protuberant mesosternum. Later, Bland (1862, 1864) described two similarly metallic species as *Gaurotes abdominalis* and *G. cressoni,* which lacked the protuberant mesosternum. In the Old World, other species were assigned to *Gaurotes* on the basis of similar superficial resemblances (Fairmaire, 1864; Plavilstshikov, 1921; etc.). In the Biologia Centrali-Americana and subsequently, Bates (1880, 1885, 1892) described several Mexican species of "*Gaurotes*" which share with *Leptura cyanipennis* a protuberant mesosternum, but which differ in other important features which exclude them from the same genus.

Although the present paper is not concerned with the Old World species which have been assigned to *Gaurotes* (see, for example, Gressitt, 1951; Podany, 1962[2]), those at hand differ markedly from *G. cyanipennis* in sculpturing and other features. With the exception of those species related to *Gaurotes ussuriensis* Blessig, type of the genus *Paragaurotes* Plavilstshikov (distinctive by possessing spined intermediate and posterior femora), most of the others appear to be referable to *Carilia* Mulsant (1863), a genus based upon *Leptura virginea* Linnaeus.

Key to the North American Lepturine Genera Related to Gaurotes LeConte

1. Mesosternum anteriorly abruptly declivous with a distinct keel or protuberance between coxae 2
   Mesosternum anteriorly gradually, arcuately declivous at most, convex but without a protuberance between the coxae 3

2(1) Antennae with scape shorter than third segment, fifth segment longest; mesosternal keel not prominently elevated; pubescence spare, almost lacking dorsally; elytra with

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[1]The authors gratefully acknowledge support of the National Science Foundation, through grant G-19959.

[2] The monograph on the genus *Gaurotes* by Podany (1962, Mitt. Muncher Ent. Gesells., 52:219-252) was received subsequent to the submission of this paper for publication. With the exception of the necessary name changes, the results and conclusions of Podany have not been incorporated. One point must be clarified, however; *Neogaurotes* Podany, 1962, is a junior synonym of *Carilia* Mulsant, 1863, by virtue of isogenotypy.

edges elevated around scutellum; integument bright metallic bluish or greenish .... *Gaurotes*

Antennae with scape longer than third segment, subequal to fifth; mesosternal keel prominently protuberant; pubescence distinct, often dense; elytra with edges not elevated around scutellum; integument dark metallic greenish, black, or brownish.......... *Tomentgaurotes*

3(1) Elytra finely to coarsely punctate, but not distinctly rugose; pronotum sparsely to densely punctate, not rugose.......... 4

Elytra coarsely, irregularly rugose; pronotum strongly irregularly rugulose; elytra with pale maculate at middle .... *Sachalinobia*

4(3) Antennae with scape shorter than fifth segment, shorter than or subequal to third segment.......... 5

Antennae with scape subequal in length to fifth segment, longer than third segment.......... 6

5(4) Elytra with inner edges elevated around scutellum; antennae with third segment subequal in length to fourth; integument brilliant metallic green or blue.......... *Pseudogaurotina*

Elytra with inner edges not elevated around scutellum; antennae with third segment much longer than fourth; integument testaceous and black, not metallic.......... *Evodinus*

6(4) Posterior tarsi with first segment much longer than following two together; head with genae long; pronotum strongly transversely impressed at apical constricture; elytra with apices usually truncate.......... *Acmaeops*

Posterior tarsi with first segment not longer than two following segments together; head with genae short; pronotum not impressed apically; elytra with apices usually rounded; body form stout, robust.......... *Brachysomida*

GAUROTES LeConte

Gaurotes LeConte, 1850, Jour. Acad. Nat. Sci. Philadelphia, (2) 1:324.

The only North American species remaining in this genus as here defined is *Leptura cyanipennis* Say, the monobasic type.

PSEUDOGAUROTINA Plavilstshikov

Pseudogaurotina Plavilstshikov, 1958, Ent. Obozr., 37:624.

Gaurotes (pars), Lacordaire, 1869, Genera des coléoptères, 8:422; Leng, 1890, Ent. Americana, 6:55; Casey, 1913, Memoirs on the Coleoptera, 4:217; Swaine and Hopping, 1928, Nat. Mus. Canada Bull., 52:14; Hopping, 1937, Nat. Mus. Canada, Bull., 85:19; Knull, 1946, Ohio Biol. Surv. Bull., 39:178.

Head oblique, gradually narrowed behind eyes, neck and temples not abruptly angled; antennae inserted below anterior margin of eyes, segments three and four subequal, fifth longer than scape or third segment; eyes entire, finely faceted; palpi unequal, not dilated. Pronotum inflated, narrowly constricted at apex, transversely impressed at base and apex, sides obtusely angulate; prosternum transversely excavated; anterior coxae contiguous, coxal cavities open behind; mesosternum with intercoxal process not abruptly elevated nor tuberculate; metathorax with episternum broad in front, narrowly tapering posteriorly. Elytra convex, polished, brightly metallic, sutural edges elevated around scutellum, surface with punctures not rugose, pubescence sparse, apices rounded; wings without a closed cell in anal sector. Legs moderately long, tibiae with spurs terminal; posterior tarsi with a pubescent sole on first segment, first segment as long as following segments together; tarsi with apical segment cleft to base, bilobed.

Type species: *Gaurotes splendens* Jakowleff (by original designation).

This genus may be distinguished from *Gaurotes* by the lack of a protuberant mesosternal process. Additionally, the antennal scape is longer than the third segment or subequal to it in length; in *Gaurotes*, the scape is shorter than the third antennal segment.

The characteristics of this group differ sufficiently to warrant recognition of *Pseudogaurotina* as a distinct genus rather than a subgenus of *Gaurotes* as originally proposed.

In North America, *G. cressoni* Bland definitely fits the definition of this genus and *G. abdominalis* Bland can also be assigned to *Pseudogaurotina*. This latter species, although smaller in size and lacking the lateral pronotal impressions, agrees with *cressoni* in other characteristics.

TOMENTGAUROTES Podany

Tomentgaurotes Podany, 1962, Mitt. Müncher Ent. Gesells., 52:242.

Head oblique, rather suddenly narrowed behind eyes, neck and temples abruptly angled; antennae inserted at anterior margin of eyes, scape subequal in length to fifth segment, longer than third, third segment subequal to fourth; eyes entire, finely faceted; palpi unequal, often dilated in the male. Pronotum convex, narrowly constricted apically from a little before middle, not impressed at base or apex, sides obtusely angulate, not tuberculate; disk with a median longitudinal, glabrous line; prosternum transversely excavated; anterior coxae contiguous, cavities open behind; mesosternum with intercoxal process produced into a distinctly elevated keel, abruptly declivous anteriorly; metathorax with episternum broad in front, tapering posteriorly. Elytra convex, tapering, dark metallic or brownish, sutural edges not elevated around scutellum, punctuation not coarsely rugose, pubescence uniform or condensed into patches, apices emarginate, angles dentate; wings without a closed cell in anal sector. Legs moderate, slender, tibiae with spurs terminal; posterior tarsi with a pubescent sole on first segment, first segment as long as following segments together, apical tarsal segments cleft to base.

Type species: *Gaurotes batesi* Aurivillius (= G. *donacioides* Bates) (by original designation).

This genus differs from all others in this group by the very prominent intercoxal process of the mesosternum. From *Gaurotes,* it may be separated by the longer antennal scape, non-depressed scutellum, and entirely different facies.

Tomentgaurotes is known presently only from Mexico, where it is represented by five species, one apparently previously undescribed.

Key to the Known Species of Tomentgaurotes

1 Elytra with pubescence dense to moderately dense, uniform, not condensed into patches 2

Elytra with pubescence condensed into distinct irregular patches 4

2(1) Antennae and legs uniformly concolorous black, or with aeneous lustre 3

Antennae, except base, femora, except knees, and tibiae, except base, reddish yellow. Length, 9 mm .... *ochropus*

3(1) Integument dark metallic greenish; elytra with pubescence mostly sub-depressed, without long black erect hairs at base; metasternum and abdomen lacking erect hairs. Length, 9-12 mm .... *batesi*

Integument uniformly black, not metallic; elytra with long erect dark hairs at base; metasternum and abdomen with sparsely interspersed erect hairs. Length, 8-10 mm .... *plumbea*

4(1) Elytra and appendages brownish testaceous, legs often with dark bands at apices of femora and tibiae. Length, 9-11 mm .... *maculosa*

Elytra and appendages dark metallic or black, antennae with segments three to eleven grayish pubescent at base. Length, 11-14 mm .... *multiguttata*

Tomentgaurotes batesi (Aurivillius)

Gaurotes donacioides Bates, 1880, Biol. Centr.-Amer., Coleoptera, 5:37, pl. 4, fig. 23.

Gaurotes batesi Aurivillius, 1912, Coleopterorum catalogus, 39:194 (new name for *donacioides*).

Gaurotes (Tomentgaurotes) batesi, Podany, 1962, Mitt. Müncher Ent. Gesells., 52:242.

The obscure, uniform brassy color and uniform pubescence distinguish this species from others in this genus.

Type locality: "Mexico, near the capital."

Material examined: 7 ♂♂, Matilde, D.F., VIII-27-56 (R. and K. Dreisbach); 1♂, 22 miles north of Atlacomulco, Mexico, VIII-18-54 (C.D. Michener and party); 1♂, 32 miles west of Puebla, Puebla, IX-7-51 (H.A. Scullen); 1♂, 4 miles northwest of Colonia, Hidalgo, VIII-14-56 (J.W. MacSwain); 1♀, 10 miles northwest of Tamazulapan, Oaxaca, VIII-22-59 (L.A. Stange, A.S. Menke).

TOMENTGAUROTES OCHROPUS (Bates)

Gaurotes ochropus Bates, 1880, Biol. Centr.-Amer., Coleoptera, 5:37.

Gaurotes (Tomentgaurotes) ochropus, Podany, 1962, Mitt. Müncher Ent. Gesells., 52:243.

This species is basically similar in coloration to *T. batesi* but apparently differs by having reddish-yellow legs and antennae.

Type locality: "Mexico."

Tomentgaurotes plumbea Chemsak and Linsley, new species

Female: Form small, robust; integument shining black, densely clothed with grayish pubescence. Head small, vertex convex, punctures shallow, rather coarse, a glabrous median line extending from antennal tubercles to neck; pubescence dense, grayish, subdepressed, with very long, black erect hairs sparsely interspersed; antennae not attaining middle of elytra, segments gradually broadening apically, first four segments and most of fifth clothed with fine grayish, depressed hairs, outer segments opaque, densely clothed with very fine, dark, depressed pubescence. Prothorax broader than long, sides obtusely angulate, narrowing from before middle to apex, apex much narrower than base, base and apex barely transversely impressed; pubescence moderately dense, depressed, with long, dark, erect hairs abundantly interspersed, disk rather finely, sparsely punctate, with a longitudinal glabrous line, sides with punctures dense; prosternum densely pubescent; meso- and metasternum densely clothed with recumbent gray hairs, sparsely interspersed with longer, suberect hairs. Elytra less than twice as long as broad, tapering apically; punctures at base fine, well separated, much finer than those on disk of pronotum, not becoming finer apically; pubescence dense, subdepressed and suberect, with very long, black, erect hairs sparsely interspersed; apices obliquely emarginate, angles acute. Legs slender, densely clothed with recumbent gray pubescence. Abdomen finely, densely, shallowly punctate, densely pubescent; apex of fifth sternite rounded. Length, 8-10 mm.

Holotype female (California Academy of Sciences) from 9 MILES SOUTHEAST OF NOCHIXTLAN, OAXACA, MEXICO, VIII-22-59 (A. S. Menke, L. A. Stange); one female paratype from Orizaba, Veracruz, Mexico, VIII-12/22-61 (R. and K. Dreisbach).

This species may be distinguished from *T. batesi* by the black color and long, erect hairs in the elytra. It differs from *ochropus* by the concolorous appendages and from *multiguttata* and *maculosa* by the lack of irregular, pubescent maculation.

Tomentgaurotes maculosa (Bates)

Gaurotes maculosus Bates, 1885, Biol. Centr-Amer., Coleoptera, 5:277.

Gaurotes (Tomentgaurotes) maculosa, Podany, 1962, Mitt. Müncher Ent. Gesells., 52:244.

This species may be recognized by the brownish elytra and appendages. The elytra are maculated by irregular patches of pubescence.

Type locality: "Mexico."

Material examined: 3 ♂ ♂, 1 ♀, 4 miles west of Pachuca, Hidalgo, VI-24-53, "Taken on pepper trees" (Univ. Kansas Mex. Expedition); 1 ♂, 13 miles northwest of Comitan, Chiapas, III-3-53 (E.I. Schlinger).

Tomentgaurotes multiguttata (Bates)

Gaurotes multiguttatus Bates, 1892, Trans. Ent. Soc. London, 1892:158, pl. 6, fig. 2; Casey, 1913, Memoirs on the Coleoptera, 4:217.

Gaurotes (Tomentgaurotes) multiguttata, Podany, 1962, Mitt. Müncher Ent. Gesells., 52:244.

The entirely dark color with irregular patches of pubescence on the elytra characterize this species.

Type locality: Xucumanatlan, Guerrero, Mexico.

SACHALINOBIA Jacobson

Sachalinobia Jacobson, 1899, Ann. Mus., Zool. St. Petersburg, 4:39.

Pseudopachyta Swaine and Hopping, 1928, Nat. Mus. Canada, Bull., 52:15.

Gressitt (1953) has pointed out that *Sachalinobia* and *Pseudopachyta* are synonyms, and that the type species of the former, *Brachyta koltzei* Heyden, is apparently only subspecifically distinct from that of the latter, *Toxotus rugipennis* Newman.

BRACHYSOMIDA Casey

Brachysomida Casey, 1913, Memoirs on the Coleoptera, 4:219.

This genus was not recognized by Swaine and Hopping (1928), apparently being considered synonymous with *Acmaeops.* It contains a number of distinctive species in western North America. The type of the genus is *Acmaeops tumida* LeConte (by original designation).

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A HOST OF MACROSAIGON CRUENTUM (GENMAR) IN GEORGIA

(Coleoptera: Rhipiphoridae)

ROY R. SNELLING
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Since so few hosts have been recorded for species of *Macrosaigon* the present record is of interest, especially since this is the first report of a solitary vespid serving as a host for any rhipiphorid in North America, although Bequaert (1918) records *M. (Emenadia) ferrugineum flabellatum* (Fabricius) as a parasite of *Synagris spiniventris* (Illiger) and *S. calida* (Linné) in the Belgian Congo. To date only three species of *Macrosaigon* hosts have been recorded in this country. These have been wasps of the families Tiphiidae and Sphecidae. Hosts have been recorded for *M. flavipenne* (LeConte) (*Bembix spinolae* Lepeletier, Barber, 1915), *M. pestinatum* (Fabricius) (*Tiphia* sp., Davis, 1919) and *M. sayi* (LeConte) (*Myzine* sp., as *Elis* sp., Rivnay, 1929).

On January 25, 1958, an adult female of *M. cruentum* (Germar) emerged from a cell of *Ancistrocerus campestris* (de Saussure). The vespid had utilized two empty cells in an old nest of the sphecid, *Sceliphron caementarium* (Drury). The nest, collected on the Fort Gordon Military Reservation, Richmond County, Georgia, was placed on the roof of a small observation bunker on a hillside. The bunker was "dug-in" so that one end of the roof was actually only about 18 inches above ground level.

Two other series of *Ancistrocerus* cells from the same bunker yielded no additional *Macrosaigon*. Cells containing *Sceliphron* were also examined but these showed no indication of infestation by the parasite. However, it may well be that the sphecid regularly serves as the host species and that parasitism of the vespid was accidental. Further rearings must be made before this can be determined.

The inside of the cell was lined with a thin onion-skin-like layer of material, as usual in vespids, which could be readily pulled away from the cell wall. This layer differed from that typically found in vespid nests in being thinner and lacking the usual sheen. Evidently the parasite induced an abnormal reaction in the host larva at the time the cell lining was produced. At the anterior one-half of the cell a second lining was evident; its lower side was firmly attached to the first lining while the upper side was free, separated from the cell wall at the apex by about 2.8 mm. A few very fine fibers connected this secondary lining to the primary lining at this point. Feces and the larval and pupal exuviae were found within the cocoon.

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A NEW SPECIES OF ORNITHONYSSUS FROM THE WHITE-TAILED ANTELOPE SQUIRREL, WITH A REDIAGNOSIS OF THE GENUS ORNITHONYSSUS

(Acarina: Dermanyssidae)

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The genus *Ornithonyssus* Sambon previously has been characterized as having the dorsal plate entire. The new species described here has the dorsal armature divided into two plates, including a small pygidial plate near the caudal margin of the body, although agreeing in all other major features with typical members of *Ornithonyssus*. It first came to our attention through two female specimens collected in southern California in 1951. In early 1962, we collected large numbers of males, females, and protonymphs in the deserts of southern California.

In a recent paper, Dr. D. M. Allred (1962) referred to this species as an undescribed dermanyssid mite. We wish to express our appreciation to Dr. Allred for his kindness in making available to us the material he recorded from Nevada and an additional series collected in Utah. The Nevada material was collected in the course of a project supported by the U.S. Atomic Energy Commission. We also wish to thank Allan M. Barnes, California Department of Public Health, who provided mites from Inyo County, California.

Most other members of Macronyssinae with a divided dorsal plate in the female have the posterior plate large and extending over most of the opisthosomal length *(Steatonyssus* Kolenati, *Pellonyssus* Clark and Yunker, *Bewsiella* Domrow). *Ophionyssus* Megnin, with a separate pygidial plate, differs from the new species in the following characteristics: all setae nude; caudal setae with blunt tips; pygidial plate without setae; female with sternal plate bearing no more than two pairs of setae; epigynial setae on unarmed integument; male with anal plate separate from remainder of ventral armature and without lateral swelling on palpal femur; chelicera relatively short, with stout base and strongly tapered second segment.

Although the species in *Sauronyssus* Sambon originally were described as having the dorsal plate entire, Strandtmann and

Wharton (1958) indicate that a separate pygidial plate may occur. In *Sauronyssus*, the female always has a reduced sternal plate bearing only two pairs of setae; the male has a sternogenital plate and a separate anal plate; the male palpal femur lacks a lateral process.

The subfamily Dermanyssinae, considered by Krantz (1959) to contain a single genus, *Dermanyssus* Duges, includes several species with reduced female dorsal armature and some of these have a single pygidial plate. This subfamily is clearly distinguished from the Macronyssinae by the possession of greatly attenuated, needle-like chelicerae with minute chelae.

ORNITHONYSSUS Sambon, 1928

Liponyssus of authors, not Kolenati, 1856.

Leiognathus Canestrini, 1885 (Type: *Dermanyssus sylviarum* Canestrini and Fanzago), preoccupied by *Leiognathus* Lacepede, 1802.

Bdellonyssus Fonseca, 1941 (Type: *Leiognathus bacoti* Hirst, 1913)

Neoichoronyssus Fonseca, 1941 (Type: *Liponyssus wernecki* Fonseca, 1935), new synonymy.

Fonsecanyssus Radford, 1950 (Type: *Dermanyssus sylviarum* Canestrini and Fanzago).

Type species: *Dermanyssus sylviarum* Canestrini and Fanzago, 1877.

Diagnosis.—All idiosomal setae slender and acuminate; some, particularly caudal and marginal dorsal setae, with one to several small barbs. Legs moderately slender. Claws subequal. Coxae without ventral spurs or ridges other than normal sculpturing; coxa I rarely with proximal seta mounted on pedicel; anterior marginal spur of coxa II usually present, but typically very small.

Female.—Dorsal plate tapered posteriorly, leaving broad lateral areas of unarmed integument; rarely divided into podosomal and pygidial plates; bearing no more than 20 pairs of setae; without pair of minute setae anterior to terminal pair. Sternal plate with fine reticulate sculpturing over most of surface, but without other surface markings, specialized structures or heavily sclerotized bands; usually bearing three pairs of setae with third pair on posterior angles of plate; rarely with third pair on unarmed integument close to plate. Epigynial plate flared anteriorly, but without abrupt medial projection; tapering posetriorly to end in pointed or narrowly rounded tip; usually with pronounced median longitudinal thickening; bearing single pair of setae. Gnathosoma with narrow base. Hypopharyngeal processes relatively long, reaching at least to end of palpal genu and in some species to end of palp. Ventral surface of palpal trochanter usually with small, spur-like distal process. Chelicerae long and slender, not strongly tapered; chelae well developed but slender, without teeth or hook-like processes.

Male.—Ventral armature entire, at most slightly expanded posterior to coxae. Palpal trochanter without process. Palpal femur with prominent lateral or ventrolateral swelling bearing stout seta.

The following species have characteristics corresponding with this diagnosis. Females are described for all, and males and protonymphs are known for six species.

O. aridus Furman and Radovsky, new species
O. bacoti (Hirst, 1913)
O. banksi Strandtmann and Wharton, 1958
O. brasiliensis (Fonseca, 1939)
O. bursa (Berlese, 1888)
O. eruditus (Fonseca, 1935)
O. hirsti (Fonseca, 1935)
O. iheringi (Fonseca, 1935)
O. lutzi (Fonseca, 1941)
O. meprai (Manso and Pletneff, 1951)
O. monteiroi (Fonseca, 1941)
O. ondatrae (Willmann, 1952)
O. sylviarum (Canestrini and Fanzago, 1877)
O. vitzthumi (Fonseca, 1941)
O. wernecki (Fonseca, 1935), new combination

We have seen specimens only of the three species commonly found in human environs *(O. bacoti, O. bursa* and *O. sylviarum)* plus *O. aridus* and *O. wernecki*. However, most of the descriptive literature has been available, including the excellent descriptions by Fonseca. *O. wernecki*, the type of *Neoichoronyssus*, has the proximal seta of coxa I mounted on a tuberculate process, but otherwise agrees with the diagnosis of *Ornithonyssus*. The alternative to inclusion in this genus would be retention of *Neoichoronyssus* as a monotypic genus separated from *Ornithonyssus* by a single characteristic. Other species which have been placed in *Neoichoronyssus* do not appear closely related to *Ornithonyssus*.

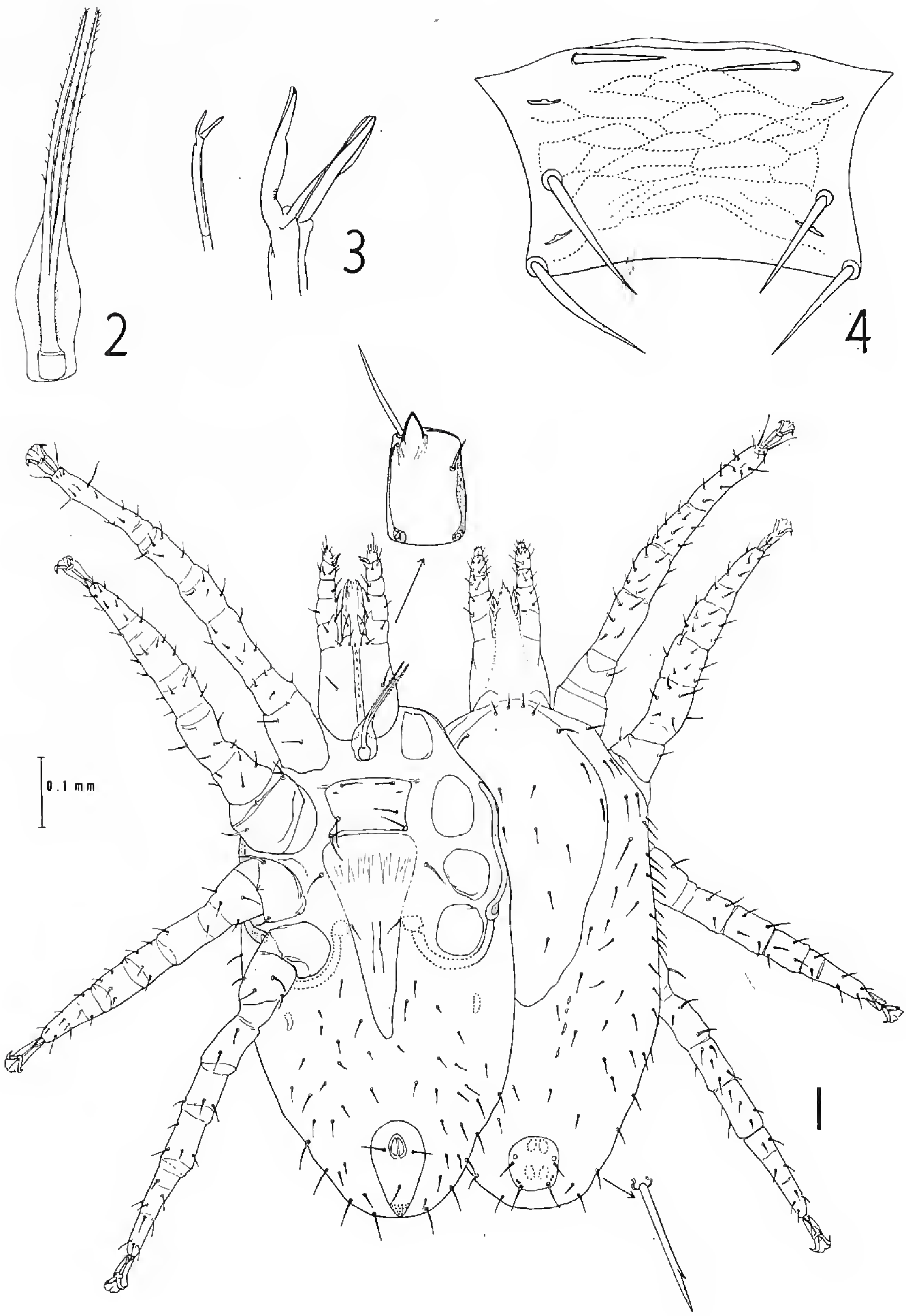
Certain hostal and geographic trends are apparent for the listed species. The principal hosts are small mammals, almost entirely rodents, except for *O. sylviarum* and *O. bursa* which occur on birds. The last two species with *O. bacoti* and *O. ondatrae* occur on hosts which have been widely dispersed by human activity. All of the others are known only from the New World. As Strandtmann and Wharton (1958, p. 200) have pointed out, the role of *O. bacoti* as vector of a filarial parasite of an American rodent, *Sigmodon hispidus*, suggests that this species has evolved in the Western Hemisphere.

A number of species previously placed in *Ornithonyssus* are not included here. From their descriptions, none of these appears to have slender, barbed setae and each has other characteristics indicating that it does not belong in *Ornithonyssus.*

Ornithonyssus aridus Furman and Radovsky, new species
(Figs. 1-7)

Division of the dorsal armature of the female into podosomal and pygidial plates differentiates this species from all others in the genus. Additional features of diagnostic value are relatively sparse setation, few barbed setae and these with a single barb about two-thirds of length from base; two stout dorsal setae on femur IV, adult peritreme terminating over middle of coxa II, and male dorsal plate narrow posteriorly.

Female (Figs. 1-4).—*Dorsum:* Podosomal plate widest over coxae II; strongly tapered near posterior margan; ending short distance behind coxae IV, with bluntly pointed tip; bearing 11 pairs of simple setae, including vertical pair, five lateral pairs and five submedian pairs; submedian setae subequal, somewhat shorter than laterals. Four pairs of weakly defined, linear sclerotizations form two converging rows posterior to podosomal plate. Pygidial plate located at level of posterior portion of anal plate (in unengorged specimens) ; subcircular in outline; bearing two pairs of submarginal setae; lateral setal pair located about midlevel of plate, with or without barb; posterior setal pair longer, barbed; one pair of small pores in front of lateral setae, one or two pairs in front of posterior setae. Oval areas of weaker sclerotization present on both dorsal plates; usually two pairs on pygidial plate. Setae on unarmed dorsum moderate in number; most caudal, some lateral and a few anteromarginal setae barbed; other setae nude and shorter. *Venter:* Tritosternum (Fig. 2) with subrectangular base narrowing abruptly to form long, slender neck region; laciniae long and slender, with fimbriae over most of length, becoming more numerous near tip; hyaline expansions present on each side of base, flaring out in neck region and gradually tapering to disappear some distance past separation of laciniae. Pre-sternal region without sculpturing, covered with striate integument. Sternal plate (Fig. 4) with anterior margin between first pair of setae straight, lateral margins concave, posterior margin nearly straight; first pair of setae shorter than other sternal setae, sometimes two-thirds their length or less; second pair of setae almost twice as far from first pair as from third. Epigynial plate with tip usually narrowly rounded, sometimes pointed; with strongly sclerotized longitudinal, median strip; trichopores of genital setae usually marginal. Anal plate with anterior margin strongly convex, caudal end bluntly pointed; margins strongly sclerotized, especially laterally; adanal setae arising about or slightly behind midlevel of anal ring. Metapodal plates weakly sclerotized, apparently subcuticular. Peritreme ending about midlevel of coxa II; no peritremal plate extending beyond tip of peritreme; weakly sclerotized remnant of anterior portion of plate, over parts of coxae I and II, visible on flattened specimens. Unarmed venter with moderate number of setae, nude except some setae near



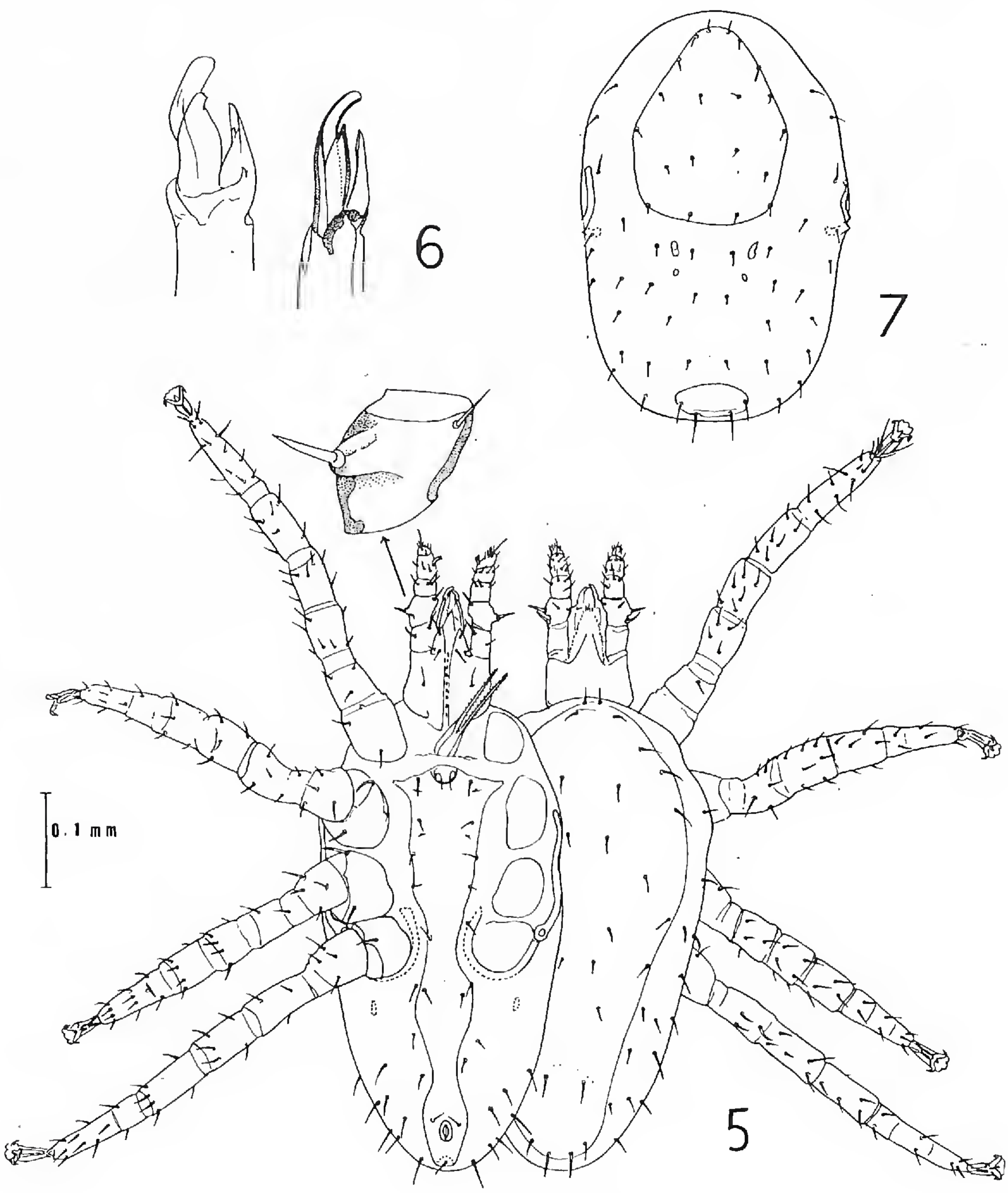
EXPLANATION OF FIGURES

Ornithonyssus aridus, female. Fig. 1. Ventral and dorsal views with enlargements of palpal trochanter and barbed seta. Fig. 2. Tritosternum. Fig. 3. Chelicera: to scale of Fig. 1 and enlargement of distal portion. Fig. 4. Sternal plate.

caudal margin with single, lateral barb. *Legs:* Anterior setae of coxae II and III and a few setae on more distal segments usually barbed. Anterior spur of coxa II arising somewhat dorsally, small, slender and inconspicuous, about 6-10μ in length. Femur IV with two very stout setae. *Gnathosoma:* Deutosternal groove with about 10 teeth in single file. Tectum with acuminate tip and sparse lateral barbs. Hypopharyngeal processes ending slightly beyond base of palpal tibia. Palp with ventral process of trochanter short, bluntly pointed; seta arising at base of process very long; proximal seta of trochanter short and slender; femur with stout lateral seta and femur and genu each with stout ventro-medial seta; dorsomedial seta of genu flattened, with broad, hyaline tip. Chelicera (Fig. 3) about 225μ from base of second segment to tip of fixed chela; maximum width less than 20μ; with strong dorsal notch near base of fixed chela. Fixed chela with hyaline margin distally. Movable chela with blunt tip bent slightly mediad; with membranous bursa arising dorsally near base, covering tip of chela and with sides meeting ventrally about one-third length from base. *Measurements* (10 specimens): Idiosomal length (unengorged) 680-730μ (mean 702). Pygidial plate length 71-83μ (mean 75). Pygidial plate width 66-78μ (mean 70). Tarsus I length 119-139μ (mean 127).

Male (Figs. 5, 6).—Barbed setae usually limited to a few caudal and marginal pairs, terminal pair on dorsal plate and anterior seta on coxa III. *Dorsum:* Dorsal plate extending nearly or quite to caudal margin of idiosoma; tapering strongly from level of coxae III, leaving much of opisthosoma unarmed; with rounded tip; sometimes with lateral constrictions near tip and suggestion of suture demarcating pygidial portion of plate; usually 16 pairs of setae, but varying from 15-18 pairs depending on number of pairs on tapering lateral margins; setae include vertical pair, four anterolateral pairs, two pairs near tip of plate. *Venter:* Holoventral plate with sternogenital region having nearly straight sides, without projections between coxae, except anterolateral angles projecting between coxae I and II; ventral region slightly expanded just posterior to coxae IV, strongly constricted to form narrow neck anterior to anal region; bearing usual sternal, metasternal, genital and anal setae; usually two or three setae on ventral region of plate. Unarmed integument with only about four or five pairs of setae, except for those on or very close to opisthosomal margin. Peritreme terminating about midlevel of coxa II. *Legs:* Similar to female except spur of coxa II anterior, not anterodorsal. *Gnathosoma:* Tectum, deutosternal teeth and hypopharyngeal length as in female. Palp with proximal seta of trochanter stout, inflated; lateroventral seta of femur stout, inflated, mounted on a prominent, incrassate pedicel; dorsomedial seta of genu stout and acuminate, unlike that of female. Chelicera (Fig. 6) about 120μ from base of second segment to tip of spermatodactyl, stouter than in female. Movable chela with dorsal arm weak and only slightly hooked dorsad; spermatodactyl boat-shaped, blunt-tipped, curved dorsad. Fixed chela slightly shorter than dorsal arm of movable chela; tapering; with hyaline margin around tip. *Measurements* (10 specimens): Idiosomal length (unengorged) 497-545μ (mean 520). Tarsus I length 111-123μ (mean 118).

Protonymph (Fig. 7).—All plates lack sculpturing. Barbed setae usually restricted to pygidial plate and caudal margin. Tritosternum and legs as in adults. *Dorsum:* Podosomal plate bearing 10 pairs of setae including vertical pair, five lateral pairs and four submedian pairs; all setae moderate in length, anterolateral setae longest, second submedian pair shortest. Usual two pairs of platelets behind podosomal plate somewhat variable in shape, but typically anterior pair three-lobed and posterior pair ovoid. Pygidial plate with convexly arched anterior margin; lateral and posterior pairs of setae usually barbed, posterior pair longest; usually only two pairs of setae on plate, but



EXPLANATION OF FIGURES

Ornithonyssus aridus. Fig. 5. Male, ventral and dorsal views with enlargement of palpal femur. Fig. 6. Male chelicera, two views of distal portion. Fig. 7. Protonymph, dorsal view of idiosoma.

occasionally with pair of short, simple setae on anterior margin. Unarmed dorsum with about 18 pairs of setae. *Venter:* Sternal plate with blunt caudal tip. Anal plate with straight or very weakly convex anterior margin. Unarmed venter with four pairs of setae anterior to anal plate and four or five pairs lateral to anal plate or on caudal margin; caudal setae sometimes barbed. Peritreme slender, curving dorsad from spiracle, forming a dorsal arc and curving ventrad at termination approximately at level of anterior one-fourth of coxa III; about 75μ long, including spiracle. *Gnathosoma:* Similar to adult female except palpal trochanter without process or distal seta. Chelicera about 140μ long from base of second segment to tip of fixed chela. *Measurements* (10 specimens): Podosomal plate length 193-216μ (mean 204). Tarsus I length 76-86μ (mean 81).

Holotype female, allotype, paratypes including 30 females, 20 males and 20 protonymphs, from *Ammospermophilus leucurus leucurus* (Merriam), 5 MILES EAST OF MECCA, RIVERSIDE COUNTY, CALIFORNIA, 19 April 1962, D. P. Furman, B. Furman and F. J. Radovsky. Holotype, allotype and several paratypes deposited in the U.S. National Museum; one paratype of each sex and stage in British Museum (Natural History); remaining paratypes in collections of the authors. Other specimens identified as *O. aridus* all were taken on *A. leucurus.* The California and Nevada localities are within the range of *A. leucurus leucurus.* The Utah collecting site is close to the range limits of this and two other subspecies. Collections were made from adult and juvnile hosts of both sexes. California. 160 adults and 100 protonymphs, same data as type series; 8 protonymphs, Kramer Hills, 5 miles south Kramer Junction, San Bernardino County, 16 April 1962, D. P. Furman, B. Furman, and F. J. Radovsky; one female, Oro Grande, San Bernardino County, 25 October 1951, J. Poll; one female, 1 mile north Palo Verde, Riverside County, 8 November 1951; 9 females, 10 protonymphs, National Park Service Headquarters, Death Valley National Monument, Inyo County, 10 January 1962, D. Rohe. Nevada. Taken from total of 6 hosts, on U.S. Atomic Energy Commission Test Site, north of Mercury, Nye County, collected by D. M. Allred, 2 females, 26 August 1959; one female, 12 May 1960; one male, 25 August 1960; 4 females, 2 protonymphs, 22 and 23 May 1961. Utah. 3 females, 10 protonymphs, 1 mile east Veyo, Washington County, D. E. Beck.

The collecting records indicate that *O. aridus* is a specific parasite of a desert-inhabiting squirrel, *Ammospermophilus leucurus.* The specimens that we collected were recovered by briefly exposing the dead hosts to chloroform vapor and then washing them in a detergent solution. No mites of this species were recovered from *Perognathus, Dipodomys,* and *Onychomys* taken at the same time and vicinity and treated in the same way.

The type locality, a few miles north of the Salton Sea, is in a particularly barren region with steep, rocky ridges separated by flat, sandy and sparsely vegetated ravines. Here, over 200 adults and 120 protonymphs were taken on seven squirrels, mostly juveniles, from one night's trapping.

Note on Preparation of Materials

The various water-miscible preparations used for mounting mites each contains a clearing substance, and frequently specimens can be mounted directly from alcohol with excellent results. However, the ease of this procedure may cause workers to neglect premounting treatments which sometimes are necessary for satisfactory study material. Most of the specimens of *O. aridus* had a black residue in the gut and their legs were strongly flexed. Specimens in the large series from the type locality also were heavily coated with fine particles of dust and debris. Direct mounting did not solve these problems, and the following procedure was the most satisfactory attempted.

Specimens were transferred to glycerine and vigorously shaken in a vial, which removed most of the adhering particles. After being returned to alcohol, they were placed in 10 per cent potassium hydroxide. Treatment in this solution for one to two hours at room temperature cleared the dark material in the gut without overclearing the specimens. After neutralization in acid-alcohol for a brief period, the mites were left overnight in lactophenol for additional clearing. A final brief cleansing of the mites was accomplished after placing them in Hoyer's medium, where use of a fine needle facilitated removal of remaining debris. The legs soon extended when specimens were mounted from lactophenol and slides were heated on a plate at 70° C.

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A NEW SPECIES OF APACHE FROM CALIFORNIA
(Homoptera:Derbidae)

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In 1957 several specimens of the otiocerine genus *Apache* were collected in different types of fruit fly traps used by the California Department of Agriculture. These specimens were found to differ from other known species of this genus.

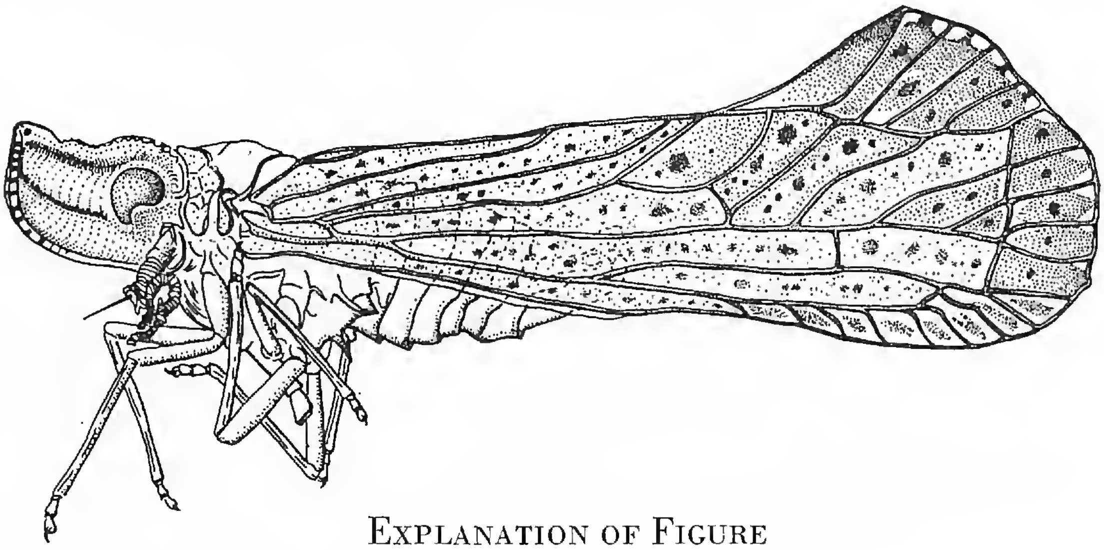
Specimens were trapped in California only in Solano County in 1957, but during 1958 they were found in Colusa, Glenn, Lake, Placer, Sacramento, Tehama, Yolo and Yuba counties, and in 1959 a single specimen was collected from San Luis Obispo County.

The major insect collections of the western United States were canvassed to see if specimens of this species were present. None were found outside of California. Several specimens were found in the University of California collection at Davis, dating back to 1953, from the counties of Shasta and Tehama. These were all collected in light traps of some type. One specimen was in the collection of the California Academy of Sciences, collected by E. P. Van Duzee at Cazadero, Sonoma County in 1918, and a single male was found in the collection of the California Insect Survey, University of California, Berkeley. This specimen was collected at Orangevale, Sacramento County, August 9, 1938, by Quentin Tomich.

Eight specimens (2♂♂ and 6♀♀) in the collection of the University of British Columbia, determined as *Apache degeeri* Kirby from various locations in British Columbia, were checked and found to be *degeeri*. These represent the only records of this species west of the Rocky Mountains as far as is known.

Considerable effort has been made to find the host association of the new species. To date this has been unsuccessful. In the eastern part of the United States, other members of the Otiocerini have been collected on beech, hickory, maple, oak and willow.

The types of fruit fly traps used and the lures are as follows: Steiner trap—"Siglure" with methyl eugenol and anisyl acetate; Frick trap—ammonium carbonate; and the McPhail trap—brown sugar, yeast and pyridine. All specimens taken in these traps were males, whereas both sexes were attracted to light traps.



Explanation of Figure

Fig. 1, *Apache californicum* Wilkey, new species.

Apache californicum Wilkey, new species

(fig. 1)

Length of male: 9.5 mm to 11.0 mm. Length of female 10.0 mm to 11.0 mm.

General color rosaceous, varying from pale to quite dark. Thorax pale orange with a rather wide, white medial stripe. Basal segments of antenna whitish, remaining segments and subantennal process reddish, darker than other rosaceous parts. Legs white. Veins of elytra reddish, cells slightly opaque with brownish spots and markings.

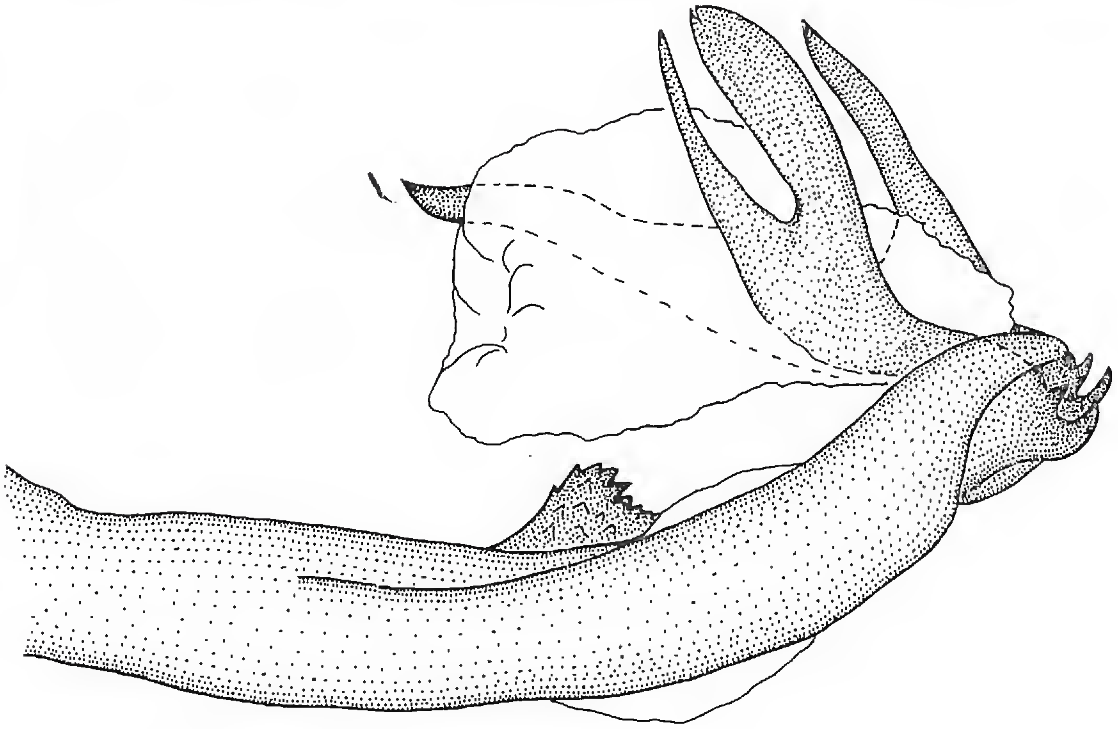
Head compressed laterally, forming a frontal groove, in profile rectangular, dorsal margin undulate, minutely notched along basal three-fourths (notches filled with a powdery wax), apex acute and slightly upturned. A swollen rectangular area present laterally between eye and frontal margin. Black markings present on frontal and ventral margins of head.

Anal segment of the male (fig. 3), in lateral view, acutely angular, forming a direct right angle, with a pair of sclerotized teeth at apex. Segment distinctly indented at inside angle. Flagellum of aedeagus (fig. 2) with 3 sclerotized processes, one forked appearing as two. Apical process of aedaegus almost straight, acutely pointed. Flagellum with 2 pairs of basal hooks. Shaft of aedeagus with a dorsal keel, serrate along margin, and toothed laterally.

Genital style in lateral view with apex upturned and very blunt, style with 2 dorsal protuberances, the larger one flattened on top, the other roundly pointed.

No appreciable difference could be detected between the female of this species and *Apache degeeri* Kirby which it resembles quite closely. The males also are superficially very similar. However, the difference in the male genitalia is sufficient to easily separate the two species.

The 2 pairs of hooks at the base of the flagellum in *A. cali-*



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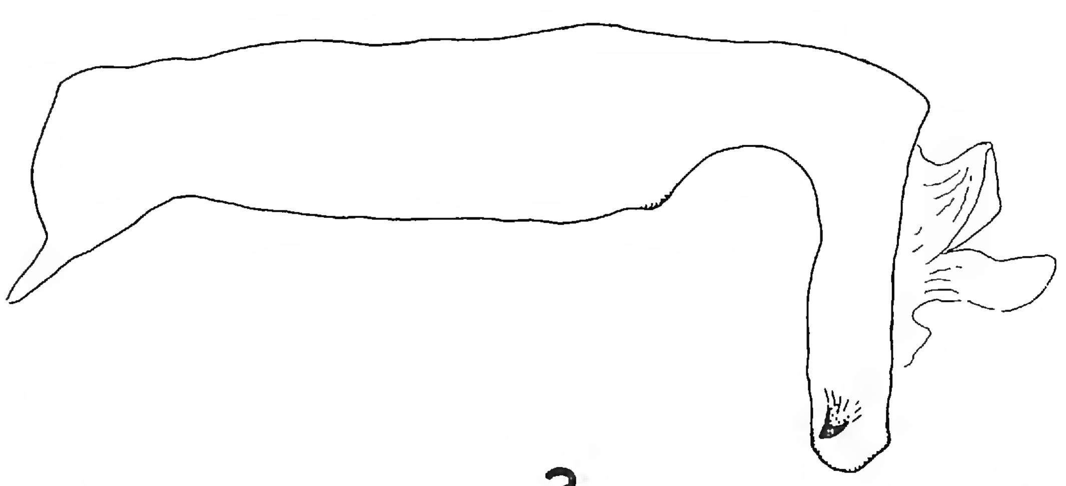

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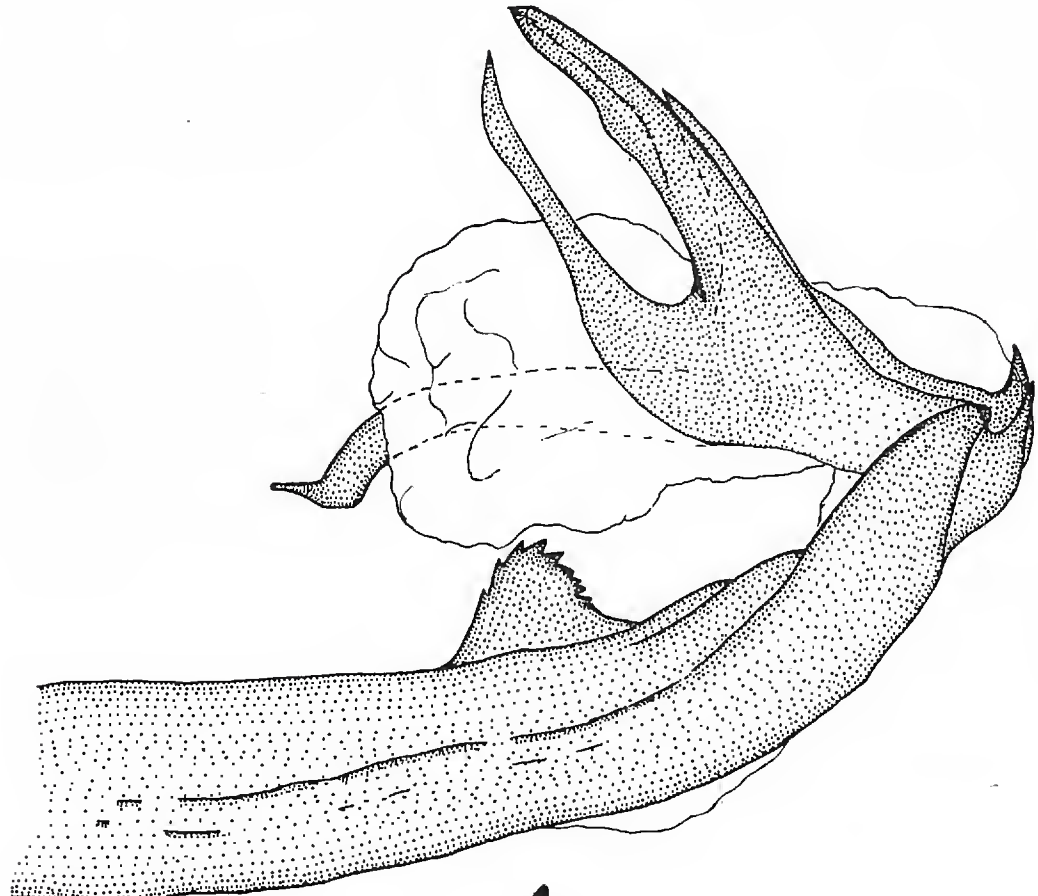
EXPLANATION OF FIGURES

Figs. 2 and 3, *Apache californicum* Wilkey; fig. 2, aedeagus of male; fig. 3, anal segment of male.

Figs. 4 and 5, *Apache degeeri* Kirby; fig. 4, aedeagus of male: fig. 5. anal segment of male.

fornicum is the strongest differentiating character, *A. degeeri* having only a single pair (fig. 4). The presence of lateral teeth on the keel, the different shape of the anal segment of *A. degeeri* (fig. 5), and the different shape of apical aedeagal process (fig. 4) strengthens the position of *californicum* as a separate species.



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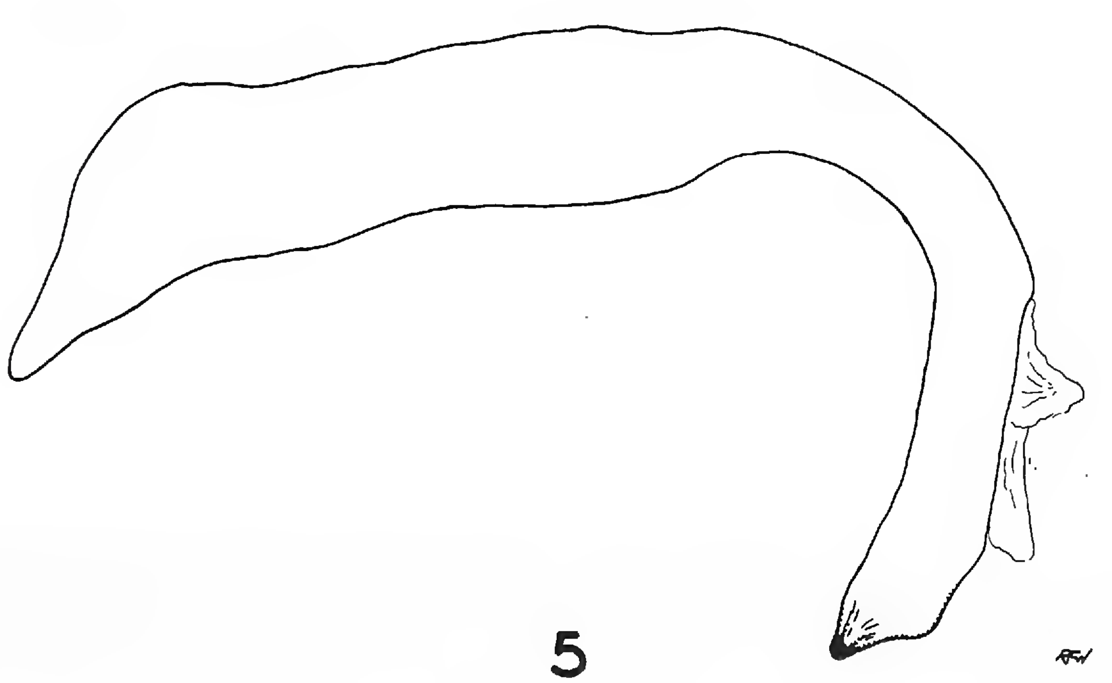

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Holotype male [CDA 57G19-6], VACAVILLE, SOLANO COUNTY, CALIFORNIA, 17-VII-1957, J. M. Marston. Allotype female, Anderson, Shasta Co., California, 8-VII-1955, Joe Willis. Paratypes (all California).—Amador County: Drytown, July, 1961 [61H1-3], Leland Brown, Frick trap (1♂). Colusa County: Colusa, 9-IX-1958 [58I16-36], A. K. Raymond, Steiner trap (3♂♂). Lake County: Kelseyville, 7-VII-1958 [58G10-22], Tom Pierce, Steiner trap (3♂♂). Placer County: Loomis, 1-VIII-1958 [58H7-3] (1♂), 1-VIII-1958 [58H13-332] (4♂♂—on slides), 29-VIII-1958 [58I2-4] (1♂), 10-IX-1958 [58I8-17] (1♂), all A. K. Raymond, Steiner traps. Sacramento County: Orangevale, 9-VIII-1938, Quentin Tomich (1♂); Rio Linda, 10-IX-1956, Jack Fowler, light trap (1♂). San Luis Obispo County: Santa Margarita, 21-VII-1959 [59H12-1], R. M. Drake, McPhail trap (1♂). Shasta County: Anderson, 4-VII-1955, Joe Willis (1♂, 1♀); Redding, 1954, Joe Willis (2♂♂). Solano County: Pleasant Valley, 23-VIII-1957, J. M. Marston, Steiner trap (2♂♂); Vacaville, 26-VI-1957 [57G2-1] (1♂), 17-VII-1957 [57G19-6] (1♂), 24-VII-1957 [57G29-103] (1♂), all J. M. Marston, Steiner traps. Tehama County: Dairyville, 3-VII-1956 (1♂), 9-VII-1956 (1♂), E. Yoemann; Los Molinos, 24-VII-1956 (1♀), 5-X-1956 (1♀), E. Yoemann, light traps; Red Bluff, 13-VII-1953 (1♂), 20-VII-1956 (1♂), E. Yoemann, light traps. Tuolumne County: Strawberry, 11-VIII-1960, D. Q. Cavagnaro (1♀). Yolo County: West Sacramento, 6-XI-1958 [58K20-2], Jim Yant, Steiner trap (1♂).

The holotype and allotype as well as paratypes are deposited in the type collection of the California Department of Agriculture, Bureau of Entomology, Sacramento, California (CDA).

Paratypes are also to be deposited in the collections of the following institutions: United States National Museum, California Academy of Sciences, University of California at Berkeley and Davis.

MEETING NOTICE

The 1963 National meeting of the Entomological Society of America will be held at the Sheraton-Jefferson Hotel in St. Louis, Missouri on December 2 through 5.—*Editor.*

NOTES ON THE BEHAVIOR OF STENOPOGON COYOTE BROMLEY WITH A DESCRIPTION OF THE EGGS[1]

(Diptera: Asilidae)

R. J. Lavigne

University of Wyoming, Laramie

Although the type series of *Stenopogon coyote* Bromley was collected near Lander, Wyoming (5000-8000 ft.) by Roy Moodie before 1909, the species was not described until 1931. At this time, Bromley noted that while specimens of this species appeared to be common in many collections, they were misidentified. James (1941) provided additional distribution data for Colorado, but made no mention of the habits of the species. No further information on this species has appeared in the literature, nor has any reference appeared concerning the oviposition habits of any member of the genus.

General Behavior

The habitat of *Stenopogon coyote* in southeastern Wyoming is in the open, short-to-medium grass rangeland at elevations of 4200′ to 8000′. Adults first appeared on the range in 1960 and 1961 about the end of June or the first part of July, depending upon weather and elevation, and remained in evidence until the end of August.

I have observed that movement varies with the individual asilid. Some individuals would shift their position as often as 24 times in eight minutes. A change in position was usually preceded or followed by a rest in one position of several minutes. Other individuals remained in one spot as long as 50 minutes, merely changing direction to face the perceived movement of some other organism. There appeared to be no difference between the male and the female in the length of time spent in one position. Adults flew either silently or with a low-pitched buzz. Grasshoppers tended to crouch upon hearing the buzz. Also, individual asilids made buzzing sounds while carrying prey.

The distance travelled by an individual varied from a few inches to about ten feet per flight. The distance covered was apparently related to the abundance of prey. If no prey was sighted in the immediate vicinity, the individual tended to fly farther. Fol-

[1] Published with the approval of the Director, Wyoming Agricultural Experiment Station, as Journal Paper No. 183.

lowing an unsuccessful attack on a grasshopper, individuals tended to return to the same position or to a position only a foot or so away. Flight into the air did not usually exceed two feet in height.

Landings were generally made on the bare soil, on cow pats, on dead twigs, or on grass no more than one or two inches off the ground. When an adult landed on bare soil it immediately sought a vantage point from whence it could obtain a better view. Ants did not appear to disturb the members of this species. When an ant approached, the asilids merely raised their bodies off the ground as far as possible and allowed the ant to crawl beneath.

Predation Behavior

As far as the author is aware, S. coyote is unique among asilids in Wyoming in that it does not necessarily effect capture in the air, a type of behavior which is prevalent among other species. On seven occasions, individuals were observed attacking a grasshopper on the ground in the following manner: The asilid could perceive the approach of its prey from a vantage point about one to two inches above the soil level, usually on a clump of grass or a cow pat. When a prey, ordinarily a grasshopper, appeared, the asilid would come to attention and turn to face it. If the grasshopper stopped and crouched against the soil, it would not be attacked, since the asilid attacks only when the prey is moving. Upon subsequent movement by the grasshopper, the asilid launches itself at the victim across the short open space separating them. The struggle is short; the *Stenopogon* inserts its proboscis into the dorsolateral area of the intersegmental membrane between head and thorax, and injects a "toxic" material that renders the prey largely immobile within seconds. Holding the prey with its head up at an approximate 60-degree angle from the soil surface, it proceeds to suck out the contents of the victim. The asilids were not always successful in their attacks and their prey would sometimes escape.

A number of times *S. coyote* was observed to capture its prey in the air. Once captured, the prey was brought to earth, where it was immediately paralyzed and fed upon by the asilid.

While grasshoppers constituted the major portion of *S. coyote's* prey, other insects were occasionally taken. A female asilid was captured by the author as it carried a mature larva, *Sarcophaga* sp., which was probably captured while crawling on the ground. *S. coyote* was also observed capturing a beetle, *Epicauta ferruginea*

(Say), that was crawling over a goldenrod blossom. Subsequently *Phymata americana* Melin, a phymatid, took it away from the asilid.

Because *S. coyote* ordinarily holds its prey on the ground while feeding, the prey is sometimes lost to scavenger grasshoppers before the asilid has finished feeding. While the asilid was still feeding, a *Melanoplus foedus* Scudder female was observed to eat the hind leg of *S. coyote's* prey, a male *Amphitornus coloradus* (Thomas), and subsequently the grasshopper took possession of the prey after a brief struggle.

Size apparently determines which species of grasshopper *S. coyote* is able to overcome. Such species as *Ageneotettix deorum* (Scudder), *Cordillacris occipitalis* (Thomas), *Amphitornus coloradus* (Thomas) and nymphs of overwintering species, which do not exceed 20 mm in length, appeared to be fair game. Grasshoppers which range from 20 to 26 mm in length, while not necessarily safe from attack, were able to extricate themselves from the grasp of the asilid. Females of *Aulocara ellioti* (Thomas) and

Explanation of Figure

Fig. 1. A clutch of 12 eggs deposited in the soil of open rangeland by a *Stenopogon coyote* female.

Melanoplus occidentalis (Thomas) fall into this category and, although they appeared to be particularly attractive as prey, were always able to escape. Those species such as *Melanoplus bilituratus* (Walker) and *M. foedus* Scudder, which exceed 26 mm in length, seemed to be ignored by *S. coyote*, or to frighten her away.

Mating Behavior

Five pairs of *S. coyote* were observed in copulation. In all cases observed, the behavior was identical. Initiation of mating was not observed by the author. Copulation was performed on grass stalks approximately three to five inches off the ground. The mating pair faced in opposite directions with the claspers of the male holding the ovipositor of the female. Both individuals hung on separate grass stems so that their bodies formed a figure V. The pair remained in copula for about 25 minutes from the time first observed, remaining in the same position unless disturbed by the approach of a disturbing influence such as a grasshopper. If forced to change position, the pair flew *in copulo* to another similar habitat three to 15 feet away, where they took up the same position as previously described. Separation occurred on the grass stalks and was initiated by the female, who used her hind legs to force the male to desist. After separation, the male flew off while the female remained or moved off 3 to 4 in., where she proceeded to clean herself with her legs.

Oviposition Behavior

I was able to witness three females oviposit on separate occasions. On one occasion the oviposition took place in the midst of a downy chess grass *(Bromus tectorum* L.) area. The other acts of multiple oviposition were performed in short grass areas as follows: The female flies close to the ground, stopping every ten seconds or so in an open space between grass clumps, apparently to test the soil consistency;. To do this, she sweeps the area with a sideways motion of her ovipositor. Upon finding a suitable location, she proceeds to create a hole in the soil at the base of a grass clump by sideways agitation of her ovipositor. The hole is dug to a depth of 9 to 10 mm, her abdomen being buried in the sand as far up as the posterior margin of the third abdominal segment. The eggs are deposited and the ovipositor removed from the hole. The ovipositor is then utilized to tamp down sand on the eggs and to sweep the area clear, perhaps to remove signs of oviposition. Sometimes the female does not fill the hole completely. The row of spines at the apex of the ovipositor are ideal for digging and sweeping the soft sand. The whole procedure usually required approximately four minutes, but on one occasion egg deposition required seven minutes.

A second clutch of eggs was laid by each female within 2 to 14 minutes. In the single instance where eggs were recovered, 12 eggs were found in the first hole and six in the second, all 18 eggs having been laid by one female. Examination of pregnant females revealed that 16 to 18 eggs become fully developed in the ovaries at any one time, thus supporting the view that no more than two ovipositions are necessary to empty the ovaries.

The eggs are oval and creamy white. They range in size from 2.09 to 2.27 mm in length with an average of 2.18 mm. In width they range from 0.64 to 0.73 mm with an average of 0.69 mm. They were laid in groups, one on top of another, three to four to a row, and cemented together, as shown in Figure 1.

The author wishes to express his appreciation to Dr. Charles Martin, University of Oregon, for reading and criticizing this manuscript.

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THE EVANIID WASPS OF CALIFORNIA

(Hymenoptera: Evaniidae)

ROY R. SNELLING
Turlock, California

The discovery of a male specimen of *Evaniella neomexicana* (Ashmead) collected in the desert region of California prompted the author to search for additional representatives of this and other evaniids from California. The fact that only three additional specimens were located accentuates the rarity of these interesting parasites of roaches. To Mr. Gerald I. Stage of Berkeley, California, I wish to express my gratitude for securing the specimens of *E. californica* (Ashmead) which are recorded below.

Evaniella neomexicana (Ashmead)

Evania Neomexicana Ashmead, 1901. Can. Ent., 33:304.
Evaniella neomexicana Townes, 1949. U.S. Natl. Mus. Proc., 99:529-530.

This desert species has previously been known only from the original two males collected many years ago by Cockerell at Las Cruces, New Mexico. One of these, the lectotype designated by Townes, was collected on September 9; the other specimen was undated. A single male specimen was recovered from miscellaneous materials taken in a Pink Bollworm Survey light trap placed at Blythe, Riverside, County, California. The specimen was collected on October 23, 1961, by Mr. K. L. Japport of the U. S. Department of Agriculture, and is in the collection of the California Department of Agriculture.

Evaniella californica (Ashmead)

Evania californica Ashmead, 1901. Can. Ent., 33:304.
Evaniella californica Townes, 1949. U.S. Natl. Mus. Proc., 99: 529, 530.

This species has previously been known only from the male type collected at Natoma, Sacramento County, California, on July 7, 1895. Three additional specimens have been collected in Tuolumne County as follows: 1♂, Tuolumne City, May 27, 1953 (B. L. Rozen); 1♀, Twain Harte, June 25, 1961 (M. Lundgren); 1♀, same locality, August 27, 1959 (D. Lundgren). The male is the property of the California Insect Survey, and Mr. D. L. Lundgren has consented to have one of the females placed there also; the other specimen is being returned to Mr. Lundgren.

The females agree quite well with the description of the male as given by Townes, differing only in having the antennae somewhat shorter and stouter. No doubt assiduous collecting in the Sierran foothills at moderate elevations could yield many more specimens. The diversity of dates indicates that *E. californica* flies from mid spring until late summer or early fall. The species should be looked for in densely wooded areas, especially near streams, in areas where considerable slash cuttings and dead logs are nearby.

OBSERVATIONS ON AEDES NIPHADOPSIS DYAR & KNAB AND CAMPESTRIS DYAR & KNAB IN NEVADA[1]

(Diptera:Culicidae)

Harold C. Chapman

Entomology Research Division, Agricultural Research Service, U.S.D.A.

The writer has had considerable opportunities to observe these vernal species in Nevada from 1959-61 since they fill the vacuum or void that exists in *Aedes* mosquitoes between the first hint of very early spring (January) to the first production of irrigation mosquitoes in later April. Although a few investigators have written on the biology and ecology of these two species, especially *A. campestris* Dyar & Knab, some of the data do not agree with those obtained in Nevada.

Aedes niphadopsis Dyar & Knab

This species is known from the great basin of Utah, southern and central Idaho, southern Oregon, and eastern Nevada (Rees and Collett 1954) (Carpenter and LaCasse 1955). Collections were also made in Uinta County, Wyoming, by Roth and Eddy (unpublished data 1960) of the Entomology Research Division, U.S. Department of Agriculture. Richards *et al.* (1956) reported it in Nevada from Esmeralda and Eureka Counties, and more recently the writer found it very abundant in Churchill, Lyon, and Washoe Counties but less prevalent in Douglas County. These counties are more western than eastern.

Aedes niphadopsis Dyar and Knab is the first *Aedes* to appear in the spring. Larvae were observed as early as January 13 and the aquatic stages are usually present to mid-April. It has a single generation each year and the length of the aquatic cycle usually ranges from about four to six weeks depending on the temperature. In Utah the principal hatch begins in the middle of April and is completed about the last of May (Rees and Collett 1954).

Breeding sites were moderate to highly alkaline pools, ponds, seep areas, sinks, and lake margins in the valleys. Water from 108 suspected aquatic habitats of *niphadopsis* and *campestris* was analyzed for pH and total soluble salts. *Aedes niphadopsis* occurred in 103 of those samples which possessed a mean pH of 7.9, rang-

[1] In cooperation with the Nevada Agricultural Experiment Station, Reno, Nevada.

ing from 7.1-9.3. The total soluble salts ranged from 1,250 to 49,350 ppm, with a mean of 11,781 ppm. *A. niphadopsis* was the most prevalent species in 78 of the 108 potential breeding sites examined. Associated species were *A. campestris, dorsalis* (Meigen), and *Culiseta inornata* (Will.), especially the first species. When *A. niphadopsis, campestris,* and *dorsalis* occurred in the same pool, *niphadopsis* larvae were generally in more advanced instars and the adults emerged before the other species. The aquatic stages of *campestris* invariably matured before those of *dorsalis*.

Two adjacent sites contained no mosquito larvae but apparently possessed adequate vegetation for egg deposition and larval protection and had total soluble-salt readings of 67,200 and 71,680 ppm. Possibly these readings exceeded the tolerance of these vernal mosquito species. In Utah, Rees and Collett (1954) reported that *A. niphadopsis* occurred in waters with a pH ranging from 7.1-8.2, with an average of 7.6, and in a salt concentration as high as 10% by weight (100,000 ppm.). They also stated that it is a persistent and vicious biter of domestic livestock, other animals, and man. The writer has had very little success inducing *niphadopsis* females to attack during the day in the field although tremendous larval populations were present and adults were quite abundant in the vegetation in the vicinity of their breeding sites. The few females that did feed were collected in vials (20 mm in diameter and 93 mm in length) and held for oviposition in the laboratory at about 75° F., according to the technique of Barr and Al-Azawi (1958). They laid from 35-55 eggs per female.

Autogeny is herein reported for the first time for *A. niphadopsis*. Adults obtained from field collected pupae were retained in cages (9 × 9 × 11 inches), supplied with sugar and honey water, dried raisins, apple slices, and provided with absorbent cotton and balls of cheesecloth moistened with water from their breeding sites for oviposition. Distilled water and water from the breeding sites were also provided in open dishes. Field populations were checked for autogeny from three areas: Winnemucca Lake and Gerlach in Washoe County and Hazen in Churchill County. A few eggs were deposited, probably only from one individual, in the several hundred mosquitoes from the Winnemucca Lake area. Almost 100 eggs were deposited by about 400 *niphadopsis* collected in the Gerlach area. A much larger sample of pupae was collected from the Hazen area and many of the females deposited hundreds of eggs both on the moistened absorbent cotton and the balls of cheesecloth. Some eggs were also collected from open dishes of water. Deposition started about 10 days following emergence. None of these eggs hatched after being conditioned and subjected to a hatching stimulus (one part of strained corn juice to 100 parts of distilled water).

The only report on the biology of *niphadopsis* states that "under optimum laboratory conditions, with a mean temperature of 72° to 75° F., the length of time required to complete the life cycle from first instar larvae to adult was 23 days. The length of time spent in each of the first three larval stages was similar, extending slightly over 72 hours for each, while the fourth instar larvae lasted approximately 10 days. The pupal stage required approximately 72 hours." (Reese and Collett 1954)

These data are not compatible with information obtained in our Reno laboratory at about the same temperature (75° F.), especially the stadium of the fourth-instar larva. Newly hatched first-instar larvae were brought into the laboratory, supplied with food, and reared in aerated water. The aquatic cycle from first-instar larva to adult was completed in a minimum of 14 days. The first three instars and the pupal stage each lasted 2-3 days, whereas the fourth instar required 4-5 days.

Comb scales of *niphadopsis* are said to vary from 8-12, but the writer has observed fourth-instar larvae with comb scales ranging from 6 to 17. One or more apical pecten teeth are said always to be detached and this character is usually used to delimit this species in keys (Carpenter and LaCasse 1955, Stage *et al.* 1952). Many larvae from Nevada do not have detached pecten teeth but the pecten teeth in all specimens examined extended about one-fourth the length of the siphon which is characteristic of this species.

AEDES CAMPESTRIS Dyar & Knab

This species has a much wider distribution than its congener *A. niphadopsis* and is known from Canada, Alaska, Colorado, Idaho, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, Wisconsin, and Wyoming (Carpenter and LaCasse 1955). In Nevada

Richards *et al.* (1956) reported it from Churchill, Mineral, Nye, and White Pine Counties. In addition, the writer has found it in Douglas, Elko, Eureka, Lyon, and Washoe Counties; abundant larval and adult populations were observed in Churchill, Lyon, and Washoe Counties.

Although larvae of *campestris* were observed as early as February 5, the main brood occurs in March and April. Adults emerge in late April and May. Companion species were *niphadopsis, dorsalis,* and *Culiseta inornata.* Breeding sites were the same as those enumerated for *niphadopsis.* Of the 108 suspected breeding sites, *campestris* was present in 61 among which the pH of the water ranged from 7.1-9.1, with a mean of 7.9. The total soluble salts of these samples ranged from 1,250 to 30,720 ppm, with a mean of 10,352 ppm. *Aedes campestris* breeding was absent in six areas with total soluble salts in excess of 31,000 ppm and which contained larvae of *niphadopsis. Aedes campestris* was the dominant species in only 21 of the 108 samples and *dorsalis* predominated in the remaining 9 sites.

Biting adults of *campestris* are very annoying in the vicinity of their breeding grounds and are both diurnal and noctural pests of man and animals. Numerous specimens of both sexes visited the blossoms of wild radish *(Raphanus sativus* L.) and horse brush *(Tetradymia glabrata* Gray) during mid-day.

With the exception of a report by Rempel (1953), who mentions a possible second brood in Saskatchewan, and McGregor and Eads (1943), who recorded multiple generations in Texas, most investigators believe *campestris* to be a univoltine species (Rees 1943, Owen and Gerhardt 1957, Barr 1958). In 3 years the writer has collected *campestris* larvae in Nevada only twice, other than in the spring. A few larvae were collected once in early December and a large brood of *campestris* and *dorsalis* were observed in several large alkaline areas in June following an unusual summer storm which deposited over an inch of precipitation. These areas had produced first a large brood of *niphadopsis* in March and then *campestris* in May after which the areas dried up in late May. Although it is possible that some of the *campestris* eggs that hatched in June were eggs from the year before that failed to hatch during the first spring flooding, the writer believes the preponderance of the June brood was derived from eggs laid by the preceding spring generation. Although the areas contained many eggs of *niphadopsis*, no larvae were collected during June.

In 1961 biting *campestris* females were field collected in vials as described for *niphadopsis* and retained in the laboratory for oviposition at about 75° F. and 65% relative humidity. Ten females oviposited 5-10 days after a blood meal. The number of eggs per female ranged from 120-330, with a mean of 269. One female fed a second time and laid a second batch of 179 eggs. Approximately one day after oviposition eggs were placed on moist filter paper in petri dishes. Twenty eggs from each of eight females were subjected to a hatching stimulus (as described for *niphadopsis)* when approximately one-week-old and 53% hatched. Similar tests with 20 three-week-old eggs from each of 10 females resulted again in a 53% hatch. Up to 95% of the eggs from some females hatched and the total hatching percentage would have been much higher except for the very few numbers that hatched from three females each time. Similar hatching results were obtained in 1960. These results indicate that although *campestris* is actually a multivoltine species, it usually behaves as a univoltine species in Nevada because of ecological and climatological conditions. For example, there may be a lack of precipitation and the breeding sites may be flooded only once a year in the winter or early spring; or the sites may remain inundated the year around with enough fluctuation of water along the shoreline to stimulate egg hatching of both *campestris* and *niphadopsis*.

The aquatic cycle of *campestris* from first-instar larva to adult was completed in a minimum of 11 days in the laboratory at about 75° F.

Several thousand pupae were collected from Hazen in Churchill County and reared (as described for *niphadopsis)* in a cage (12 × 12 × 18 inches). Hundreds of autogenous eggs were deposited begining 10 days following emergence. The eggs were laid singly and in groups on absorbent cotton, balls of cheese cloth, and on brown paper toweling, in petri dishes, all of which were kept moist with water from breeding areas. No eggs were deposited in open dishes of distilled water, contrary to observations reported by Beckel (1955) in Canada. No hatching of autogenously produced eggs was noted.

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RELEASES OF RECENTLY IMPORTED INSECT PARASITES AND PREDATORS IN CALIFORNIA, 1960-61

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University of California Citrus Research Center and Agricultural Experiment Station, Riverside

The following list, reporting the first field release of certain imported species of parasites and predators by the Department of Biological Control, supplements preceding biennial reports beginning with the years 1952-53. The year of first release is 1961 unless otherwise indicated.

The releases of weed-feeding insects were conducted in cooperation with the Entomology Research Division, United States Department of Agriculture.

The species listed in the 1958-59 report as *Aphytis* n. sp. (Israel), has since been described as *Aphytis holoxanthus* DeBach.

Host and Parasites or Predators	Origin	Area or County of Release
Aphis gossypii Glover		
Aphelinus "T"	Taiwan	Orange
		San Bernardino
Aphelinus gossypii Timberlake	India	Lake
		Orange
		Riverside
		San Benito
		San Diego
Lemnia personata (Weise)	Taiwan	Riverside
Propylea japonica (Thunberg)	Taiwan	San Bernardino
Trioxys communis Gahan	Taiwan	Riverside
Aphis spiraecola Patch		
Aphelinus "T"	Taiwan	Riverside
		San Diego
Lemnia personata (Weise)	Taiwan	Riverside
		San Bernardino
Lemnia swinhoei Crotch	Taiwan	Riverside
		San Bernardino
Nesomicromus navigatorum (Brauer)	India	Riverside
Propylea japonica (Thunberg)	Taiwan	Riverside
Trioxys angelicae (Haliday)*	Israel	Riverside
Aphis helianthi Monell		
Lemnia personata (Weise)	Taiwan	San Bernardino
Lemnia swinhoei Crotch	Taiwan	San Bernardino
Chromaphis juglandicola (Kaltenbach)		
Lemnia personata (Weise)	Taiwan	Contra Costa
Lemnia swinhoei Crotch	Taiwan	Contra Costa
Myzus persicae (Sulzer)		
Aphelinus flavipes Kurdjiamor*	Iran	Riverside
Praon volucre myzophagum Mackauer*	Israel	Imperial
		Orange
		Riverside
		San Diego
		Santa Barbara
Macrosiphum rosae (Linnaeus)		
Ephedrus japonicus Ashmead	Taiwan	Riverside

CHAITOPHORUS sp.		
Propylea japonica (Thunberg)	Taiwan	San Diego
AONIDIELLA AURANTII (Maskell)		
Aphytis coheni DeBach*	Israel	General
Aphytis sp. (*africanus*, ms. name)	So. Africa	Imperial San Bernardino Ventura
Chilocorus infernalis Mulsant	India	Riverside Ventura
Chilocorus hauseri (Weise)	India	Riverside
AONIDIELLA CITRINA (Coquillett)		
Aphytis sp. (*africanus*, ms. name)	So. Africa	Tulare
Aphytis coheni DeBach	Israel	Tulare
CHRYSOMPHALUS DICTYOSPERMI (Morgan)		
Aphytis coheni DeBach*	Israel	Ventura
AMORBIA ESSIGANA Busck		
Trichogramma pallidum Meyer*	U.S.S.R.	San Diego
HYPERA BRUNNEIPENNIS (Boheman)		
Habrocytus sp.*	Iran	Riverside
Patasson sp.*	Iran	Imperial Riverside San Diego
RHAGOLEITIS CINGULATA (Loew)		
Opius ferrugineus Gahan	Moorestown, N.J.	Siskiyou
TETRANYCHID AND ERIOPHYIID MITES		
Typhlodromus rickeri Chant	India	Orange Riverside San Diego Santa Barbara Ventura
Typhlodromus aerialis (Muma)	India	San Diego
OPUNTIA spp.		
Olycella junctolineella (Hulst)	Texas	Santa Cruz Island
TRIBULUS TERRESTRIS Linnaeus		
Microlarinus lareynii (Duval)	Italy	Kern Los Angeles Riverside San Joaquin Stanislaus
Microlarinus lypriformis (Wollaston)	Italy	Fresno Madera Riverside Tulare

* First release made in 1960.

TOPOGRAPHIC ANALYSIS OF THE CLEAR LAKE GNAT PROBLEM

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For many years the people of Lake County, California, have endured the nuisance arising from the summer emergence of myriads of the non-biting gnats *Chaoborus astictopus* Dyar & Shannon (Diptera: Culicidae: Chaoborinae) from Clear Lake. The question has frequently been posed as to why there is such a serious gnat problem at Clear Lake and not in other confined waters of Northern California, where this species occurs. There follows an attempt to answer this question and to suggest the most probable cause of the problem in Clear Lake.

Chaoborus astictopus is classified as a typically profundal, bottom dwelling organism closely related to other species associated with many of the world's lakes and reservoirs (Muttkowski, 1918; Juday, 1921; Eggleton, 1932; Herms, 1937, 1938; Brundin, 1949; Sublette, 1957). Generally, the life histories of the gnats are quite similar. Eggs are laid offshore on the water where they hatch in a day or two either on the surface, if the egg is afloat, or on the bottom, if the egg has sunk. Early instar larvae are pelagic and free swimming, forming a part of the plankton, whereas third and fourth instar larvae migrate to the deeper waters where they enter the benthic mud, coming out mostly at night to feed in the open water (Juday, 1921; Eggleton, 1932; Berg, 1937; Lindquist and Deonier, 1943; Wood, 1953, 1956).

This appears to be the general picture for *C. astictopus* in Clear Lake. The eggs are laid on open water in the evenings. During the night, if calm weather prevails, the eggs form great drifts, several yards wide and several hundred yards long. Estimates of the numbers of eggs have ranged up to 10 million per square foot in drifts as large as 200 acres (Lindquist and Deonier, 1942b). The young larvae become free swimming and generally disperse throughout the entire lake. Late instar larvae are rather evenly distributed in bottom samples. The gnats overwinter as larvae with emergence commencing in late April and continuing into July, when a second generation is already starting to appear. Heavy flights then continue through the summer with some gnats present into October (Lindquist and Deonier, 1942a). Unlike *Chaoborus punctipennis*

Say and *Chaoborus flavicans* Meigen in less temperate waters, *C. astictopus* is suspected of producing as many as three overlapping generations per year (Lindquist and Deonier, 1942a). The former two species, when living in more northern latitudes, apparently are largely univoltine, although Miller (1941) reported two generations of *C. punctipennis* in Lake Costello of the Algonquin Park lakes in Ontario, Canada, and Muttkowski (1918) suspected two generations from Lake Mendota, Wisconsin.

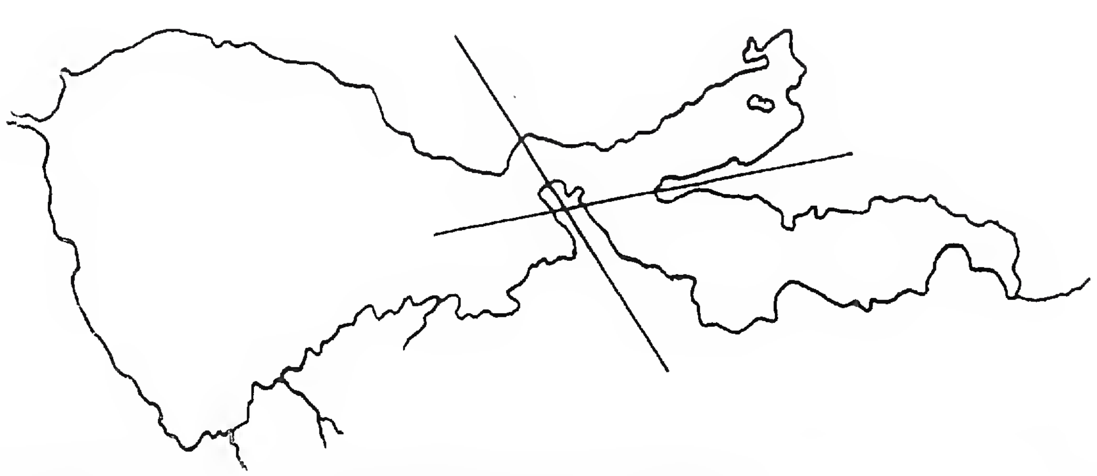
After emergence it is evident that the gnats move shoreward, since there is a general concentration of individuals along the entire shore line, with only random local variation. Whether this migration is due to some flight orientation process is unknown. Inland from the shore margins, adults decrease rapidly in numbers, although individual gnats have been found several miles from their source.

There has been little in the literature indicating a serious problem arising from chaoborids, except at Clear Lake. Most gnat and midge problems of a similar nature are the result of chironomids. Juday (1922) mentions great chaoborid flights from Lake Mendota, Wisconsin, but refers to no economic problem. Berg (1937) mentions the great breeding swarms of *Chaoborus flavicans* (as *Corethra flavicans)* that last from early July to early August in Esrom Lake, Denmark, but he also attaches no economic significance to these flights. Perhaps the residents along the lake shores in Wisconsin and Denmark are more tolerant because of the shorter duration of the flights, or perhaps they are simply more tolerant of insects and have learned to live with them. In any case, the larval counts per unit of bottom area in the latter lakes have been found comparable to those in Clear Lake.

Regardless of the potential menace of the gnats elsewhere, the problem becomes particularly acute with a body of water the size of Clear Lake. The reason is deduced as a corollary of the simple principle that, as a circle enlarges, the circumference increases as the first power ($2\pi r$) and the area as the square (πr^2) of the radius. Although lakes are rarely circular, nevertheless as a first approximation it may be stated that as the average diameter becomes greater the area increases faster than the shore line. This theorem may be applied to the inland waters of California with particular reference to the gnat problem.

Clear Lake is located in north-central California in the inner Coast Range at an elevation of about 1,340 feet. Typical of this part of the state, the winters are cool with an average rainfall of about 25 inches and the summers are long, dry, and hot. The lake itself averages about 42,000 surface acres with variations from 40,000 to 44,000, and is very shallow: 30 feet maximum in the upper portion with spots as deep as 50 feet in the two arms. As a result of this shallowness, the lake has no actual thermocline and is extremely eutrophic and rich. The bottom becomes very homogeneous a short distance from the littoral zone and is comprised of an extremely soft and highly organic ooze. On the whole, conditions appear close to optimal for *C. astictopus*.

In terms of gnat populations Clear Lake can be divided into three parts: The large upper or northern part, and the southwest and southeast arms (Fig. 1). The influence of gnats arising from any one of the three parts on the populations of the other areas may be considered negligible. The three parts may therefore be regarded as separate populations for the sake of this discussion. From Table 1 it is seen that the upper part contains 32,900 surface acres and only 36 miles of shore line. Hence, if we assume adult distribution to be reasonably uniform it follows that the gnats concentrated along each mile of shore line will have been derived from 914 acres of lake surface. This ratio of lake surface area to shore line is very much greater than that of any other body of water in this region where chaoborids are known to occur. The southwest arm has 318 acres per mile of shore line and the southeast arm has 231 acres per mile of shore (Table 1). If larval



EXPLANATION OF FIGURE

Fig. 1. Clear Lake, California, with lines dividing lake into large upper portion and southeast (upper right) and southwest (lower right) arms.

counts per unit of bottom were equal the southwest arm could not have more than 35 per cent the number of gnats per shore line mile and the southeast arm 25 per cent the number of gnats per mile of shore as that of upper Clear Lake. Regular monthly bottom samples, however, for the three areas of Clear Lake demonstrate larval counts in the two arms to be consistently less than the upper part. Although it might be difficult to convince some of the residents along the shores of the two arms, there is little doubt that the problem in these areas is not as acute as around the upper portion of the lake.

By similar means, other lakes in the region have been compared with upper Clear Lake. As can be seen in Table 1, if all other conditions were as favorable for the gnat as those of upper Clear Lake, and larval counts were comparable, no body of water in the area should encounter the problem that exists here. This is not to say that a serious economic problem could not arise from an infestation far less than that of upper Clear Lake, as those residents along the lower arms will attest. Larval counts comparable to upper Clear Lake have been found in Upper Blue Lake, whereas larval densities up to twice as high have been taken in Laurel Dell.

Table 1.—Sizes of various California lakes and reservoirs with the ratio of surface acres to miles of shore line expressed as a percent of that of upper Clear Lake.

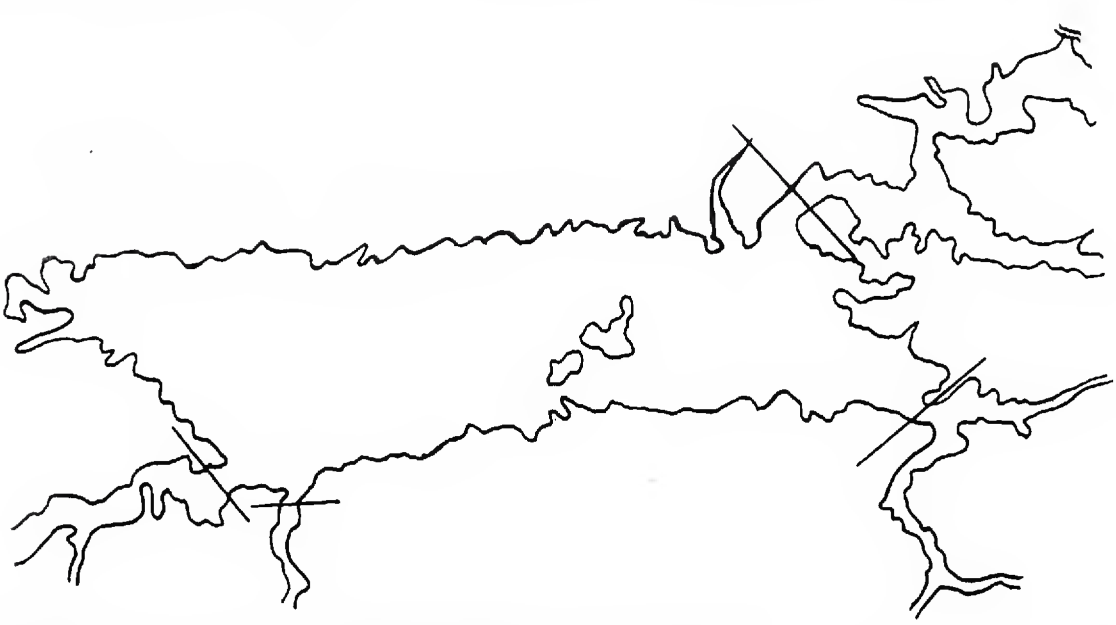
Lake	Surface Area (Acres)	Shore Line (Miles)	Surface Acres Per Mile of Shore Line	Ratio Percent to Upper Clear Lake
Upper Clear Lake	32,900	36	914	100
S.E. Arm Lower C.L.	3,468	15	231	25
S.W. Arm Lower C.L.	7,635	24	318	35
Berryessa	19,300 (14,000)*	169 (36)*	114 (390)*	12 (43)*
Mendocino	1,956	14.5	135	15
Laurel Dell (Lower Blue)	46	1.7	27	2.9
Upper Blue	104	3.1	33	3.6
Pillsbury	2,325 (1,900)*	23 (13)*	101 (146)*	11 (16)*

* Corrected figures (see text)

Although quantitative data on gnat flights are lacking, local residents along these nearby bodies of water disclaim any significant gnat problem. Observational comparisons of gnats around lights on the shores of these two lakes with those of Clear Lake demonstrate a ratio percent similar to that calculated in Table 1.

Highly irregular shore lines, of course, considerably increase distances in relation to the surface area. A good example is Lake Berryessa (Fig. 2), a recently constructed reservoir (1958). Due to the many extensive coves and backed up creeks, a strict surface to shore line ratio would be misleading. As with Clear Lake, different populations may be arbitrarily recognized based upon the shore line most likely to be influenced by specific parts of the lake. Those gnats emerging from the main body of the lake are not likely to have much influence upon the shore line well up into the coves. Consequently, arbitrary corrections have been made in an attempt to evaluate conditions more realistically. For this purpose four of the largest coves have been hypothetically eliminated (see lines drawn across the mouths of coves in Fig. 2), and the remaining shore line treated as smooth. This procedure yields a corrected value of 43 percent for Lake Berryessa (Table 1). Similarly, the value for Lake Pillsbury is raised from 11 to 16 per cent.

There are obviously many conditions that will bear upon and perhaps bias the foregoing calculations. The first, and perhaps the most significant from an economic standpoint, involves the



Explanation of Figure

Fig. 2. Lake Berryessa, California, with lines separating main body from extensive coves.

uniformity of adult distributions around the shore line and the factors which could influence it. Westerly winds prevail at Clear Lake during the summer months, especially in the afternoon and early evening when the gnats emerge. These winds are not as regular or strong as the westerlies closer to the coast. Nevertheless they evidently have some effect upon the gnats since the eastern shore of upper Clear Lake appears to have the highest concentrations of adults. *C. astictopus* is known to be highly phototrophic, a fact of primary importance. Just what general influence this could have in attracting gnats to the artificially lighted settlements and towns is not known with certainty. However, during gnat flights great numbers can be attracted to light traps anywhere along the shore line. Hence, this response could be a significant factor influencing the concentration of gnats to point sources of illumination scattered along the shore.

Irregularities in the shore line are also a factor that could influence gnat concentrations provided that the gnats tended to settle on the first solid objects encountered after flying off the lake. Thus, the gnats would tend to concentrate on the most exposed headlands. This sometimes appears to occur, especially where trees grow along the shore. Yet such concentrations are difficult to evaluate, especially through short distances, because the gnats appear rather generally distributed at least several hundred yards inland from the lake and are sometimes found in moderate numbers up to a mile inland. This phenomenon, to be sure, is most readily observed where there is flat country inland off the lake. Where the hills come down to the shore abruptly, as on parts of the eastern side, there probably will not be as much of the inland dispersion as occurs on the western shore. The confinement to narrower stretches of beach on the eastern side may also be a factor causing the number of gnats to be greater on that shore.

Despite these influences, and likely many others, as long as there is an obligatory movement by emerging gnats toward the shore lines, the numbers that arrive on the shores must be a function of the numbers that develop in the lake. If this ratio of surface or bottom acres to miles of shore line is great, more gnats can be expected around the circumference of the lake than if the ratio is small, even though larval counts per unit area and environmental conditions are comparable.

With the constantly increasing numbers of reservoirs throughout this state and elsewhere, there has been increasing concern over the possible creation of new gnat problems. Up to the present no gnat problem has developed in this part of the country as serious as that at Clear Lake. By using Clear Lake as an index to maximum infestation, it is possible, by the method described, to predict the infestation of other bodies of water in terms of a percentage of that found at Clear Lake. By so doing perhaps potential future problems can be partially anticipated.

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DISTRIBUTIONAL AND FOOD PLANT RECORDS IN THE CYANIPENNIS SUBGROUP OF THE GENUS LYTTA
(Coleoptera: Meloidae)

RICHARD B. SELANDER[1] AND JOHN C. DOWNEY[2]

The Cyanipennis Subgroup of the genus *Lytta* Fabricius is composed of three morphologically similar species of blister beetles found in western North America. The most widely distributed of these, *Lytta nuttalli* Say, occurs in sympatry with the others, *L. cyanipennis* (LeConte) and *L. viridana* LeConte, which are apparently allopatric in distribution. Each of these species has been found feeding in the adult stage on a variety of legumes, but at the time of Selander's (1960) study of the genus *Lytta,* only *L. cyanipennis* had been recorded from the genus *Lupinus*.

In the course of a field investigation of *Plebejus (Icaricia) icarioides* (Boisduval), a lycaenid butterfly closely associated with *Lupinus,* Downey has had the opportunity of observing adults of all species of the Cyanipennis Subgroup feeding on flowers and seed pods of *Lupinus* at several localities in the western United States. Records of these observations are reported in this paper, together with a few records from other sources.

LYTTA NUTTALLI Say

A series of 15 specimens was collected 12 miles south of Jacob Lake, 8800 feet, Coconino County, Arizona, July 2, 1961, on *Lupinus barbiger* Watson. The beetles were feeding in great numbers.

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Concerning the distribution of *Lytta nuttalli*, attention should be called to a record (as *Cantharis nuttalli*) from Fort Dodge, Iowa, published by Wickham (1911). This is the only record of the species from Iowa; it was overlooked by Selander (1960).

Lytta cyanipennis (LeConte)

Four new records of this species were obtained by Downey, as follows: Red Canyon, 7475 feet, near Hebgen Reservoir, Gallatin County, Montana, July 5, 1960, on *Lupinus sericeus* Pursh (6 specimens); Galena Summit, 8500 feet, Blaine County, Idaho, July 1, 1960, on *Lupinus arbustus calcaratus* (Kellogg) Dunn (42 specimens); 20 miles north of Vernal, 8200 feet, Uintah County, Utah, June 18, 1960, on *Lupinus caudatus* Kellogg (3 specimens); 2 miles south of Snake River Entrance to Yellowstone National Park, 6750 feet, Teton County, Wyoming, July 5, 1960, on *Lupinus argenteus* Pursh (3 specimens). In addition, we have a record of 14 specimens collected by Dr. G. F. Edmunds, Jr., at Mountain Dell, near the summit of Big Mountain (summit at 8263 feet), Salt Lake County, Utah, on *Lathyrus* sp.

From a distributional viewpoint, the record from north of Vernal, Utah, is of interest because it extends the known range of the species eastward into the Uintah Mountains, within a few miles of the eastern border of the state. The specimens from the Uintah Mountains are like those from the Wasatch Mountains of Utah described by Selander (1960) with regard to the form of the hind trochanters. As expected, the specimens from Idaho and Montana exhibit the typical spined (male) or distinctly angulate (female) condition of the hind trochanters, while those from Wyoming show an intermediate development of this character.

The undetermined species of *Lupinus* recorded by Selander (1960) as a food plant of *Lytta cyanipennis* in the Wasatch Mountains of Utah (Alta and Brighton) has now been identified as *Lupinus spathulatus* Rydberg. This plant is a close relative of *L. argenteus*, which is recorded above as a food source of this same species of beetle in Wyoming. At the Wyoming locality *Lupinus sericeus* (the food plant in Montana) occurred with *L. argenteus*, but specimens of *Lytta cyanipennis* were found only on the latter species. Since so few specimens are involved, no conclusion regarding food plant preference is warranted. The possibility of such a preference is an interesting one, however, and deserves investigation.

Lytta viridana LeConte

Three new records of this species are available. The first is based on eight specimens collected 9 miles west of Encampment, 8700 feet, Carbon County, Wyoming, July 9, 1960, on *Lupinus alpestris* A. Nelson. This record, the third for the species in Wyoming, severely narrows the distributional gap between *Lytta viridana* and *L. cyanipennis*. The latter species has been recorded from Carbon County, Wyoming, at Como and Saratoga[3]. The new locality for *L. viridana* is in the Sierra Madre Mountains at a point about 20 miles south-southwest of Saratoga. Since both Como and Saratoga are at elevations considerably lower than the locality in the Sierra Madre Mountains, it is conceivable that the two species are at least partially isolated by altitudinal differences. It should be pointed out, however, that we really do not know precisely where and at what elevations the specimens of *L. cyanipennis* labeled as from Como and Saratoga were taken. As intimated below, it is unlikely that *L. virdana* and *L. cyanipennis* are isolated by food plant differences, especially in view of the fact that the food plant of *L. viridana* in the Sierra Madre Mountains is very closely related to *Lupinus argenteus*, a known food plant of *Lytta cyanipennis*.

The second new record of *L. viridana* is from Caribou, 8800 feet, Boulder County, Colorado, June 16, 1960. At this locality 8 specimens were collected from an unidentified species of the *Lupinus argenteus* complex.

The third record was obtained for us by Dr. William R. Horsfall, who found adults of *Lytta viridana* in a wet mountain meadow 6 miles west of Estes Park, 8500 feet, Larimer County, Colorado, July 5, 1961, feeding on the flowers of *Iris missouriensis* Nuttall. Radford (1959) previously recorded *L. viridana* from this species of plant in Arizona. These are the only records of this blister beetles from Iridaceae known to us.

Discussion

Distributional and ecological data available on the blister beetles of the Cyanipennis Subgroup of *Lytta* suggest several problems of evolutionary significance. Adults of the three species are active at the same time of the year. Their habitats, if not

[3] Wyoming localities were omitted from the list of records of *L. cyanipennis* published by Selander (1960), although the localities were indicated on the distributional map. These localities are as follows: Wyoming: Como, 1; Granite Creek and Jenny Lake, Grand Teton National Park, May, July, August, 5; Saratoga, June, 5; Yellowstone National Park, 34 (20 in July).

identical, are at least broadly overlapping. At present there is no record of actual sympatry between *L. cyanipennis* and *L. viridana,* but distributional data presented in this paper indicate that the populations are in contact. Finally, as discussed below, the beetles do not show the degree of specificity to food plants that would suggest either a means of significant reduction of interspecific competition or a basis for interspecific isolation.

At present there is nothing in what we know of the ecological relationships of *Lytta cyanipennis* and *L. viridana* to explain why these species are allopatric with each other while at the same time *Lytta nuttalli* is broadly sympatric with both of them. The answer to this problem is possibly to be found in the larval ecology. Perhaps *L. cyanipennis* and *L. viridana* have mutually exclusive ranges because of a competitive relationship involving the same larval hosts, while *L. nuttalli* has a broader range of larval hosts or a different set of hosts and is therefore able to coexist with the other species despite the possibility of some competition for adult food.

All three species of blister beetles utilize food plants of several genera. Both *Lytta nuttalli* and *L. cyanipennis* are known to feed on *Vicia* and cultivated beans; both *L. nuttalli* and *L. viridana* are recorded from *Cnemidophacos pectinatus* (Hooker) Rydberg, *Diholcos bisulcatus* (Hooker) Rydberg, and species of *Caragana;* and it is probable that both *L. cyanipennis* and *L. viridana* feed on *Lathyrus*[4]. In addition, each of the species is recorded in this paper from *Lupinus*. Within the genus *Lupinus,* no species has been recorded as a food plant of more than one species of *Lytta,* but it has been determined that members of a species complex of *Lupinus* may be utilized by more than one species of beetle. Thus, both *Lytta nuttalli* and *L. cyanipennis* are recorded from the *Lupinus sericeus* complex (involving *L. sericeus* and *L. barbiger*) and both *Lytta cyanipennis* and *L. viridana* are recorded from the *Lupinus argenteus* complex (involving *L. argenteus, L. spathulatus,* and *L. alpestris*). Each of these complexes consists of closely related forms, the exact taxonomic status of which is questionable; some of them now given specific names may prove to be conspecific. At any rate, in view of the relatively wide range of food plants utilized by the individual species of the Cyanipennis Subgroup of *Lytta,* it seems unlikely that closely related forms of

[4] *Lytta viridana* has been recorded from "peavine," which is probably a reference to a species of *Lathyrus*. The occurrence of *L. cyanipennis* on *Lathyrus* is confirmed in the present paper.

Lupinus are differentiated sufficiently so as to provide a basis for interspecific isolation among the beetles feeding upon them.

With regard to interspecific isolating mechanisms operative within the Cyanipennis Subgroup, the finding of hybrids between *L. nuttalli* and *L. viridana* in Canada (Selander, 1960) suggests that genetic incompatibility may not be a critical factor. Unfortunately we do not know if these hybrids are fertile or how they compare adaptively with their parents. On the other hand, interspecific morphological differences between adult beetles involve almost without exception modifications of structural parts (antennae, legs, abdominal sterna) known to function importantly in the courtship and mating activities of one of the species *(Lytta cyanipennis)* and many other blister beetles. Thus we are led to believe that the species of the subgroup may be isolated by behavioral differences.

Addendum

New records obtained after the present paper was submitted for publication demonstrate that *Lupinus sericeus,* recorded above as a food plant of *Lytta cyanipennis,* is also utilized by the other two species of the Cyanipennis Subgroup. In South Dakota (4 miles north of Moon, 6950 feet, Pennington County), on June 27, 1962, Downey collected 6 specimens of *Lytta nuttalli* and 18 of *L. viridana* on *Lupinus sericeus* var. *egglestonianus* C. P. Smith. Two days later, in Wyoming (1 mile north of Sundance, 5075 feet, Crook County), he took 25 specimens of *Lytta nuttalli* from this same variety of *Lupinus*. The record of *Lytta viridana* is the first from the state of South Dakota.

An additional record of interest was obtained for us by Mr. Hugh B. Leech, who on August 15, 1962, collected 4 specimens of *Lytta nuttalli* on a ridge above Red Lake, 11,200 feet, Virginia Lakes, Mono County, California. The beetles were feeding on *Leptodactylon pungens* (Torrey) Nuttall, a species of Polemoniaceae.

Acknowledgments

We are grateful to Dr. David B. Dunn, Curator, University of Missouri Herbarium, for identification of the lupines herein recorded. Pressed specimens of each of these lupines have been deposited with Dr. Dunn.

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NOTES ON THE LEAF-CUTTER BEE MEGACHILE (EUTRICHARAEA) GRATIOSA GERSTAECKER

(Hymenoptera: Megachilidae)

J. S. TAYLOR
Port Elizabeth, South Africa

Four species of small solitary bees have occupied artificial nest sites at Port Elizabeth. The leaf-cutter, *Megachile (Eutricharaea) gratiosa* Gerstaecker and the megachilid *Heriades freygessneri* Schletterer, have been the most numerous inhabitants. The latter species is the subject of another paper now in press.

The artificial nests have been described elsewhere, and it is sufficient to mention here that *M. gratiosa* readily used glass vials or tubes of two sizes, three inches by three-tenths of an inch and one inch by one-fifth of an inch respectively. It was found, however, that nests in glass vials tended to become mouldy through the "sweating" of the leaf fragments used in nest construction. Although some bees were successfully reared in them, many died in the developmental stages. The fact that the larger tubes were open at both ends did not seem to help. Paper cylinders of the same dimensions were substituted for the larger vials and these have been most successful. Unfortunately, however, it was impossible to observe progress in the paper cylinders. Rearing tubes made of cellophane and liberally punctured with pin holes were an improvement in this respect, but the cellophane was found to be somewhat flimsy. Cylinders made of celluloid are now being used with fair success. In a recent paper Stephen (1961) describes how milk straws were used for the mass production of *Megachile (Eutricharaea) rotundata* (Fabricius) in the Pacific Northwest, and it is intended to experiment here with the transparent type of straw if and when available.

It may here be mentioned that the cylinders containing the nests are inserted in holes in small blocks of wood which are situated out-of-doors on a north-facing window sill. This constitutes the nest site. On completion the nests are removed indoors and kept at room temperature until emergence. During summer the room temperature varies from 82°F to 64° F, the daily average being 72.8°F. In autumn and winter it varies from 70°F to 50° F, the average being 60°F.

M. gratiosa is active at Port Elizabeth from spring to late summer and autumn. In 1959, it was first noted at the nest site on 11 September, in 1960 on 15 September, and in 1961 on 5 September. In 1960, it remained present until the beginning of May, but in 1961 it was not seen after 27 March. In 1962, it was last seen at the nest site on 6 April, and it reappeared again there on 13 August. While activity at the site continues throughout, it is more marked in late spring and again late in the summer.

Nest construction commences as soon as the bees appear at the site, and continues, more or less, until they are last noted there in autumn. They are, of course, more active in warm weather; under cold and wet conditions they remain dormant in their partially constructed nests. The number of cells per nest varies: up to nine have been found in the large vials and cylinders, although eight is the more usual maximum, while the small vials can take only four cells at the most. Nests often consist of fewer cells and sometimes of one cell only.

The time occupied in the construction of a nest also varies greatly and depends largely upon the climatic conditions prevailing at the time. In fine and warm weather, construction is much more rapid. Thus, under such conditions, a nest of eight cells has been completed in five days, while in less favourable weather a nest of this size has taken twenty days to construct. In one case it took eight days to complete two cells, and in another seven days were occupied in the construction of one cell. Building at the rate of one cell per day would appear to be the average.

The structure of the cells of leaf-cutter bees is too well-known to require description here: suffice it to say that the cells and nest of *M. gratiosa* are typical, *i.e.* long, elliptical leaf portions for the sides of the cells and round portions for the ends. Green leaves are generally used but sometimes colored, modified leaves are used as well as flower petals. The longer elliptical sections may measure up to 6 × 4 mm in length. When the last cell of a nest has been completed the entrance is plugged with a thick wad consisting of round sections of leaf. This wad, which may be anything up to 20 mm in length, often protrudes outwards, with a longer and loose piece of leaf extending further. In the larger vials there is sometimes an empty space of varying length between the last cell and the entrance plug. Occasionally a vial may be partially or even entirely filled with plug material with few or no cells. Perhaps even leaf-cutter bees have their frustrations.

M. gratiosa is more active on the wing than *Heriades*, flying around to a greater extent and making a high humming sound in flight. In the emergence vials they betray their arrival with loud humming, whereas *Heriades* is silent. While prospecting for nest sites they repeatedly enter holes, removing fragments or splinters of wood, etc., in their way. Sometimes one will enter a vial already occupied by *Heriades*, but it is soon forcibly ejected. One individual, which already had a nest, was seen endeavouring to pull, head first, another female out of her nest. The intruder soon desisted and returned to its own abode. Sometimes, on returning to the nest site, leaf-cutter bees settle on the wooden block containing the vials or elsewhere in the vicinity before entering their nests, but they are not so persistent in this custom as *Heriades*.

While engaged upon nest construction the bees are constantly going and coming, taking less than a minute to fetch their portions of leaf. They may remain in the vials for about one minute or longer and during this time they often come out and back in again rapidly. The same procedure takes place when collecting nectar or pollen but periods of absence may then extend up to ten minutes. Soon after entering they come out to reverse in again, the time spent within once more occupying about one minute. On several occasions, a bee, when disturbed, dropped a piece of leaf just as it was about to enter its nest. It hovered around for a few seconds and then left to fetch another piece without attempting to recover the dropped portion. The latter was then placed in the entrance to the nest, but it was immediately thrown out by the bee when it returned with a fresh piece.

Newly constructed cells contain a dark orange liquid, somewhat granulated and sweet, which leaves a yellow stain when dry. Immersed in this is a more solid, dough-like bee bread formed from a pollen believed to be derived from composite flowers. In this connection, Stephen *(op. cit.)* states that *Megachile (Eutricharaea) rotundata* is oligolectic to alfalfa (lucerne) in the Pacific Northwest. For this reason it was being mass-reared to assist the pollinating of the crop for increased seed production.

The cylindrical and hyaline egg, measuring some 2 mm in length, is deposited on its side upon the accumulated food in the cell and in a more or less vertical position.

The period occupied by the immature stages of *M. gratiosa* varies considerably with the time of year. Nests formed from late February, and sometimes even earlier, do not produce adult progeny until the following December, and emergences from nests formed in the spring commence at about the same time. In 1960, adults emerged from nests formed in the spring before those from nests constructed in the previous autumn. The origin of the spring individuals seen at the nest site from August to November, remains unknown. No emergence from nests formed in the autumn of the previous season has taken place before December. The species disappear from the nest site in autumn and have not been seen there again until early spring.

The shortest period from the completion of a nest to emergence was 24 days, but this was quite exceptional. For spring and summer nests the more general duration of the combined developmental stages varied from 36 to 72 days. The nests formed in late summer and autumn have occupied from 261 to 306 days, but an extreme instance of 330 days was also obtained. This was from a nest completed on 28 January 1961, and from which numerous individuals of a chalcid parasite emerged from 17 March to 24 April. Unexpectedly, two bees emerged from this nest on 23 and 28 December. From the commencement of nest construction to first emergence the periods are naturally somewhat longer.

Sometimes all the bees emerge from a nest on the same day, but more generally over a period of a few days. In *Heriades* a greater time lag exists between each emergence from one nest. However, emergence in the case of *M. gratiosa* may also be protracted, and three extreme periods of 12, 15 and 23 days were recently obtained, but these are exceptional. Otherwise the emergence period has varied from 1 to 8 days with an average of 4.3 days in 1961/62. In most, but not all, cases the males emerge before the females. In 15 out of 17 nests the males emerged first, and in the remaining two (while males were the first to emerge) other males emerged later, after several females had done so. In one case a male was the last of seven bees of both sexes to emerge. Occasionally all the progeny of one nest are of the same sex, but a mixture of both sexes is much more usual. From 29 nests a total of 164 adult bees were obtained, of which 91 (55.5%) were males.

The adult bee is stout, between 7 and 8 mm in length. The female is well-covered with silvery grey hairs, which are darker on the upper part of the face and head. The abdomen is black and ringed with short silver hairs, giving a banded appearance. The tip of the abdomen is pointed and the scopa or pollen brushes are deep orange. The female can be safely handled and is reluctant to sting although capable of doing so. If pressed gently between one's fingers, it first uses its mandibles which can inflict faint nips. It will eventually use its sting, but the effect is only momentary. The sting does not seem to be sufficiently powerful to pierce the human skin easily.

In the male bee the tip of the abdomen is blunt, and the hairs, including the abdominal rings, are yellowish-buff. The male has not been seen at the nest site or in the vials except at the time of emergence.

Natural Enemies

Two individuals of *Miltogramma* sp. (Sarcophagidae) emerged from a five-celled nest which was formed between 6 and 13 March, 1960. The first fly emerged on 7 April, and the second not until 1 November, while two bees emerged from the same nest on 12 and 13 December. A much more numerous parasite is a minute chalcid which first made its appearance during the late summer of 1961. This parasite has been determined, from the female sex only, as *Melittobia* sp. probably *hawaiiensis* Perkins (Eulophidae). From a nest completed at the beginning of January, this chalcid commenced to emerge on 6 February and continued to do so in numbers until 25 February, while one bee emerged on 8 February. On 10 March, the nest was removed from its paper cylinder and examined. Two cells were found to contain the desiccated remains of adult bees, while the three first or basal cells had a few minute holes in the sides, lids and/or bases. These three cells were empty save for fragments of pollen and thin and flaky semi-transparent material, apparently the skins of chalcid pupae. Another nest from which parasites had emerged between 4 and 8 March, 1961, was also opened. One cell contained parts of the head and abdomen of a bee as well as parasites in various stages of pupal and adult development. Other parasitized nests were subsequently found. In 1961/62, from a nest formed in November the chalcid parasite has been emerging since 23 January.

More recently a metallic green ruby wasp *Chrysis (Tetrachrysis) laetabilis* Buysson (Chrysididae) has been obtained from nests of *M. gratiosa.* One individual emerged from an overwintering nest, and three emerged in late January from a nest formed in November. This chrysidid is widely distributed in South Africa, and has also been obtained from the nests of *Heriades freygessneri.*

H. freygessneri sometimes occupied a vial which already had one or more completed or abandoned cells of *M. gratiosa.* In such cases, most or all of the original nest or partial nest, as the case may be, is removed by the new occupant, although one of the emptied cells is often used as a foundation for the new nest. Very occasionally an adult *M. gratiosa* may emerge from one of these commandeered nests.

Acknowledgments

The writer is much indebted to Dr. K. V. Krombein, U.S. National Museum, Washington, D.C., for the determination of *Megachile (Eutricharaea gratiosa)* Gerstaecker, and to Dr. B. D. Burks for the determination of its chalcid parasite; also to the Commonwealth Institute of Entomology, London, for the determination of *Miltogramma* sp., and to Mr. D. P. Annecke, Division of Entomology, Pretoria, for much assistance with parasite material.

Reference

Stephen, W. P.
1961. Artificial Nesting Sites for the Propagation of the Leaf-Cutter Bee *Megachile (Eutricharaea) rotundata* for Alfalfa Pollination. Jour. Econ. Ent., 54(5):989-993, 11 refs.

MEETING NOTICE

The 47th Annual meeting of the Pacific Branch of the Entomological Society of America will be held at the Gearhart Hotel, Gearhart, Oregon on June 24 through 27. Among the sixty papers to be presented, five will be included in a symposium entitled, "Recent advances in research on the relationship of pesticides to public health, wildlife and water pollution."—*Editor*

NEW SPECIES AND NEW RECORDS OF PYGOSTENINI FROM UGANDA AND KENYA

(Coleoptera: Staphylinidae)[1]

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The purpose of this paper is to report new species of Pygostenini and new records of previously described species which we collected recently in Uganda and Kenya. The specimens were collected on two trips to Kenya and one to Uganda in 1960 and 1962. To this material has been added a short series from the British Museum (Natural History), London, and a series collected in Kenya by Mr. G. R. Cunningham-Van Someren.

Our first trip to Uganda and Kenya was completely unplanned. We had been collecting and studying myrmecophiles at Yangambi, Congo Republic in 1960 when the revolution occurred. We had planned to leave Yangambi at about that time and continue our studies at Lwiro, Congo Republic. However, emergency conditions prevailed and when the American Air Force flew us out of Stanleyville, they landed at Entebbe, Uganda. It seemed unwise as well as virtually impossible to get over to our previously scheduled stop, so we decided to try our hand at Entebbe. In the meantime, the press of refugees was creating crowded hotel conditions so we decided to move on to Nairobi, Kenya, where we could work in an atmosphere less disturbed by refugees, the landing of United Nations troops, and other events related to the Congo crisis. Thus we spent about three weeks in Kenya in 1960 and put together a rather large sample of the myrmecophiles associated with *Dorylus (Anomma) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr. The author was assisted in the field during this trip by his wife, Alzada Carlisle Kistner, and an assistant, Mr. Robert Banfill. All of the specimens were collected by the three of us working as a team unless otherwise noted herein.

In 1962, I returned to Kenya to study further the dry season behavior of the ants and the myrmecophiles. Since I had a good sample from the previous visit which had been partially studied, my activities were concentrated on the behavioral aspects and only occasional specimens were taken. On this phase of this trip, I was working alone as I had sent my wife home to have our youngest daughter.

[1] This study was aided by a grant from the National Science Foundation (No. G-12859)

During the course of the two trips, we sampled myrmecophiles from the following localities: Kisubi Forest, Uganda, is about 10 miles from Entebbe, a little off the road to Kampala. There is a large Episcopalian mission and school very near to it. Its elevation is about 3500 feet above sea level. Karen, Kenya, is situated in the Ngong Hills about 11 miles from the center of Nairobi at an elevation of about 6,000 feet. Very close to Karen is the private forest of Dr. V. G. L. Van Someren and his son Mr. G. R. Cunningham-Van Someren. This forest, called the "Sanctuary," is maintained in a relatively undisturbed condition and was the most profitable locality we worked in Kenya. Muguga, Kenya, is about 4-5 miles from Kikuyu, a few miles off the left of the Nakuru road (Rte. A-104). I should judge its altitude at about 7,000 feet. It is the location of the East African Agriculture and Forestry Research Organization (EAAFRO), which permitted us to use their guest house and laboratory facilities during our stay there. Nyeri is about 97 miles from Nairobi on the Fort Hall Road (Rte. B-18). Its elevation is 5870 feet. The specimens we captured there were found on the grounds behind the Outspan Hotel. We made a short trip to Mbooni Hill which is about 15 miles out of Machakos and at an elevation of about 6,000 feet. During 1962, a small sample was taken on the shores of Lake Naivasha about 54 miles out of Nairobi on the Nakuru road at an elevation of about 6200 feet. All of the Kenya localities we visited are ecologically similar in that they are all mountain forest areas except where the land has been cleared for agriculture of one sort or another. During the early days of railroad building in Kenya, large tracts of land were planted in black wattle trees (a species of *Eucalyptus)* to use for fuel and to produce tannic acid for processing leather. We were never able to find driver ants or many other insects for that matter in these stands. The Uganda locality we visited is situated in a plateau region with the rainfall distributed pretty evenly over the entire year. It has a flora which resembles that of the equatorial regions of the Congo, but is less lush.

The methods used to collect from *Dorylus (Anomma)* colonies were the same ones described previously (Kistner, 1963b). We managed to find one colony of *Dorylus (Dorylus) helvolus* Linnaeus and the study of this species and its myrmecophiles requires slightly different methods.

D. helvolus lives almost entirely underground. It is able to raid under the turf and bore its way under the soil to a considerable depth. It seems to have a fondness for bones. One day after we had been searching for this species for weeks, I happened to pick up a dog's bone in Mr. G. R. Cunningham-Van Someren's back yard. Upon examination, this bone had *D. helvolus* in it which were grinding off little bits of the bone inside the marrow cavity. When we examined the ground beneath the bone, small underground trails were detected and the ants were seen carrying the small bits of bone in these trails. One cannot capture myrmecophiles from such a disturbed trail so it became necessary to find some means to attract the ants to the surface. We did this by planting bones in a cleared area (Mrs. Van Someren's garden) and packing the dirt down tightly around and beneath them. The next morning there were well established trails on the surface to the planted bones from which we extracted three myrmecophiles. The ants in the trails so established are extremely sensitive to sunlight and if not shielded will quickly dig underground again. Also, in using planted bones this way, it would be good to have little cages which can be secured firmly to the ground because the forest abounds with larger animals which also seem to be fond of bones and which frequently will steal all of the ant bait.

I have written two papers previously that deal with species of Pygostenini found in East Africa (Kistner, 1958 and 1960). Both of these papers contain complete bibliographic citations of the species described up to that time. Hence, new records given in this paper will not contain bibliographic citations unless these are not to be found in the aforementioned papers. All morphological terms, systems of notation, and study methods have been previously described by Kistner (1958, 1959, and 1963a).

Most of the specimens that I had studied previously came from coastal regions of East Africa. These had presented a rather distinctive fauna, so that it was surprising to me to see how closely the species found in the highlands of Kenya were related to the species characteristic of the mountainous regions of Kivu, Congo Republic, and Rwanda.

We are grateful to many people for kindness and hospitality extended to us during this phase of our trips. We are particularly grateful to Dr. A. J. Haddow, Director of East African Virus Research Institute at Entebbe, who gave us directions to find localities likely to produce "safari ants" (the East African common name for the driver ants); to Dr. Russell, Director of the East African Agriculture and Forestry Research Organization at Muguga, who extended to us the use of the laboratory facilities of his organization and permitted us to secure food and lodging at EAAFRO's guest house; to Mr. W. Wilkinson, also at EAAFRO, for aiding us in the field and in the laboratory. Especial thanks are due to Dr. V. G. L. Van Someren and his son Mr. G. R. Cunningham-Van Someren for the use of their private forest and to Mr. G. R. Cunningham-Van Someren again for directly participating in our field studies during both trips and for sending us additional material that he collected after we left.

The taxonomy of the driver ants seems to be extremely complex and much of the value of our studies would be lost without the valuable determinations provided by Professor J. K. A. Van Boven, Université de Louvain. For these many determinations we are very grateful.

Last, but not least, I want to thank my wife and two student assistants, Mr. Robert Banfill of Columbus, Montana and Mr. Paul Edmiston of Chico State College for doing most of the painstaking preparation work involved in handling the collection.

All specimens cited herein are in the collection of the author and will eventually be deposited in the Chicago Natural History Museum unless otherwise noted.

Genus *TYPHLOPONEMYS* Rey

SPLENDIDA GROUP

TYPHLOPONEMYS METHNERI Bernhauer

New Records: 10 specimens, Kenya, Karen, 24-28 July 1960, all from the central parts of raiding columns of *Dorylus (Anomma) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nests 40 and 43.

LUJAE GROUP

TYPHLOPONEMYS LUJAE Wasmann

New Records: 113 specimens, Kenya: Karen, Mbooni Hill, Muguga, Nyeri, and Naivasha, from central parts and ends of raiding columns and at the ends of nest-changing columns of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nests 39-43, 46-48, 50, 51, 53-55, 87, and 90, from 22 July-17 August 1960, 6-10 August 1962, May 1962 (this last group collected by G. R. Cunningham-Van Someren).

The spermatheca figure presented by Kistner (1960, p. 140) turned out to be truly aberrant when a large series could be studied.

BICOLOR GROUP

TYPHLOPONEMYS HORNI Bernhauer

New Records: 14 specimens, Uganda, Kisubi Forest, 19 July 1960, from the central part and the end of a nest-changing column of *D. (A.) wilverthi* Emery, nest No. 37.

This species was formerly known only from Angola, Cameroon, Rwanda, and the Congo Republic.

TYPHLOPONEMYS PALLIPENNIS Bernhauer

New Records: 370 specimens from Kenya, Karen, from the central parts and ends of raiding columns and the ends of nest-changing columns of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nests 39-43, 50, 51, 53, 54, 88-90, collected from 22 July-17 August 1960, 10 August 1962, May 1962 (the last collected by G. R. Cunningham-Van Someren).

This species was previously known only from the mountainous parts of the Eastern Congo Republic and Rwanda.

TYPHLOPONEMYS RITTERI Kistner

New Records: 3 specimens from Kenya, Karen, from the central part of a raiding column and the end of a nest-changing column of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nests 41, 53, and 90, 27 July 1960, 12 August 1960, and May 1962 (the last collected by G. R. Cunningham-Van Someren).

ALUTACEUS GROUP

Typhloponemys haddowi Kistner new species
(Figs. 1, 2)

Most closely related to *T. alutaceus* Wasmann from which it is distinguished by the shape of the spermatheca and the median lobe of the male genitalia.

Color dark reddish brown with the pronotum and abdomen lighter in color than the head and elytra. Dorsal surface of the head, pronotum, and elytra shagreened. Macrochaetotaxy of abdominal tergites II-VIII: 0, 4, 4, 4, 4, 4, 0, middle chaetae on tergites III-V reduced in length. Macrochaetotaxy of abdominal segment IX as follows: dorso-lateral plates, 7, most anterior chaetae smaller, thinner, and lighter in color than the more posterior ones; median dorso-lateral part, 5 (3 black); ventro-lateral part, 4 (1 black); median lobe, 7. Spermatheca shaped as in fig. 1. Median lobe of the male genitalia shaped as in fig. 2.

Measurements: Pronotum length, 0.44-0.49 mm; elytra length, 0.34-0.45 mm; eye length, 0.16-0.20 mm; interocular distance, 0.41-0.43 mm; head length, 0.25-0.27 mm. Number measured, 2.

Holotype female, No. 4107, UGANDA, KISUBI FOREST, 19 July 1960, from the end of a nest-changing column of *D. (A.) wilverthi* Emery, nest No. 37.

Paratype: Male, same data as the Holotype.

This species is named for Dr. A. J. Haddow of the East African Virus Research Institute.

PUBESCANS GROUP

TYPHLOPONEMYS PUBESCENS Wasmann

New Records: Kenya: 1 male, Karen, 28 July 1960, from the central part of a raiding column of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nest No. 40; 1 female, Muguga, 4 August 1960, from the end of a raiding column of the same species of host, nest No. 48.

This species was formerly known only from the Congo Republic and the Cameroun.

Typhloponemys wilkinsoni Kistner, new species

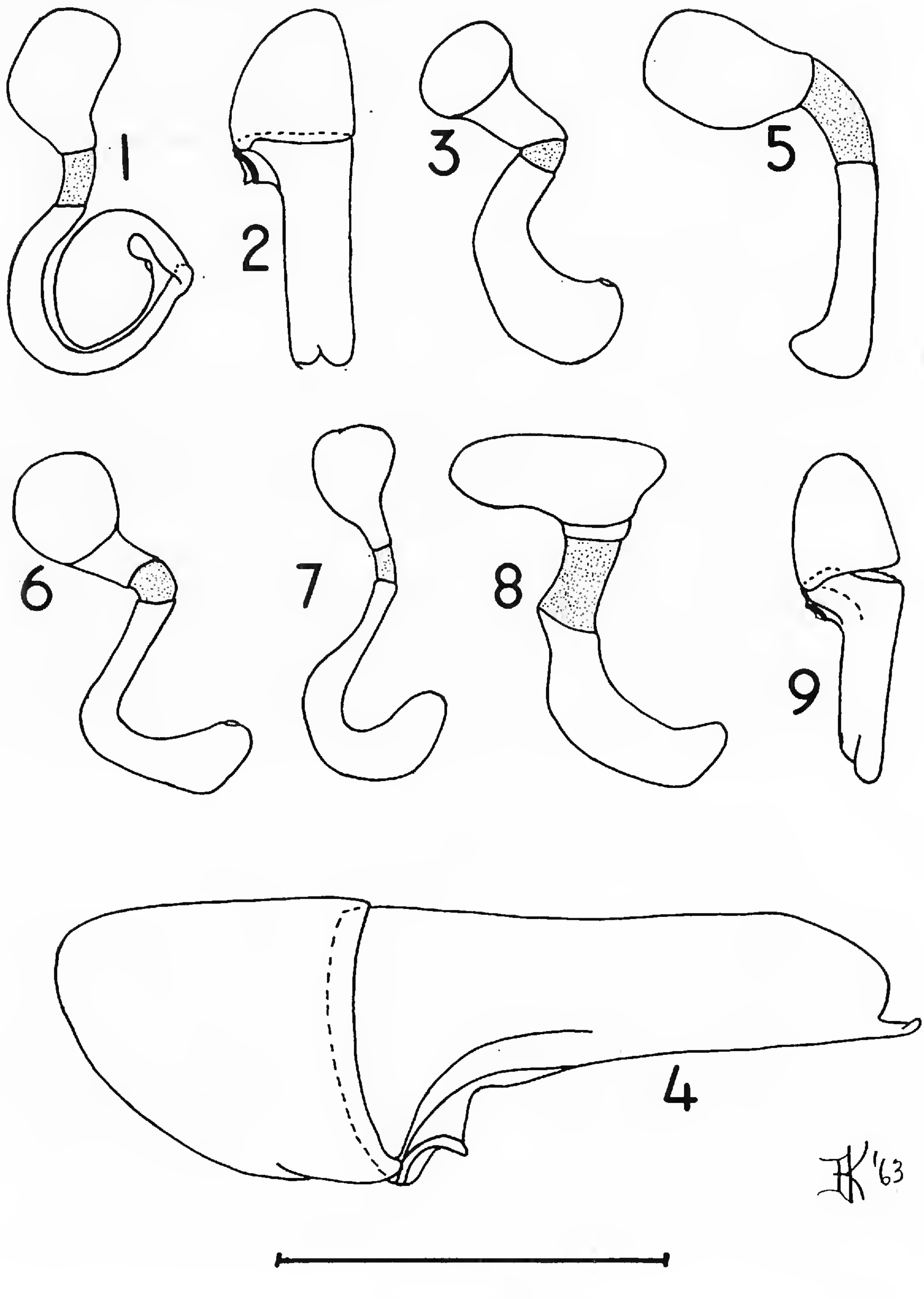
Distinguished from all other species including *T. ruficollis* Cameron to which it is most closely related by the shape of the median lobe of the male genitalia and the spermatheca. The spermatheca can be confused with that of *T. pubescens* Wasmann, but the species is easily distinguished from *pubescens* by the shape of the pronotum which is less vaulted and more sparsely covered with setae. This species together with *T. ruficollis* Cameron intergrade into the *bicolor* group but are placed in the *pubescens* group because of the abdominal macrochaetotaxy. The fact that most of the species groups of *Typhloponemys* grade into one another does not cause this author concern because if they were distinct they would merit generic or subgeneric status. The species groups as I have used them here and elsewhere imply some degree of morphological similarity and therefore relationship between the species assigned to them. As such they are a convenient way of handling genera like *Typhloponemys* with its 78 species.

Color reddish brown throughout; the pronotum and abdomen lighter in color than the head and elytra giving a two-toned effect to the coloration of most of the specimens. Dorsal surface of the head, pronotum, and elytra smooth and shiny; sparsely covered with fine yellow setae. Machrochaetotaxy of abdominal tergites II-VIII: 0. 6, 6, 6, 4, 4, 0. Machrochaetotaxy of abdominal segment IX as follows: dorso-lateral plates, 6, most anterior chaeta smaller, thinner, and lighter in color than the more posterior ones; median dorso-lateral part, 5, (3 black); ventro-lateral part, 5 (2 black); median lobe, 7. Spermatheca shaped as in fig. 3. Median lobe of the male genitalia shaped as in fig. 4.

Measurements: Pronotum length, 0.40-0.62 mm; elytra length, 0.44-0.60 mm; eye length, 0.21-0.30 mm. Number measured, 10.

Holotype female, No. 8737, KENYA, KAREN, May, 1962, from the central part of a raiding column of *D. (A.) nigricans* ssp.

burmeisteri var. *molestus* (Gerstaecker) Mayr, nest No. 89, Coll. G. R. Cunningham-Van Someren.



Explanation of Figures

Figs. 1-9, Spermathaecae. 1, *Typhloponemys haddowi* n.sp.; 3, *T. wilkinsoni* n.sp.; 5,6,7, Various forms of *T. epipleuralis* Bernhauer; 8, *T. watamuensis* n.sp. Median lobe of male genitalia: 2, *T. haddowi* n.sp.; 4, *T. wilkinsoni* n.sp.; 9, *T. watamuensis* n.sp. The smaller scale refers to Figs. 2 & 9; the larger to all others. Both represent 0,25 mm.

Paratypes: Kenya, Karen, host *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr: 52 (5 males, 2 females), same data as holotype; 2 (1 female), 22 July 1960, from the central part of a raiding column, nest No. 39; 1, 27 July 1960, central part of a raiding column, nest No. 41; 4, 28 July 1960, central part of a raiding column, nest No. 41; 1, 6 August 1960, central part of a raiding column, nest No. 41; 1, 7 August 1960, raiding column, nest No. 41; 1 female, 9 August 1960, central part of a raiding column, nest No. 41; 4 (2 females), 11 August 1960, central part of a raiding column, nest No. 41; 1, 28 July 1960, central part of a raiding column, nest No. 40; 1, 25 July 1960, central part of a nest-changing column, nest No. 42; 4 (1 male, 1 female), 26 July 1960, central part of a raiding column, nest No. 43; 1 male, 25 July 1960, central part of a raiding column, nest No. 43; 1, 10 August 1960, central part of a raiding column, nest No. 50; 1, 17 August 1960, raiding column, nest No. 51; 2, 12 August 1960, central part of a raiding column, nest No. 53; 1, 17 August 1960, debris pile, nest No. 53; 4, 14 August 1960, central part of a raiding column, nest No. 54; 1, 10 August 1962, central part of a raiding column, nest No. 88; 4, May 1962, end of a nest-changing column, nest No. 90, Coll. G. R. Cunningham-Van Someren. Muguga, same host: 5 males, 7 females, 30 July 1960, central part of a raiding column, nest No. 44; 1 male, 2 August 1960, end of a nest-changing column, nest No. 46; 1 female, 4 August 1960, end of a raiding column, nest No. 48.

This species is named for Mr. W. Wilkinson of the East African Agriculture and Forestry Research Organization, Muguga, who was so helpful to us during our stay there.

FAUVELI GROUP

TYPHLOPONEMYS EPIPLEURALIS Bernhauer
(Figs. 5, 6, & 7)

The spermatheca of this species was found to be somewhat variable and the figures illustrate this additional variation that can be expected when larger series are studied.

New Records: 77 specimens, Kenya, Karen, from the central parts and ends of raiding columns and nest-changing columns and from a debris pile of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nests No. 39-43, 50, 53, & 89, from 22 July-12 August 1960, and May 1962 (the last collected by Mr. G. R. Cunningham-Van Someren).

This species was previously known only from 4 specimens from Tanganyika.

Typhloponemys watamuensis Kistner new species
(Figs. 8 & 9)

Distinguished from all other species including *T. bernardi* Kistner to which it is most closely related by the shape of the spermatheca and the median lobe of the male genitalia.

Color yellowish brown throughout. Dorsal surface of the head, pronotum, and elytra smooth and shiny. Macrochaetotaxy of abdominal tergites II-VIII: 2, 4, 4, 4, 4, 4, 0. Macrochaetotaxy of abdominal segment IX as follows: dorso-lateral plates 6, most anterior chaeta smaller, thinner, and lighter in color than the more posterior ones; median dorso-lateral part, 5 (3 black); ventro-lateral part, 4 (1 black); median lobe, 7. Spermatheca shaped as in fig. 8. Median lobe of the male genitalia shaped as in fig. 9.

Measurements: Pronotum length, 0.34-0.41 mm; elytra length, 0.29-0.35 mm; eye length, 0.20-0.24 mm; interocular distance, 0.31-0.35 mm; head length, 0.18-0.25 mm. Number measured, 2.

Holotype female, No. 8234, KENYA, WATAMU, 60 MILES NORTH OF MOMBASSA, December, 1961, from a raiding column of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nest No. 57, Coll. G. R. Cunningham-Van Someren.

Paratype: Male, same data as holotype.

SETULOSUS GROUP

TYPHLOPONEMYS SETULOSIS Wasmann

New Records: Uganda: 6 (2 males, 1 female), Kisubi Forest, 19 July 1960, from the end of a nest-changing column of *D. (A.) wilverthi* Emery, nest No. 37. Kenya: 403 specimens from Karen, Muguga, and Nyeri, from the central parts and ends of both raiding columns and nest-changing columns of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nest Nos. 39-43, 46, 48, 50, 51, and 53, 22 July-17August 1960; 10 August 1962, and May 1962 (the last collected by G. R. Cunningham-Van Someren).

The Kenya and Uganda specimens together with certain specimens from the mountainous parts of the Eastern Congo Republic average darker in color, smaller in size, and have fewer and shorter black setae on the head, pronotum, and elytra than specimens of the same species from the Congo Basin. There seems to be little point in formalizing these population differences with a subspecific name (although *subpunctatus* Bernhauer is available), as there seem to be no host correlations, nor differences in the behavior of the two groups. The species was previously known from Cameroon, Angola, and the Congo Republic.

REICHENSPERGERI GROUP

TYPHLOPONEMYS REICHENSPERGERI Cameron

New Records: 84 specimens from Kenya, Karen, Nyeri, and Muguga, from the central parts of raiding columns and the ends of nest-changing columns of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nest Nos. 39-41, 43, 44, 50, 53, and 55, 22 July-17 August 1960.

This species was previously known from 6 specimens from Ngerengere, Tanganyika.

PUMILIO GROUP

TYPHLOPONEMYS MARANGUENSIS Kistner

New Record: 1 female, Kenya, Karen, May 1962, from the central part of a raiding column of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nest No. 89, Coll. G. R. Cunningham-Van Someren.

This is the first host record of this species which I originally described from Kilimanjaro and Muguga.

RUFA GROUP

TYPHLOPONEMYS EASTOPI Kistner

Kistner, 1963a, Ann. Ent. Soc. Amer., 56(1): 20—Coll. of C. E. Tottenham, Cambridge, England, (Cameroons, Bamenda; Nigeria, various localities).

New Record: 1 female, Kenya, Karen, 13 August 1960, from the central part of a raiding column of *Dorylus (Dorylus) helvolus* Linnaeus, nest No. 52.

This is the first host record as well as a remarkable extension of the range of the species.

Genus MANDERA Fauvel

MANDERA SANGUINEA Fauvel

New Record: 1 female, Kenya, Karen, 13 August 1960, from the central part of a raiding column of *Dorylus (Dorylus) helvolus* Linnaeus, nest No. 52.

This is only the second specimen of this species that was ever captured. It is somewhat smaller than the holotype, but all of the other features agree with the holotype very well. New range in measurements: Pronotum length, 0.62-0.88 mm; elytra length, 0.15-0.22 mm; heal length, 0.21-0.30 mm. Number measured, 2. The host was previously unknown.

Genus DORYLOXENUS Wasmann

DORYLOXENUS ALZADAE Kistner

Kistner, 1963, Pan-Pacific Ent. 39:30 (Congo Republic: Yangambi, Host: *D. (A.) wilverthi* Emery.)

New Records: 6 specimens, Kenya: Karen, from the central parts of raiding colums and from a debris pile of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gertsaecker) Mayr., nests Nos. 41, 50, 53, & 89, 27 July 1960, 12 August 1960, and May 1962 (the last collected by G. R. Cunningham-Van Someren).

DORYLOXENUS HIRSUTUS Wasmann

New Records: 1 male, 2 females, Kenya, Karen, May, 1962, from the central part of a raiding column of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nest No. 89, Coll. G. R. Cunningham-Van Someren.

Figs. 10-11, Spermathecae. 10, *Doryloxenus minutus* n.sp.; 11, *D. striatus* n.sp. Scale represents 0.25 mm.

Doryloxenus minutus Kistner new species
(Fig. 10)

Distinguished from all other species, including *D. tottenhami* Kistner to which it is most colsely related, by the shape of the spermatheca.

Color reddish brown throughout. Dorsal surface of the head, pronotum, and elytra very lightly etched, with short fine yellow setae emerging from fine punctures at regular but sparse intervals. Macrochaetotaxy of abdominal tergites II-VII: 2, 4, 4, 4, 4, 4, 0. Spermatheca shaped as in fig. 10.

Measurements: Pronotum length, 0.30-0.33 mm; elytra length, 0.21-0.22 mm; interocular distance, 0.23-0.25 mm; head length, 0.19-0.20 mm. Number measured, 2.

Holotype female, No. 8344, KENYA, KAREN, 12 August 1960, from the central part of a raiding column of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr., nest No. 41.

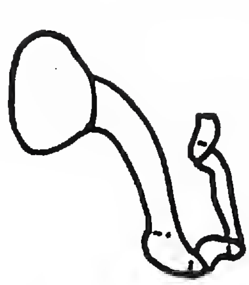
Paratype: 1 female, Kenya, Watamu, 60 miles north of Mombasa, December, 1961, from a raiding column of the same species of host as the holotype, nest No. 57, Coll. G. B. Cunningham-Van Someren.

Doryloxenus striatus Kistner new species
(Fig. 11)

Distinguished from all other species, including *D. eques* Wasmann to which it is most closely related, by the shape of the spermatheca.

Color reddish brown throughout. Dorsal surface of the head, pronotum, and elytra very lightly etched, with short fine yellow setae emerging from very small punctures at regular but sparse intervals. Macrochaetotaxy of abdominal tergites II-VIII:2, 4, 4, 4, 4, 4, 0. Spermatheca shaped as in fig. 11.

Measurements: Pronotum length, 0.43-0.45 mm; elytra length, 0.30-0.32 mm; interocular distance, 0.33 mm; head length, 0.30 mm. Number measured, 2.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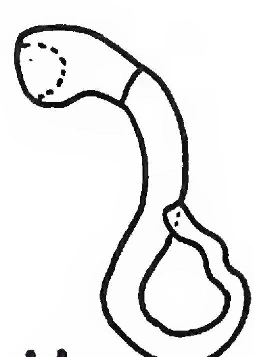
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JK '63

Holotype female, No. 8351, KENYA, KAREN, 25 July 1960, from the central part of a nest-changing column of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nest No. 42.

Paratype: Female, 25 July 1960, from the central part of a raiding column of the same host species, nest No. 43.

Genus MIMOCETE Fauvel

MIMOCETE FAGELI Kistner

New Record: 12 (2 males, 1 female), Uganda, Ruwenzori Range, Semliki Forest, 2850 feet, 22 August-3September 1952, Coll. D. S. Fletcher, in the collection of the British Museum (Natural History), London and of the author.

Mimocete kenyensis Kistner new species
(Fig. 12)

Distinguished from all other species, including *M. minor* Cameron, to which it is most closely related, by the shape of the spermatheca. The general shape of the spermatheca will distinguish it from most species; the absence of a carina on the anterior part together with subtle differences in outline will distinguish it from *M. minor.*

Color reddish brown throughout. Surface sclupture of the head, pronotum, and elytra finely shagreened. Abdominal segment IX shaped as in *M. minor* Cameron. Spermatheca shaped as in fig. 12. Male unknown.

Measurements: Pronotum length, 1.16 mm; elytra length, 0.75 mm; interocular distance, 0.68 mm. Number measured, 1.

Holotype female, No. 8339, KENYA, WATAMU, 60 MILES NORTH OF MOMBASA, December, 1961, from a raiding column of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nest No. 57, Coll. G. R. Cunningham-Van Someren.

MIMOCETE MINOR Cameron

New Records: 6 (4 females), Uganda, Kisubi Forest, 19 July 1960, from the central part of a nest-changing column of *D. (A.) wilverthi* Emery, nest No. 37.

This species was previously known from Angola and the Congo Republic.

Genus ANOMMATOPHILUS Wasmann

ANOMMATOPHILUS KOHLI Wasmann

New Records: 6 specimens, Kenya, Karen, from central parts of raiding columns of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nests 41, 43, and 50, 25 July, 27 July, and 12 August, 1960.

These specimens have been carefully compared to topotypes of the species and no consistent differences could be detected. Eichelbaum (1913) described a species, *metallicus,* from Tanganyika which I had listed as a provisional synonym of *kohli* in 1958. As Eichelbaum's collection was destroyed during World War II during an air raid which damaged the Hamburg museum, the final disposition of that name will perhaps never be solved. The Kenya specimens confirm my original suspicion that it was a synonym. The species was formerly known from Cameroon, Angola, Congo Republic, and Tanganyika.

Genus Micropolemon Wasmann

Micropolemon vansomereni Kistner new species

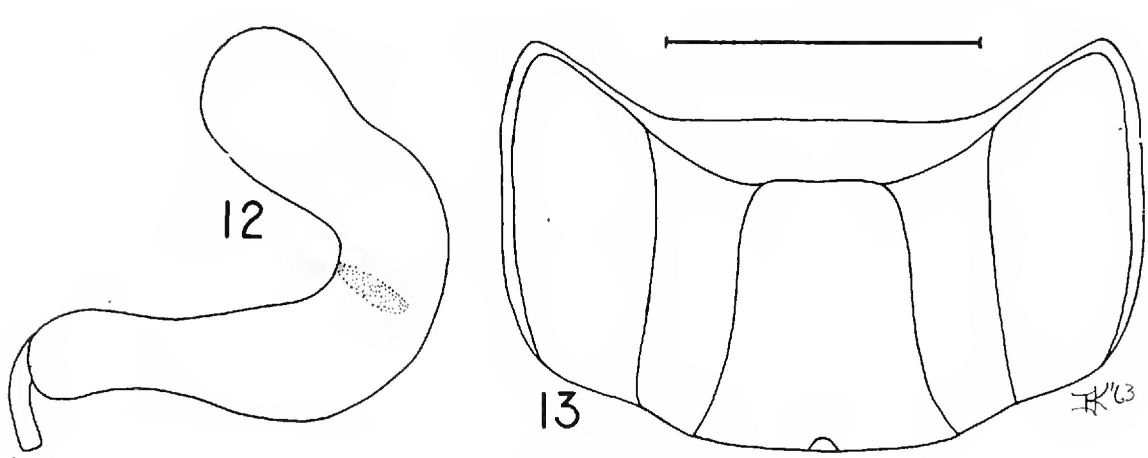
(Fig. 13)

Distinguished from all other species, including *M. cornutus* Wasmann to which it is most closely related, by the shape of the pronotum.

Color reddish brown throughout, head slightly darker than the rest of the body. Dorsal surface of the head, pronotum, and elytra punctate with fine yellow setae irregularly scattered over the surface. Pronotum with very shallow lateral grooves which become shallower posteriorly. Median groove of the pronotum limited to a very faint notch in the posterior border; shaped as in fig. 13. Macrochaetotaxy of abdominal tergites II-VIII: 0, 0, 0, 0, 4, 4, 0. Macrochaetotaxy of abdominal segment IX as in *M. tiro* Wasmann. Spermatheca coiled in such a way that it is unreliable as a species characteristic.

Measurements: Pronotum length, 0.27-0.31 mm; elytra length, 0.32-0.35 mm; interocular distance, 0.27-0.30 mm; head length, 0.27-0.32 mm. Number measured, 10.

Holotype female, No. 8352, Kenya, Karen, 12 August 1960,



Explanation of Figures

Figs. 12-13, 12, Spermatheca, *Mimocete kenyensis* n.sp.; 13, Pronotum, *Micropolemon vansomereni* n.sp. Scale represents 0.25 mm. Stippled area in fig. 2 represents an area of light sclerotization.

from the central part of a raiding column of *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr, nest No. 41.

Paratypes: Kenya, Karen, Host: *D. (A.) nigricans* ssp. *burmeisteri* var. *molestus* (Gerstaecker) Mayr: 2, females, same data as the hooltype, 2, 23 July 1960, central part of a raiding column, nest No. 40; 1, 28 July 1960, central part of a raiding column, nest No. 40; 2, 7 August 1960, from a raiding column, nest No. 41; 2, 11 August 1960, central part of a raiding column, nest No. 41.

This species is named for Mr. G. R. Cunningham-Van Someren who aided us in the field in many ways, not the least of which was the aid to the spirit provided by his contagious enthusiasm for wild life of all kinds.

Genus Typhlopolemon Patrizi

Typhlopolemon basilewskyi Jarrige

New Record: 1 female, Kenya, Karen, 13 August 1960, from the central part of a raiding column of *D. (D.) helvolus* Linnaeus, nest No. 52.

This is the second specimen of this species ever captured. In view of the fact that Nairobi is the type locality of *T. grandii* Patrizi, it was remarkable to capture this species here. However, *Micropolemon* which is the ecological equivalent of this genus in *Dorylus (Anomma)* sp. nests often has more than one species per nest and the variation in the pronotum shape is the distinguishing characteristic of species of *Micropolemon* also. The spermatheca of this species was examined and found to be of the coiled type. This species was formerly known from Katanga, Congo Republic.

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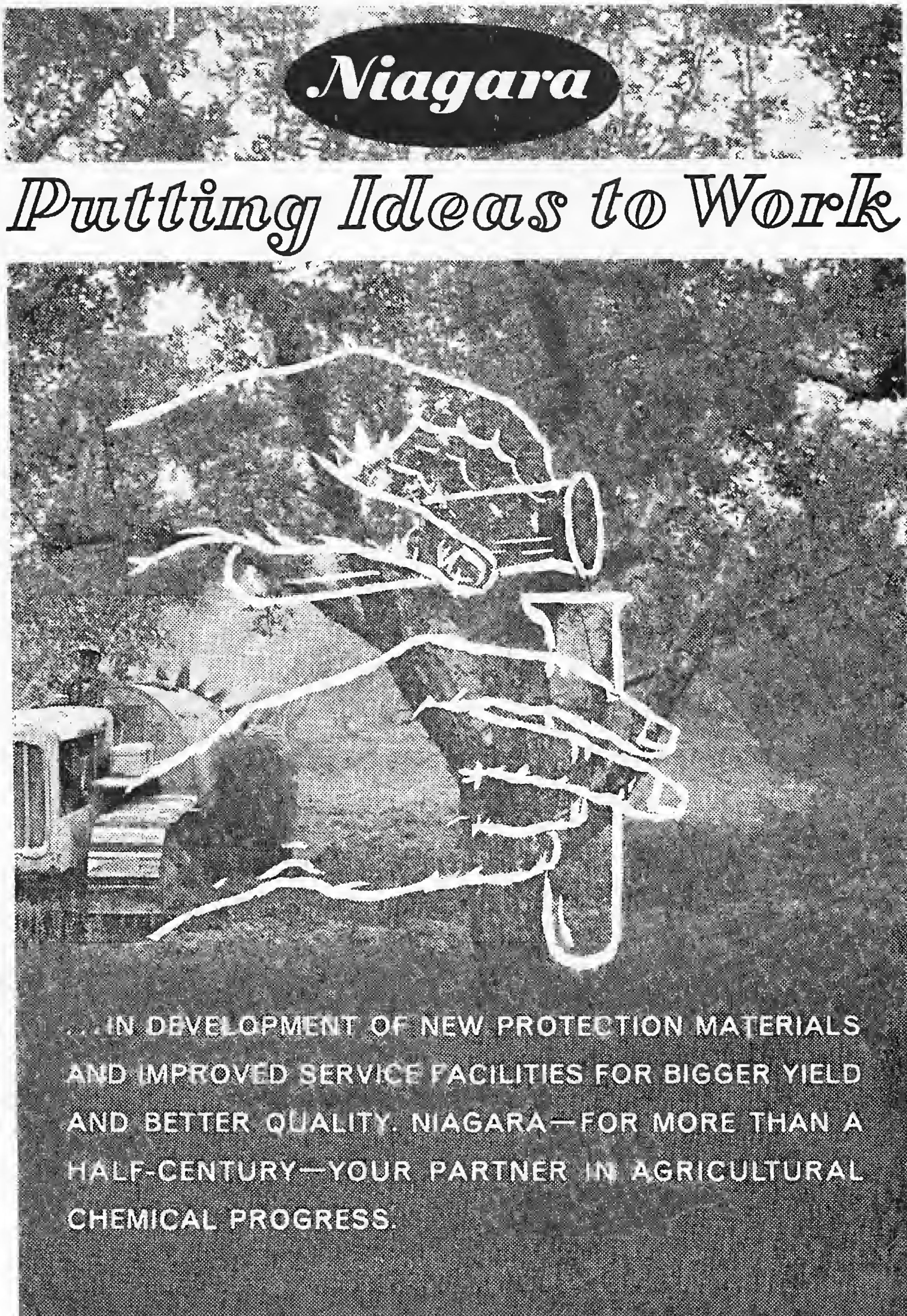
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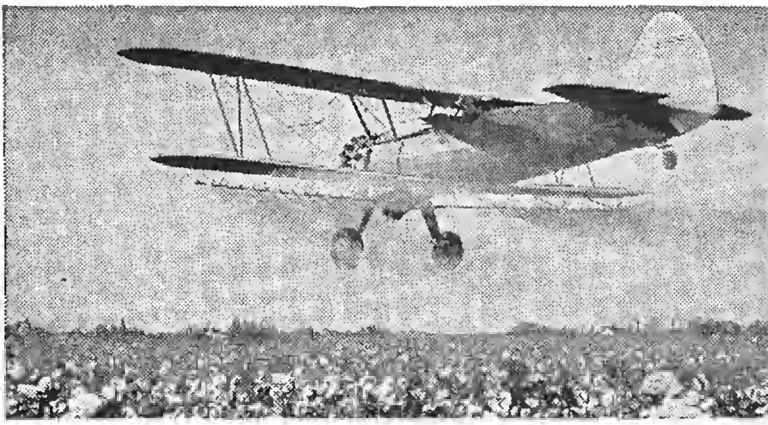

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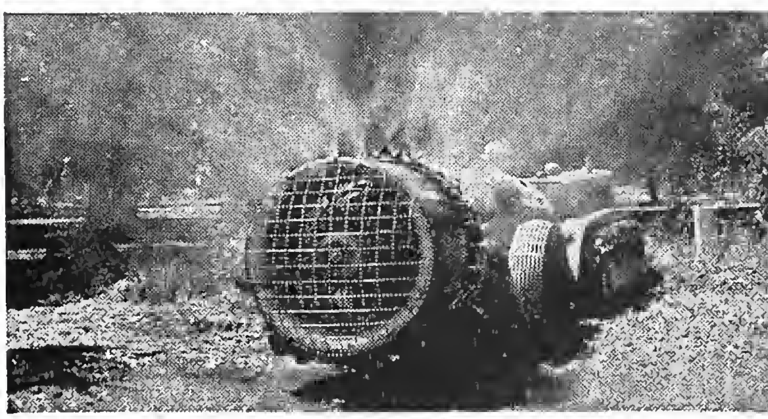

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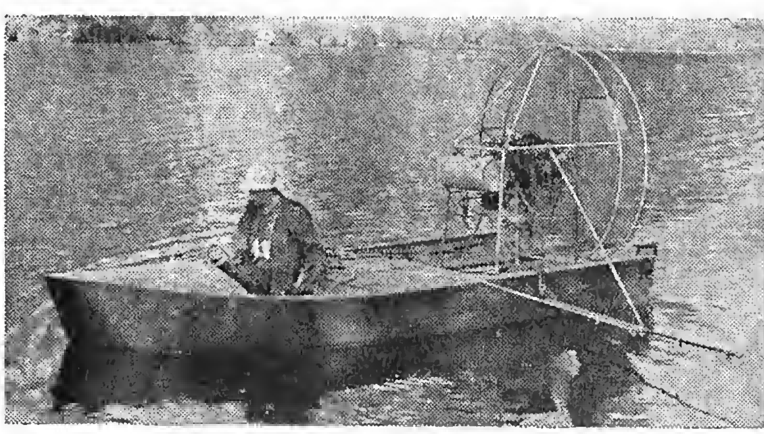

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CHROMOSOME STUDY OF THYANTA PALLIDOVIRENS (STÅL) IN RELATION TO TAXONOMY

(Hemiptera:Pentatomidae)

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A close connection exists between taxonomy and cytology in the genus *Thyanta*. *Thyanta custator* was described by Fabricius in 1803. Although Say (1831) described *Thyanta calceata* as a distinct species, later this species was synonymized with *T. custator* by many Hemipterists. Wilson (1911) studied *T. custator* cytologically and found two chromosomal races within the species. One has 16(14+XY) in the male (Wilson's race A) and the other has 27 ($24+X_1X_2Y$) in the male (Wilson's race B). Barber (1911) studied Wilson's whole series of specimens of both races morphologically and concluded that race A was *T. custator* and race B was *T. calceata* as a valid species.

Also the taxonomic status of *Thyanta custator* and *Thyanta pallidovirens* (Stål) was rather confused. *T. pallidovirens* was described by Stål (1859) from California as a species distinct from *T. custator* (Fabricius). *T. pallidovirens* was synonymized with *T. custator* by many Hemipterists. According to Ruckes (1957), for nearly a century hemipterists have identified specimens as *T. custator* (Fabricius) regardless of their places of origin or their strict conformity to the original description. Ruckes (1957) made an extensive study of the taxonomy and distribution of these two species and concluded that *T. custator* and *T. pallidovirens* are two distinct species, although they are difficult to differentiate. Also he divided *T. pallidovirens* into four subspecies.

Cytologically these two species (*T. custator* and *T. pallidovirens*) have been studied by Schrader and Hughes-Schrader (1956). They observed the same chromosome complement (14+XY) in both species, although some meiotic irregularities have been observed in hybrids between these two species.

In the course of chromosome studies of Heteroptera from the cytotaxonomic point of view, I observed that the chromosome complement of *T. pallidovirens* from California differs from that of *T. pallidovirens* from eastern U.S. This paper deals with differences in chromosome complement of members of the *T. pallidovi-*

rens complex and discusses their taxonomic status.

The author wishes to express his sincere thanks to Dr. R. L. Usinger who suggested and encouraged this study and to Mr. P. D. Ashlock who kindly made the taxonomic determinations.

Materials and Methods:—The species and the localities where they were collected are as follows:

Thyanta pallidovirens pallidovirens (Stål): Middletown, Lake County, California.

Thyanta pallidovirens spinosa Ruckes: Lone Pine, Inyo County, California.

The testes were fixed in Carnoy. All observations were made from the squash preparations stained with acetocarmine. The drawings were made with aid of a camera lucida and photographs were taken with a 35 mm camera. Their magnifications as reproduced are indicated by a 5μ scale.

Observations:—Cytologically, it has not been possible to make a distinction between *T. palidovirens pallidovirens* (Stål) and *T. pallidovirens spinosa* Ruckes. Therefore, they will be described together. They have 14 chromosomes in the diploid male, the typical number in the Pentatomidae. The spermatogonial chromosome complement of 14 chromosomes consists of 6 pairs of autosomes and XY in the male (Fig. A). One of these autosome pairs is slightly larger than the others, four pairs are of medium size, and the remaining pair is small. The X is slightly smaller than the small sized autosomes and the Y is the smallest member of the chromosome set.

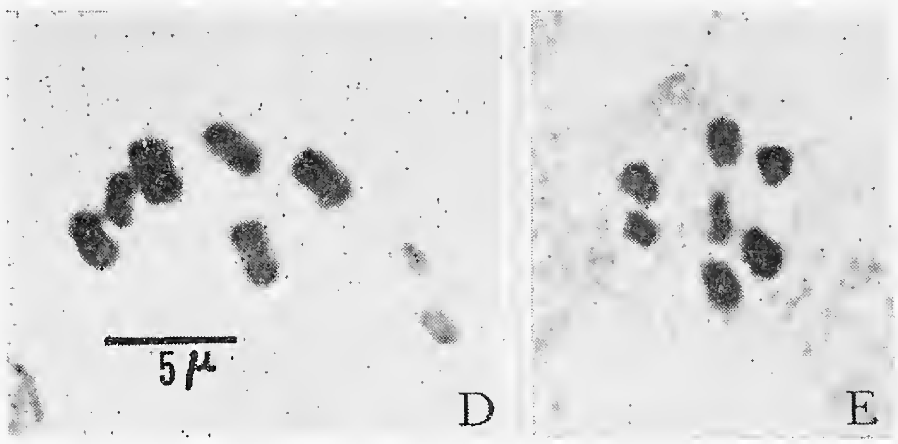
In essential features, the course of meiosis is very similar to other pentatomid bugs which are described by many cytologists. In the confused stage the sex chromosomes are positively hetero-

Explanation of Figures

Figs. A-C, *Thyanta pallidovirens pallidovirens* (Stål): A, Spermatogonial metaphase, with 14 chromosomes. B, First metaphase; sex chromosomes, showing slightly negative heteropycnosis, take a peripheral position; Y is the smallest member of the chromosome set. C, Second metaphase; X and Y lie in the center of a ring formed by 6 autosomes.

pycnotic, are already double in structure, and come close together. In late diakinesis the autosomes appear deeply stained with condensation, while the sex chromosomes separate from each other and tend to lose their staining intensity. This state of the sex chromosomes persists into the first metaphase (Figs. B and D) and, as was stated by Schrader and Hughes-Schrader (1956), is unusual in pentatomids.

In the first metaphase the six autosomal tetrads and the two sex chromosomal dyads arrange themselves on the plane (Figs. B and D). As is usual in Heteroptera, the first spermatocyte division is reductional for autosomes and equational for the sex chromosomes. As the second spermatocyte metaphase is formed, the sex chromosomes lose their negatively heteropycnotic character and stain with



EXPLANATION OF FIGURES

Figs. D and E, *Thyanta pallidovirens spinosa* Ruckes: D, First metaphase; sex chromosomes are negatively heteropycnotic and are placed outside of autosomes. E, Second metaphase, with X and Y in the center of a ring formed by 6 autosomes.

the same intensity as the autosomes. At the second metaphase the six autosomes lie towards the periphery of the plate and form a ring, while the sex chromosomes take a central position in a ring formed by the autosomes (Figs. C and E). In the second division the X segregates to one pole with six autosomes and the Y with six autosomes goes to the other pole.

The most striking difference between *T. pallidovirens* from California and from the eastern United States is the chromosome number in the diploid. *T. pallidovirens* from California has 14 (12+XY) in the male, while *T. pallidovirens* from the eastern United States has 16 (14+XY) in the male.

Discussion:—Ruckes (1957) divided *Thyanta pallidovirens* into four subspecies: *T. pallidovirens pallidovirens* (Stål), *T. pallidovirens setosa* Ruckes, *T. palidovirens spinosa* Ruckes, and *T. pallidovirens accerra* (McAtee). Of these subspecies *T. p. accerra* is widely distributed in central, northern, and southern areas of the United States and southern Canada. The other three subspecies are more restricted in their distribution. Schrader and Hughes-Schrader (1956) studied *T. custator* and *T. pallidovirens* cytologically. Ruckes identified their specimens. They observed the same chromosome complement (14+XY) in both species. According to Ruckes (1957), Schrader and Hughes-Schrader's specimens of *T. pallidovirens* are really *T. p. accerra.* They also studied the hybrids: *T. custator* x *T. pallidovirens,* which were provided by Dr. R. I. Sailer (formerly at the United States National Museum) and found meiotic irregularities in the hybrids. These meiotic irregularities indicate cytogenetical differences between the parent species and support Ruckes' separation of *T. custator* and *T. pallidovirens.* It seems clear that *T. custator* and *T. pallidovirens* (represented by the subspecies *accera*) are distinct but very closely related species.

As described previously, *T. pallidovirens pallidovirens* (Stål) and *T. pallidovirens spinosa* Ruckes are quite the same in chromosome cytology. Therefore, they may be subspecific as suggested by Ruckes (1957). These two subspecies differ from *T. pallidovirens accerra* (McAtee) in the chromosome complement. The chromosome complement of *T. p. pallidovirens* and *T. p. spinosa* is 12+XY instead of 14+XY as found in *T. p. accera* and *T. custator.* Unfortunately experimental hybridizations of *T. p. pallidovirens* x *T. p. accerra* and *T. p. spinosa* x *T. p. accerra* were not tried, but it may be safely assumed that these crosses would be intersterile, because of the chromosome complement differences. Therefore, it seems to be reasonable to assume that *T. p. accerra* is a distinct species rather than a subspecies of *T. p. pallidovirens.* White (1957) suggests that the general effect of cytological studies on insect taxonomy will undoubtedly be to increase still further the number of instances of sibling species barely or not at all distinguishable on external characters.

The meiotic processes of *T. p. pallidovirens* and *T. p. spinosa* are quite the same as in *T. p. accerra* and *T. custator.* Schrader and Hughes-Schrader (1956) found a tendency for negative heteropycnosis in the sex chromosomes at late diakinesis and first metaphase. This very unusual state for the sex chromosomes is also found in *T. p. pallidovirens* and *T. p. spinosa* (see Figs. B and D), and indicates the phylogenetic similarity of *T. p. pallidovirens, T. p. spinosa, T. p. accerra,* and *T. custator.*

Based on the cytological evidence mentioned above, I conclude the following: *Thyanta pallidovirens pallidovirens* (Stål) and *Thyanta pallidovirens spinosa* Ruckes are probably subspecies as indicated by their trinomial status. *Thyanta pallidovirens accerra* (McAtee) may be a distinct species rather than a subspecies of *Thyanta pallidovirens. Thyanta pallidovirens accerra* and *Thyanta custator* (Fabricius) are distinct species. Also *Thyanta custator* may be specifically distinct from *Thyanta pallidovirens pallidovirens* and *Thyanta pallidovirens spinosa.*

Summary

Thyanta pallidovirens pallidovirens (Stål) and *Thyanta pallidovirens spinosa* Ruckes were collected in California and were studied cytologically. The chromosome complement of these two subspecies is 12+XY in the male and differs from that of *T. pallidovirens accerra* (McAtee) which has 14+XY (Schrader and Hughes-Schrader, 1956). However, there is a tendency to be negatively heteropycnotic at the late diakinesis and in the first metaphase for the sex chromosomes as seen in *T. pallidovirens accerra.* It is suggested that *T. pallidovirens accerra* may be a distinct species rather than a subspecies of *T. pallidovirens,* based on the differences of chromosome cytology.

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NOTES ON THE BIOLOGY AND DISTRIBUTION OF PARACOTALPA GRANICOLLIS HALDEMAN

(Coleoptera: Scarabaeidae)[1]

CLIVE D. JORGENSEN

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Certain aspects of the biology and distribution of *Paracotalpa granicollis* Haldeman were observed as part of an ecological study at the United States Atomic Energy Commission Nevada Test Site, Nye County, Mercury, Nevada. Apparently little is known about the biology of this species since Ritcher (1958) did not mention it in his review of the Scarabaeidae, although Ritcher (1948) and Saylor (1940) discussed some aspects in the biology of the closely related *P. ursina ursina* (Horn).

The test site is situated in a large transitional area between the Mohave and Great Basin Deserts. The major plant communities are: (1) *Larrea divaricata* Cov. and *Franseria dumosa* Gray, (2) *Lycium pallidum* Miers., (3) *Atriplex confertifolia* (Torr. and Frem.) Wats. and *Kochia americana* Wats., (4) *Coleogyne ramossissima* Torr., (5) *Grayia spinosa* (Hook.) Moq. and *Lycium andersonii* Gray, (6) *Artemisa tridentata* Nutt., (7) *Pinus monophylla* Torr. and Frem. and *Juniperus osteosperma* (Torr.) Little, and (8) *Salsola kali* L. which occupies large areas that were denuded of their original vegetation by nuclear weapons testing. Adult males were observed flying in all of these communities except Piñon-Juniper. They were most numerous in the Grayia-Lycium and Lycium communities, and least numerous in the Coleogyne and Artemisia communities. They preferred sandy bajada soils, but not sandy washes or gullies.

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[1] This work was supported (in part) by the Atomic Energy Commission Contract AT(11-1)786.

The earliest date males were observed was January 16, 1961, in the Lycium community and the latest date was April 6, 1961, in the same community. The apparent peak of their flight activity was from February 6 to 12. Daily flights began at sunrise. The peak of daily activity was between 9:30 a.m. and mid-day, although some were observed as late as 2:30 p.m. in the Coleogyne and Artemisia communities. Cloud cover had no detectable influence on the time daily flights began but did reduce the number of beetles in flight. Some emerged from and descended into rodent burrows, but most dug shallow recluses about five inches deep in the soil.

Flight was typical of many scarabaeids. Only males were collected in flight and they were frequently concentrated in small local areas. The two methods used by males to locate females were particularly interesting since mating was probably the primary purpose for their flight. In most cases, females remained in the entrances of their burrows until located by the males. Copulation took place at the entrance, after which the females descended back into their burrows and the males usually resumed flying. The second method involved a tracking procedure. After alighting, the males searched back and forth until the trail was identified, then they followed in rapid pursuit. If the trail was lost or eliminated, they circled until it was found again. Failure to find the trail again usually resulted in their taking flight. Copulation occurred immediately when females were overtaken by males and lasted for one to two minutes. After this the female searched for a suitable burrowing site and the male usually took flight. Several pairs were observed mating on the ground, sometimes as many as eight males tried to mate with one female at the same time.

Copulation was achieved when the female was approached from behind and accomplished after her head had been forced down and abdomen raised by the male's rear legs. One female mated with three separate males, one of them twice. This occurred in approximately five minutes that it took her to find a suitable burrowing site.

Ritcher (1948) observed *ursina* larvae feeding on the larger roots of *Artemisia* at a depth of 6 to 12 inches. Most of the plant species occurring in the areas of adult activity were examined, but no larvae were recovered at the Nevada Test Site. Several dead adult females were collected from 8 to 12 inches below the ground surface, but eggs or larvae were never recovered.

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1948. Descriptions of the Larvae of Some Ruteline Beetles with Keys to the Tribes and Species (Scarabaeidae). Ann. Ent. Soc. Amer., 41:206-212.

1958. Biology of Scarabaeidae. Ann. Rev. Ent., 3:311-334.

Saylor, S. W.

1940. Synoptic Revision of the Beetle Genera *Cotalpa* and *Paracotalpa* of the United States, with descriptions of a new subgenus. Proc. Ent. Soc. Wash., 42(9):190-200.

BOOK REVIEW

Pests of Stored Grain and Grain Products. By Richard T. Cotton. I + 318 pages. 108 figs. Burgess Publishing Company, 426 S. 6th St., Minneapolis 15, Minn. Price $5.00.

This publication is an expanded edition of work previously published by Cotton. It consists of 15 instead of 11 chapters. Added chapters include information on rodent and bird pests, protecting stored seed from insect attack, detection of insect infestation, and insect control in the bakery. The other chapters give a complete account of factors that must be taken into consideration in the protection of stored grain and its products. The life long experience of the author in the field is reflected in the clear and understandable manner in which he has presented the subject matter. The book is a must for those persons in the commercial fields who have anything to do with the preservation and protection of stored food products. It furnishes a handy reference to the available information on pests, their habits, and means of protection and preventing damage. The book is assembled in a more durable fashion than the previous works. Although the publication is of greatest value to the commercial field, it should prove to be a valuable and handy reference for students and scientists interested in the general field of stored pests.—A. E. Michelbacher, *University of California, Berkeley.*

MEETING NOTICE

The XIIth International Congress of Entomology will meet July 8-16, 1964 in London, England.

NEW ACRIDIDAE FROM WESTERN NORTH AMERICA

(Orthoptera)

H. F. STROHECKER

University of Miami, Florida

A number of new species of Orthoptera have been represented among the several thousands specimens sent to me for identification during the last three years. Large collections have come from Drs. Paul Hurd and Jerry Powell of the University of California at Berkeley, and from Mr. A. T. McClay at Davis. Smaller but exceedingly interesting shipments have come from Messrs. George Buxton of the California Department of Agriculture at Sacramento and Jacques Helfer of Mendocino. Dr. W. F. Barr of the University of Idaho has sent many finely prepared specimens from his state.

Deposition of holotypes and allotypes is designated in the description of each species. In accordance with the wishes of the collectors and curators of this material, paratypes will be distributed to the major collections of Orthoptera in this country.

I have profited from the illuminating study by Ashley Gurney (1960) of several groups of *Melanoplus*, and his comments in correspondence have been a continuous help.

Trimerotropis pogonata Strohecker, new species

(Figs. 1, 2, 3)

Form short, stout. Antennae slightly longer than head and pronotum together, apically blunt, proximal and distal portions composed of quadrate articles, articles of median region about two-thirds as broad as long. Pronotum with low median carina, cut by two sulci. Metazone one and two-thirds times as long as prozone. Front margin advanced as distinct angle upon occiput, hind margin with straight sides meeting at angle of 90 degrees or slightly more. Lateral carinae distinct on metazone, disappearing at principal sulcus but briefly indicated near front margin. Lateral lobes sloping, entirely visible from above, lower posterior angle broadly rounded and somewhat flaring. Head short and not deep, genae inflated, eyes globose but smaller than is usual in the genus. Fastigium smooth, moderately excavate, roundly declivent in profile, its lateral ridges almost straight and continued without interruption as the ridges of the frontal costa, which is sulcate throughout. Lateral foveolae represented by small, triangular, flattened areas. Ocelli large and very convex. Tegmina and wings fully developed but extending but little beyond body. Hind tibiae in lateral view slightly bowed, the feeble curvature enhanced by distal flattening of tibia. Tibial spines, 11-12 on inner margin, 8-9 on outer, are longer than is usual in *Trimerotropis* and the distal calcars are very long, the inner pair extending to or beyond apex of metatarsus, with lower one slightly longer. Legs and body, except abdomen, are clothed with long white pubescence especially conspicuous on genae and lower portions of pleura.

Coloration: head, pronotum and tegmina mottled ferruginous-gray, abdomen and hind femora yellowish, hind tibiae pale yellow with spines and calcars black-tipped. The base of the tibia is ringed with black, broadly on the inner side, narrowly externally. The hind femur has a number of black points on its carinae; its inner face and lower sulcus are pale yellow with two broad black bands. The tegmen has two wide black areas confined to the costal field, and a number of rounded or quadrate spots in the dorsal and apical fields. Wings hyaline with a faint yellowish tinge, without trace of dark band but with venation of costal and apical regions dark.

The ovipositor valves of the female are slender, smooth and entirely pale, the dorsal valves strongly retracted.

Measurements (mm): length of body, male 14.2, female 19; of pronotum, male 3.3, female 4.0; of tegmen, male 12.7, female 16.0; of hind femur, male 9.3, female 12.5.

Holotype male: GROVER CITY, SAN LUIS OBISPO COUNTY, CALIFORNIA, July 4, 1956, E. G. Linsley (California Academy of Sciences). Allotype Female: Oso Flaco Lake, San Luis Obispo County, California, July 13, 1959, A. E. Menke (California Academy of Sciences). Paratypes: two males with data of holotype, twelve males and three females collected at Oso Flaco Lake, July 13, 1959 by A. E. Menke, R. M. Bohart, W. A. Steffan, R. W. Spore, F. D. Parker, P. M. Marsh. A single female was collected by P. D. Hurd at San Marcos Ranch, Santa Ynez Mountains, Santa Barbara County on July 5, 1956.

The first specimens of this insect which came to me, I considered to be small individuals of *Trimerotropis helferi* but subsequent study shows them to be distinct. The stout form, long tibial spines and calcars, and ovipositor structure suggest generic differentiation but approximation to the length of the tibial calcars can be seen in *T. arenacea* and *T. helferi,* while the female ovipositor is similar to that of *T. albescens* McNeill. The melange of species now included in *Trimerotropis* must undoubtedly be partitioned but the introduction of another generic name now may contribute to the difficulties of the revisor of this confusing assemblage.

NEW SPECIES OF MELANOPLUS

Since Gurney's recent paper (1960) went to press, several new species of *Melanoplus* have been discovered by Jacques Helfer and by the personnel of the California Department of Agriculture. From Idaho, Barr has sent representatives of three new species.

In describing the aedeagi I have followed the terminology suggested by Eades (1961).

THE IMMUNIS GROUP

Melanoplus hupah Strohecker and Helfer, new species

(Figs. 7, 8, 35)

Male.—Size medium for the group, about equal to that of *immunis,* which it resembles. Head large; eyes large, their depth one and three-fourths length of genal groove; fastigium narrowed behind and distinctly sulcate; occiput, in front view, scarcely higher than upper margin of eyes; cheeks somewhat inflated. Pronotum feebly flaring in front, its anterior margin broadly and shallowly excavate at middle, its posterior margin convex and very obtusely angulate, its median carina low on prozone, sharp on metazone. In lateral view, prozone is almost level, not tumid as in *immunis;* lateral lobe is one and a half times as long (dorsally) as deep, tegminal sinus obsolete. Tegmina longer than pronotum and narrowly rounded at apex in holotype, but equal to pronotum and obtusely subangulate in a paratype, overlapping. Epiproct a little longer than its basal width, its topography similar to that of *immunis.* Arms of furcula short and narrow, widely separated, about as long as their segment. Cercus, in lateral view, essentially straight but appearing upturned because of concavity of dorsal margin; in dorsal view apical half of cercus is broadly incurved; its external face is sulcate distally. Aedeagus is somewhat like that of *M. rehni* Hebard (Gurney 1960:151, fig. 8) but its dorsal valves are in form of semi-cylinders which conceal the sclerites; these are irregular rods in the internal wall of the valves. Ventral valves are similar to those of *rehni,* thin, transparent, narrow plates, rounded at apex.

Coloration: non-distinctive. Front and cheeks olive, occiput brown with postocular dark bar on each side. Pronotum brown, metazone paler. Lateral lobes shining black in prozonal portion, anterior and lower margins and metazonal portion pale. Mesepisternum olivaceous, mesepimeron black, metepisternum largely yellow. Abdomen mostly black with dorsal carina and row of sensillae on each side pale, sternites and lower portion of tergites yellow. Femora and front and middle tibiae yellow-brown, none of femora with dark markings. Hind tibiae pale green.

Measurements (mm): length of body 19-21; of pronotum 3.9-4.6; of tegmen 4.0-5.0; of hind femur 10.0-11.1.

Female.—much like the female of *immunis.* Consistent characters for differentiating females of this group of *Melanoplus* have not been discovered. In some females of *hupah* the head, pronotum, pleura and hind femora are pale green, the tegmina and abdomen brown. In these specimens there is a very narrow postocular band of black, and several small areas of dark color on the sides of the prozone form an irregular line. The transverse sulci of the pronotum are brown and the sides of the abdomen show vaguely delimited dark areas.

Measurements (mm): length of body 23-27; of pronotum 4.6-5.5; of tegmen 5.2-6.7; of hind femur 12.5-14.2.

Holotype male and allotype female: KNEELAND, HUMBOLDT COUNTY, CALIFORNIA, July 11, 1960, J. R. Helfer (U.S. National Museum No. 65994). Paratypes: 20 males and 13 females collected with the holotype and allotype.

The series was collected near the Kneeland postoffice, on damp, subirrigated land covered with lush grass and white clover. The grasshoppers were definitely associated with the clover. The only other acridid observed in this situation was *Chorthippus*, which was associated with the grasses.

Melanoplus wintunus Strohecker and Helfer, new species

(Figs. 9, 10, 34)

Very much like the preceding species and evidently closely related. The following differences are noted but they could hardly be used in taxonomic discrimination: fastigium less sulcate in *wintunus*, prozona flatter and with median carine indistinct, hind margin of pronotum broadly obtuse-angulate, arms of furcula shorter and more broadly triangular, much as in *immunis*, cercus smaller, thinner, its dorsal margin more strongly concave, its external face shallowly sulcate. The abdomen is largely yellow, with a large, quadrate, black area on the sides of each segment. The differences in the aedeagus are best set forth by illustration (Figs. 9, 10).

Measurements (mm): length of body of male 16-19, of female 21-23; length of pronotum of male 3.6-4.1, of female 4.7-5.3; length of tegmen of male 3.4-4.6, of female 4.3-5.4; length of hind femur of male 8.4-9.5, of female 10.9-11.6.

Holotype male and allotype female: PLASKETT MEADOWS, GLENN COUNTY, CALIFORNIA, July 26, 1961, J. R. Helfer (California Department of Agriculture. Paratypes: 16 males and 9 females collected with the holotype, and one male taken by F. L.

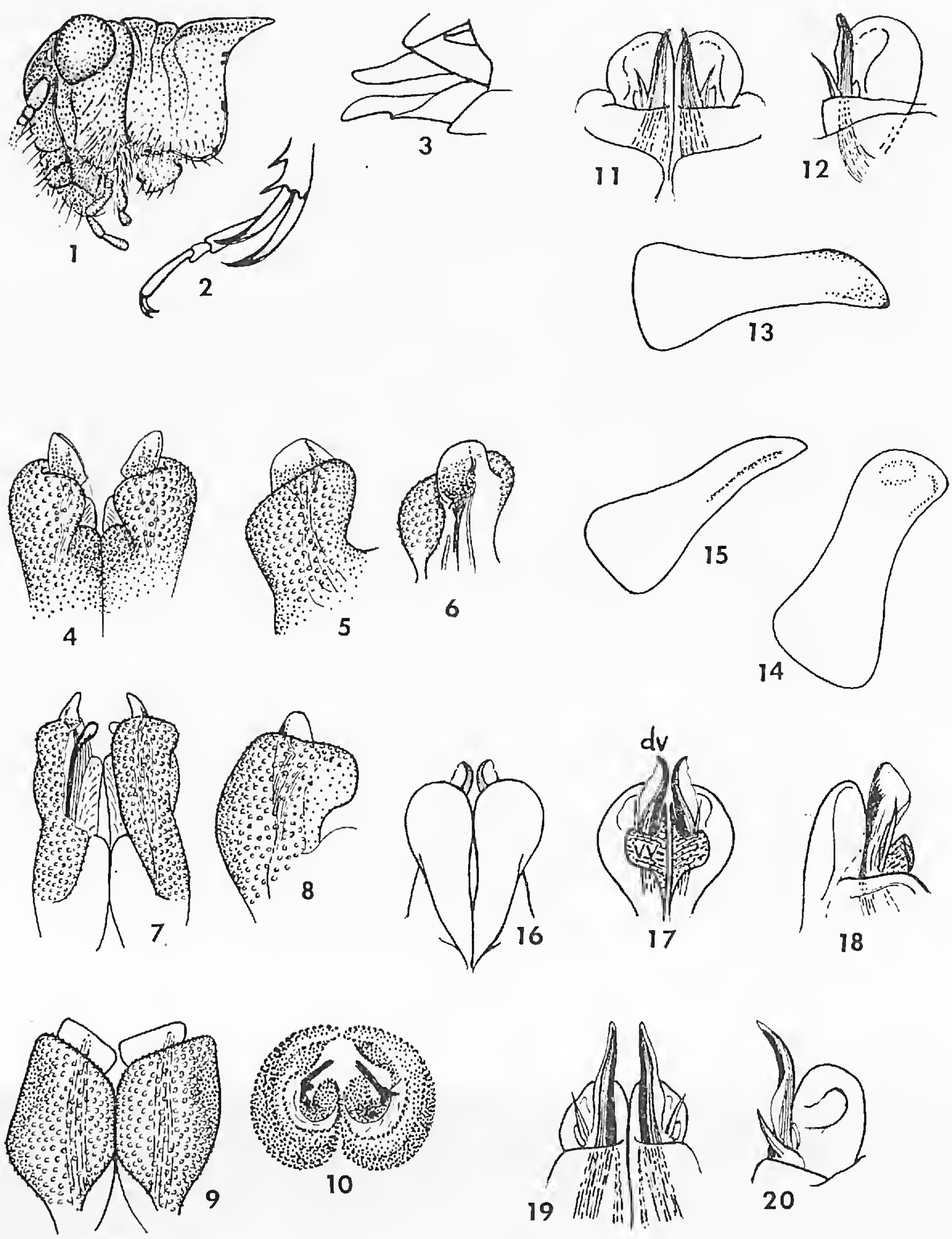
EXPLANATION OF FIGURES

Figs. 1-20. 1, *Trimerotropis pogonata* Strohecker, head and pronotum of male. 2, the same, metatibial calcars of male. 3, the same, ovipositor. 4, *Melanoplus eremitus* Strohecker, aedeagus, ventral (caudal) view. 5, the same, aedeagus, dextral view. 6, the same, aedeagus, median view of left dorsal valve. 7, *Melanoplus hupah* Strohecker, aedeagus, ventral (caudal) view, left side dissected. 8, the same, aedeagus, dextral view. 9, *Melanoplus wintunus* Strohecker, aedeagus, ventral (caudal) view. 10, the same, aedeagus, apical (dorsal) view. 11, *Melanoplus elater* Strohecker, aedeagus, ventral (caudal) view. 12, the same, aedeagus, dextral view. 13, the same, left cercus of male. 14, *Melanoplus siskiyou*, Strohecker, left cercus of male. 15, *Melanoplus buxtoni* Strohecker, left cercus of male. 16, the same, aedeagus, ventral (caudal) view, *in situ*. 17, the same, aedeagus, dorsal (anterior) view, *in situ*. 18, the same, aedeagus, dextral view. 19, *Melanoplus elaphrus* Strohecker, aedeagus, ventral (caudal) view. 20, the same, aedeagus, dextral view.

Blanc at Plaskett Meadows on August 22, 1952.

This species first came to the attention of the senior author through a single specimen sent by George Buxton in 1959. The junior author visited Plaskett Meadows to collect the series noted above. Because of the imperfect condition of the first-known specimen the holo- and allotype have been selected from this series.

The Plaskett Meadows locality is a fairly large spring area, subirrigated, and with tiny streams here and there draining into two small artificial lakes. The vegetation is lush: wiregrass, corn



lily, buttercup, rain orchids and other wild flowers, with many trees. On the first visit, in late June, the *Melanoplus* were immature, another trip in July yielded the series reported. No definite association with particular plants was observed, but the insects seemed to be absent from drier areas. A series of *M. borealis palaceus* Fulton was also taken here, a record which extends the known range of this grasshopper some hundred miles southward.

Melanoplus eremitus Strohecker, new species

(Figs. 4-6, 28)

Male.—Pronotum with median carina very low on the prozone, almost disappearing between sulci, evident but low on metazone. Tegmina equal in length to pronotum, apex rectangularly rounded to slightly acute. Furcula hardly evident, its arms broad and very short. Cercus two and a half times as long as basal width (somewhat foreshortened in figure), feebly upturned with apical third rather abruptly incurved. Aedeagus with dorsal valves semi-cylindric, concealing the slender sclerite, which ends above in a concave plate supporting an arcuate membrance. The ventral valves are typical of the *immunis* group.

Coloration: dorsum, including abdomen, blackish with some small buff markings behind eyes and along lateral carinae of pronotum. Face and genae olive. Antennae red-orange. Femora pale, hind femur with ill-defined dusky patches on outer face, lower pagina and inner face orange-red. Hind tibiae blue.

Measurements (mm): length of pronotum 3.6-3.9; of tegmen 2.9-3.8; of hind femur 8.3-8.8.

Female.—fastigium broad, plane, very little narrowed between eyes. Pronotum with median carina feeble but complete, front margin shallowly excavate at middle, hind margin obtusely subangulate. Tegmina widely separated, apices evenly rounded to subangulate.

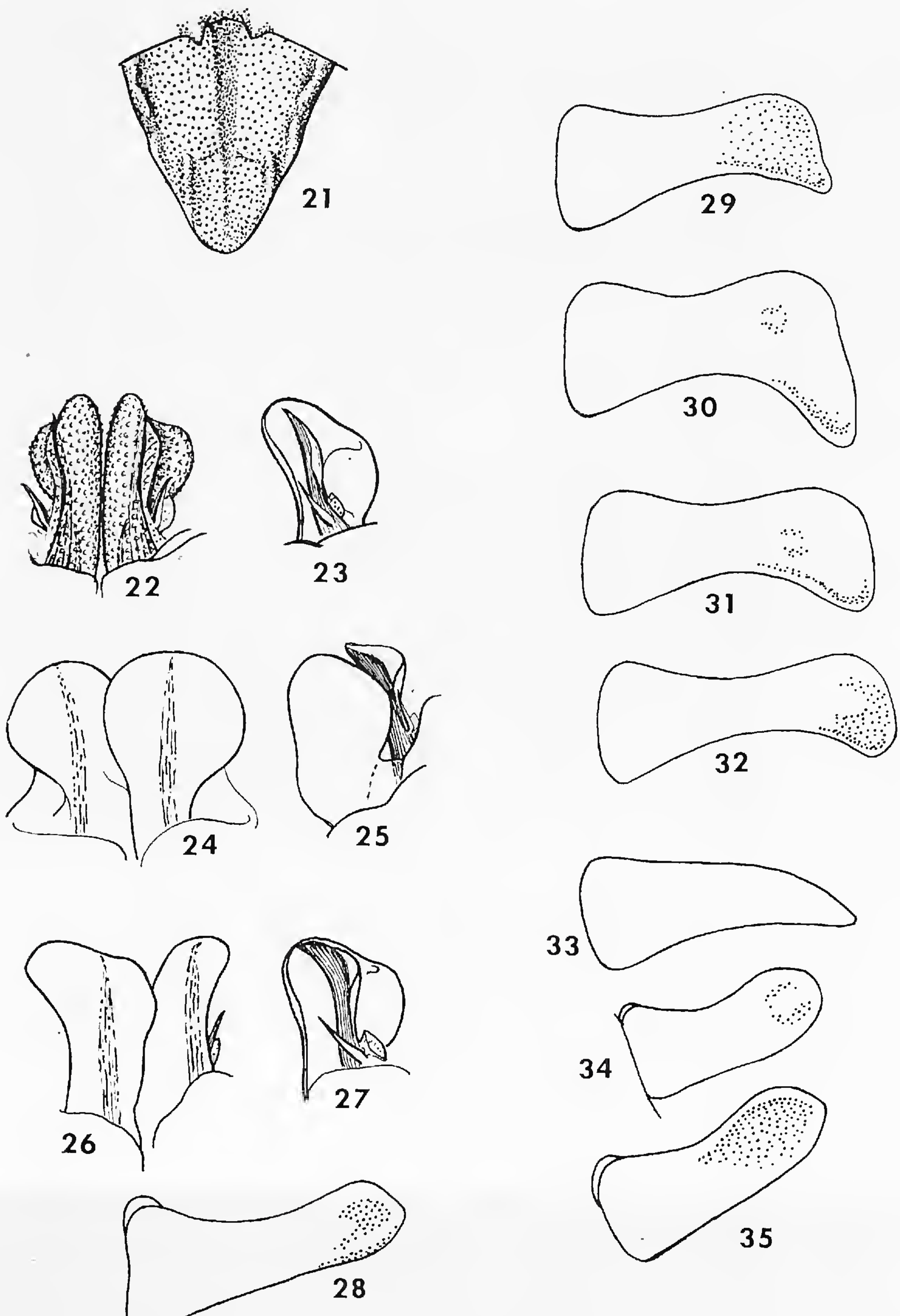
EXPLANATION OF FIGURES

Figs. 21-35. 21, *Melanoplus buxtoni* Strohecker, epiproct of male. 22, *Melanoplus validus* Scudder, paratype, Glendale, Oregon, aedeagus, ventral (caudal) view. 23, the same, aedeagus, dextral view. 24, *Melanoplus ascensus* Scudder, McCloud, Siskiyou County, aedeagus, ventral (caudal) view. 25, the same, aedeagus, dextral view. 26, *Melanoplus calapooyae* Hebard, Divide, Oregon, aedeagus, ventral (caudal) view. 27, the same, aedeagus, dextral view. 28, *Melanoplus eremitus* Strohecker, left cercus of male. 29, *Melanoplus ascensus* Scudder, McCloud, California, left cercus of male. 30, *Melanoplus calapooyae* Hebard, Divide, Oregon, left cercus of male. 31, *Melanoplus validus* Scudder, Glendale, Oregon, left cercus of male. 32, *Melanoplus ascensus* Scudder, Upper Klamath Marsh, Oregon, left cercus of male. 33, *Melanoplus elaphrus* Strohecker, left cercus of male. 34, *Melanoplus wintunus* Strohecker, left cercus of male. 35, *Melanoplus hupah,* Strohecker, left cercus of male.

Coloration: much as in male, but some specimens have areas on pronotum, mesopleura and femora green.

Measurements (mm): length of pronotum 4.7-5.0; of tegmen 3.8-4.6; of hind femur 10.6-11.4.

Holotype male and allotype female: TOP LAKE, EL DORADO COUNTY, CALIFORNIA, August 22, 1962, G. M. Buxton (California



Department of Agriculture). Paratypes: 11 males and 11 females with the same data as the holotype and two males taken by Peter C. Ting at Top Lake, August 27, 1950. All specimens associated with *Carex.*

THE SALTATOR GROUP

Hebard reviewed this group in 1937 but omitted *M. bernardinae* even though in the original dscription he had referred it to the *saltator* complex. Also omitted was *M. lepidus* Scudder, which was placed with *saltator* by Gurney in 1960.

In his treatment Hebard reduced *M. validus* and *M. calapoyae* to racial status under *ascensus.* This, I think, is a too summary dismissal of the taxonomic questions. The position of the dorsal valve of the aedeagus in relation to its sclerite, discussed by Hebard, may not be always fixed, i.e. the soft valve, subject to influence of the semi-rigid sclerite and to internal pressures, may asume different positions or may be displaced in the extraction of the phallus.

Specimens collected by George Buxton and others of the California Department of Agriculture during the past two or three years show that several additional species of this group occur in northern California. While these are closely related, the present evidence does not, I think, indicate intergradation.

While most of the species of the *saltator* group have the epiproct with a pair of oblique ridges on the apical half this feature is not present in all. Gurney has, however, pointed out a distinctive feature in the ventral aedeagal valves, which pass between and are then reflexed around the sclerites of the dorsal valves. The following simple key may be of use in preliminary sorting.

KEY TO MALE MELANOPLUS OF THE SALTATOR GROUP

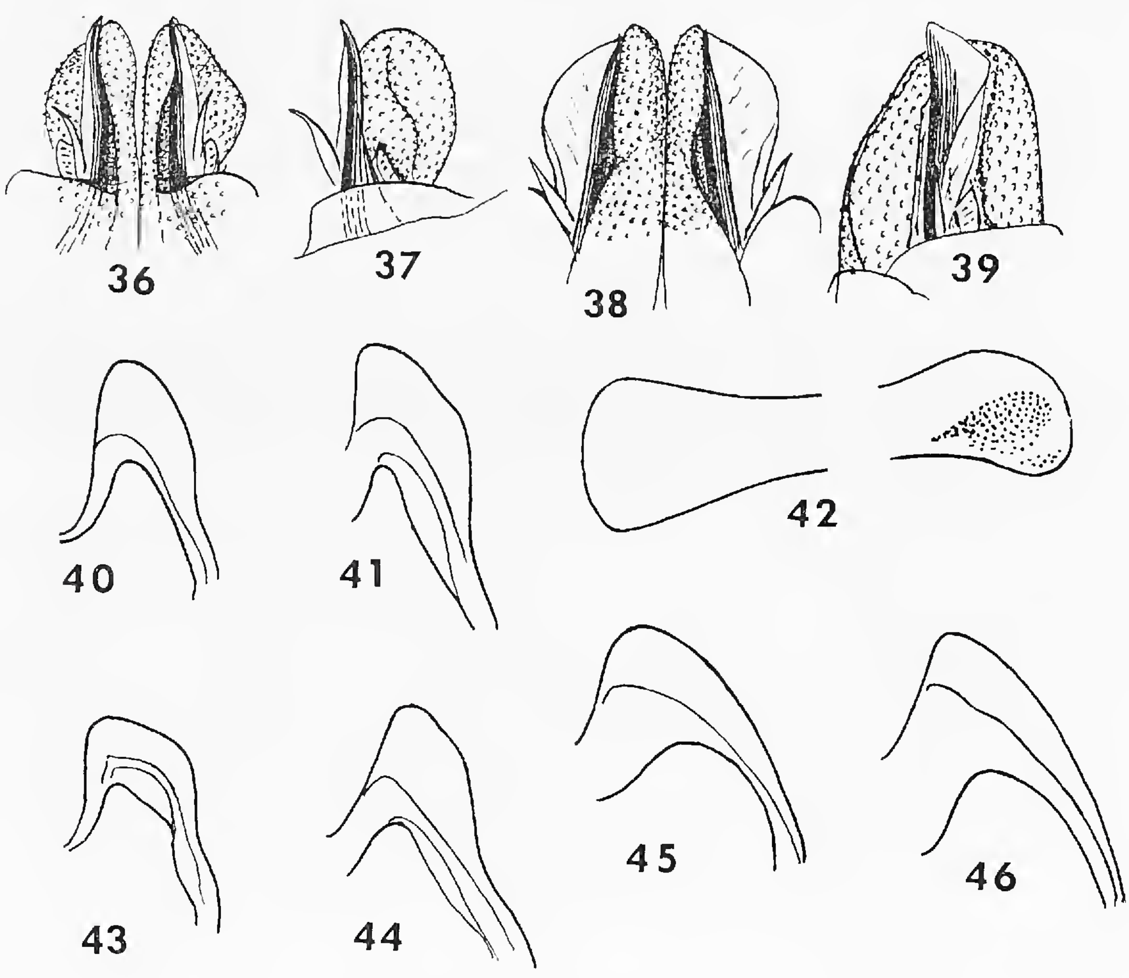
1. Cercus not or very little broadened at apex .... 2.
   Cercus distinctly broadened at apex .... 5.
2. Cercus much less than twice as long as broad (at base) .... *bernardinae.*
   Length of cercus at least twice its basal width .... 3.
3. Cercus obliquely truncate at apex .... *elater..*
   Cercus continuously tapering, styliform .... 4.
4. Distal ridges of epiproct parallel .... *buxtoni.*
   Distal ridges of epiproct oblique .... *elaphrus.*
5. Distal ridges of epiproct low, short, subparallel .... *lepidus.*
   Distal ridges of epiproct oblique, complete .... 6.
6. Tegmina somewhat attenuate, apex narrowly rounded .... 7.
   Tegmina broadly to rectangularly rounded at apex .... 8.

7. Lower distal angle of cercus greatly produced .... *calapooyae.*
   Lower distal angle of cercus slightly produced .... *siskiyou.*
8. Distal ridges of epiproct high and strongly arcuate .... *saltator.*
   Distal ridges low and gently arcuate .... 9.
9. Epiphallic lophus broad, its dorso-later edge evenly arcuate .... *ascensus.*
   Lophus rather narrow, its edge undulately curved .... *validus.*

Melanoplus bernardinae Hebard

Melanoplus bernardinae Hebard, Trans. Am. Ent. Soc., 46:388(1920). Type male, Vivian Creek, San Bernardino Mts., Riverside County, California.

Gurney (1960) has published figures of the epiphallus, cercus, aedeagus and epiproct of this species. I have seen but four males,



Explanation of Figures

Figs. 36-46. 36, *Melanoplus siskiyou* Strohecker, aedeagus, ventral (caudal) view. 37, the same, aedeagus, dextral view. 38, *Melanoplus saltator* Scudder, aedeagus, ventral (caudal) view. 39, the same, aedeagus, dextral view. 40, *Melanoplus siskiyou* Strohecker, right lophus of epiphallus. 41, *Melanoplus saltator* Scudder, right lophus of epiphallus. 42, the same, left cercus of male. 43, *Melanoplus elater* Strohecker, right lophus of epiphallus. 44, *Melanoplus validus* Scudder, right lophus of epiphallus. 45, *Melanoplus ascensus* Scudder, right lophus of epiphallus. 46, *Melanoplus calapooyae* Hebard, right lophus of epiphallus.

two from Tahquitz Valley in the San Jacinto Mts. and two from Tetley Park, San Bernardino Mts. collected by Timberlake at 4500 ft. The latter pair of specimens have the epiproctal ridges much as in *ascensus* i.e. oblique and complete.

Melanoplus elater Strohecker, new species

(Figs. 11-13)

Male.—fastigium broad and moderately sulcate, lateral ridges subparallel. Depth of eye but little less than twice length of genal groove. Pronotum with anterior margin evenly, roundly convex, median carina low but traceable throughout, a little higher on metazone, prozone: metazone ratio 25:19, hind margin broadly subangulate. Tegmina separated, apices rounded but with dorsal margin oblique, extending but little upon second tergite. Epiproct about as broad at base as long, lateral margins feebly tumid from base to about mid-length, whence a pair of curved, oblique ridges course to apex. The topography of the plate is similar to but much weaker than that of *ascensus.* Furcula more prominent than in *ascensus,* lobes broadly triangular, apically rounded and about as long as tenth tergite. Cercus slightly surpassing apex of epiproct, twice as long as basal width, rapidly and symmetrically narrowed in basal third, thence subparallel to feebly widened and obliquely truncate apex.

Coloration: dorsum, including first three abdominal tergites, dusky. Head with postocular black band, continued on prozonal part of lateral lobe. Hind femora clay yellow with two dusky nubeculae, which are continued across the dorsal surface to inner face. Hind tibiae blue.

Measurements (mm): length of pronotum 3.7-4.1; of tegmen 3.5-4.0; of hind femur 9.1-9.8.

Female.—differs from female of *ascensus* in broader fastigium, which is not constricted between eyes, even front margin of the pronotum, and narrower, separated and apically subangulate tegmina. The ventral valves of the ovipositor are narrower and sharper than in *ascensus.*

Measurements (mm): length of pronotum 3.8-4.9; of tegmen 3.2-4.3; of hind femur 9.2-11.6.

Holotype male and allotype female: 5 MILES NORTHEAST OF ZENIA, TRINITY COUNTY, CALIFORNIA, September 19, 1962, from range, G. M. Buxton and F. L. Blanc (California Department of

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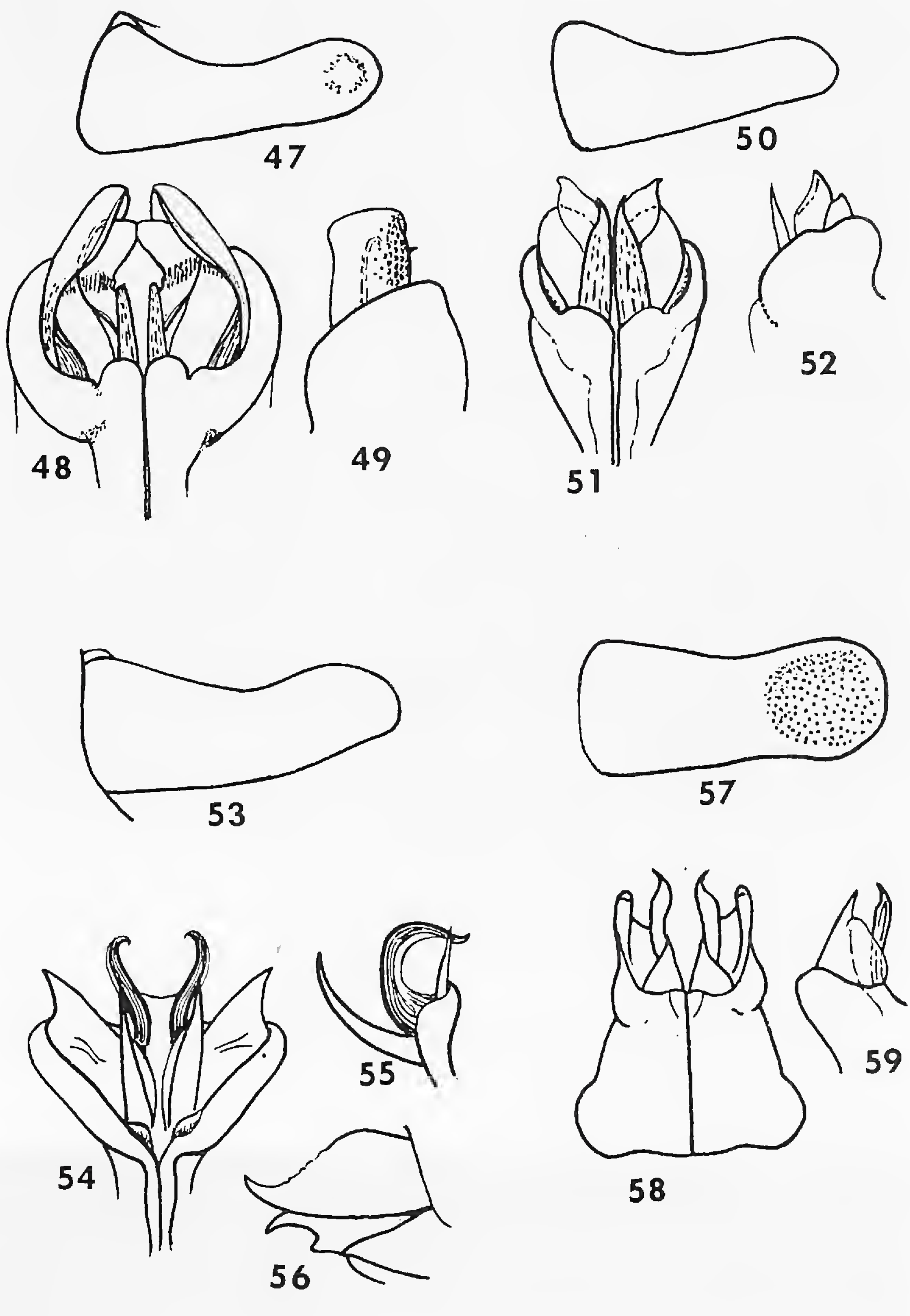
EXPLANATION OF FIGURES

Figs. 47-59. 47, *Melanoplus oreophilus* Hebard, topotype, left cercus of male. 48, the same, aedeagus, ventral (caudal) view. 49, the same, aedeagus, dextral view. 50, *Melanoplus papyraedus* Strohecker, left cercus of male. 51, the same, aedeagus, ventral (caudal) view. 52, the same, aedeagus, dextral view. 53, *Melanoplus daemon,* Strohecker, left cercus of male. 54, the same, aedeagus, ventral (caudal) view, *in situ.* 55, the same, aedeagus, dextral view, *in situ.* 56, the same, ovipositor. 57. *Melanoplus trigeminus* Strohecker, left cercus of male. 58, the same, aedeagus, ventral (caudal) view, *in situ.* 59, the same, aedeagus, dextral view, *in situ.*

Agriculture). Paratypes: 6 males and 8 females with same data as holotype. One male was collected 2 miles southeast of Wildwood on September 18 and a pair was taken 2 miles southwest of Ruth on September 19. Both these localities are in Trinity County.

The aedeagus and lophi of *elater* are similar to those of *bernardinae*.



Melanoplus buxtoni Strohecker, new species

(Figs. 15-18, 21)

Male.—fastigium normally declivent for the group, a little narrower and more deeply sulcate than in *ascensus*. Frontal costa plane, coarsely punctured. Pronotum with lateral carinae feeble but evident, slightly divergent from front basad. Prozone: metazone ratio 4:3. Median carina continuous on prozone but feeble between sulci, strong but low on metazone. Posterior margin subangulate. Tegmina attingent, short-lobate with apex subangulate, extending no farther than hind margin of first abdominal tergite. Abdomen with tergites carinate dorsally, first strongly so, its apex moderately clavate. Furcula very small, its lobes rounded. Epiproct slightly longer than basal width, side margins undulately tumid, distal third with a pair of parallel ridges. Cercus subfalcate, broad at base, tapering rapidly to midlength, thence continuously narrowed to acute, slightly deflexed apex. In dorsal aspect cercus almost straight; its external face linearly sulcate in distal half or third.

Coloration: face and genae green-yellow, occiput dusky with black postocular band continued on the anterior portion of lateral lobe of pronotum.. Dorsum of prozone dusky, entire metazone and lower portion of lateral lobe yellowish. Legs, venter and mesepisternum green-yellow, metepisternum largely yellow. Abdomen yellowish, segments 2-4 with large, lateral black spots, segment 5 with narrow black bar on each side of base. Hind femur with two black nubeculae on upper half of lateral face, these continued across the upper pagina onto upper half of inner face. Lower sulcus and inner face orange-red. Hind tibiae glaucous.

Measurements (mm): length of body 16.5-18; of pronotum 3.8-4.0; of tegmen 3.1-3.8; of hind femur 8.7-9.7.

Female.—no salient differences from other species are shown but the tegmina are shorter and more broadly rounded than in most.

Measurements (mm): length of pronotum 4.3-4.7; of tegmen 3.9-4.8; of hind femur 10.4-10.9.

Holotype male and allotype female: PLASKETT MEADOWS, GLENN COUNTY, CALIFORNIA, on range, September 14, 1960, G. M. Buxton (California Department of Agriculture). Paratypes: 2 males and 1 female taken by D. C. Rentz 6 miles west of Plaskett Meadows on August 27, 1962: two males and one female with same data as holotype.

Of the first two phalli examined one had the cochleate part of the left dorsal aedeagal valve in a median position, the second had this part of the right valve in median position. The phallus, carefully exserted, of a third specimen presented both valvular cochleae ventral to (behind) their sclerites. Figures 16 and 17 were drawn from this preparation *in situ*. In the two phalli first examined the valvular cochleae slipped into a ventral position during potash-alcohol-glycerol treatment.

Melanoplus elaphrus Strohecker, new species
(Figs. 19, 20, 33)

Male.—about the size of and closely resembling *M. saltator* Scudder. Pronotum with lateral carinae blunt but conspicuous, median carina evident throughout but low, especially between sulci, posterior margin obtuse-angulate. Tegmina shorter than pronotum, approximate dorsally, apex feebly produced and more narrowly rounded than in *saltator*. Epiproct as in *saltator* but with oblique, distal carinae weaker. Furcula small, its lobes shorter than tenth segment. Cerci stoutly styliform, tapering through curvature of dorsal margin, a little decurved in apical half, only tip incurved. In some specimens the cercus is more narrowed in its basal third and approximates that of *M. elater* in form. Aedeagus with sclerites of dorsal valves specialized as strongly sclerotized, apically decurved rods with lateral membrane. The ventral valves are typical of the group.

Coloration: not markedly different from that of *saltator*. Hind femur with outer surface dull yellow with small, indefinite, dark blotches; upper pagina blackish; lower pagina, lower sulcus and inferior portion of inner face orange-yellow. Hind tibiae varying from pale green or glaucous to a decided red.

Measurements (mm): length of body 19-23; of pronotum 4.1-4.5; of tegmen 3.5-4.0; of hind femur 10-12.

Female.—very similar to female of *saltator* and I have found no dependable characters for distinguishing the two.

Measurements (mm): length of body 21-24; of pronotum 4.4-5.0; of tegmen 3.9-4.2; of hind femur 10.7-12.

Holotype male and allotype female: 3 MILES EAST OF KNEELAND, HUMBOLDT COUNTY, CALIFORNIA, November 1, 1960, T. R. Haig (California Department of Agriculture). Paratypes: 24 males and 22 females with same data as holotype. An additional 5 males were collected at Ferndale, Humboldt County by Haig on November 2, 1960. Buxton has recently sent 36 males and 25 females collected by him and Blanc from range grasses at Cold Springs, Trinity County on September 18, 1962.

Haig's collection notes state that these insects were found in roughly circular areas fifty to one hundred feet in diameter. When flushed from these spots they quickly returned and collecting was thus easy. These circular areas occurred at intervals of several hundred yards on a rocky surface.

MELANOPLUS LEPIDUS Scudder

Melanoplus lepidus Scudder, Proc. U.S. Nat. Mus., 20:321 (1897)

Hebard (1912:86) designated as lectotype a male from Truckee, Nevada County, California. Gurney (1960:159) has presented a series of figures. A notable feaure of the aedeagus is the relatively great length of the sclerites of the dorsal valves.

Melanoplus siskiyou Strohecker, new species

(Figs. 14, 36, 37, 40)

Male.—fastigium rather deeply sulcate, much narrowed between eyes. Pronotum with front margin broadly and shallowly excavate at middle, median carina low, obliterated or almost so between sulci, lateral carinae feeble, disc rounding into lateral lobes, hind margin broadly subangulate. Tegmina slightly overlapping, notably attenuate with apex narrowly rounded. Epiproct scarcely longer than basal width, side margins roundly tumid from base to middle, there abruptly convergent and paralleled by oblique ridges, apex acutely rounded. Cercus about two and a half times as long as basal width, a little narrowed in basal third, thence subparallel to apex, upper apical angle broadly rounded, lower angle briefly and roundly produced. Femora much enlarged, hind ones with outer face more than usually convex, lower pagina very strongly developed and decidedly sinuate proximad, base of the femur deflexed into a short "tooth" as in *Aeloplides*. This feature may be seen feebly expressed in other species of the group but is much more strongly developed in *siskiyou*. The aedeagus is very similar to that of *M. elater* but the sclerites of the dorsal valves are more widely separated and more aciculate. The aedeagus also shows some general resemblance to that of *validus*, but the small amount of material at hand does not suggest actual merging of populations.

Coloration: face, genae, lateral lobe of pronotum and mesopleura olivaceous, occiput, prozone of pronotum and first three abdominal tergites fuscous, metazone and tegmina umber. Head with a pair of dark postocular bars, broken dark line on prozonal portion of lateral lobe. Abdomen, metepisternum and femora yellow, hind femur with two irregular dark areas, continued over dorsal paginae onto inner face. Hind femur may be better described as having its outer face largely dark with scattered yellow points on its basal third and a conspicuous yellow band at mid-length, lower pagina and inner face red-orange. Hind tibiae pale blue.

Measurements (mm): length of pronotum 4.6; of tegmen 4.5; of hind femur 10.3.

Female.—fastigium broader and less sulcate than male. Tegmina attingent, narrowly rounded at apex. The single specimen is pale yellow (green in life?) with narrow postocular dark bar and several narrow dark lines on prozonal part of lateral lobe. The transverse sulci dark here but not dorsally. Upper edge of outer face of hind femur with a row of dusky points.

Measurements (mm): length of pronotum 4.9; of tegmen 4.3; of hind femur 11.6.

Holotype male: FT. JONES, SISKIYOU COUNTY, CALIFORNIA, September 3, 1942, H. W. Graves (California Department of Agriculture). Allotype female: Ft. Jones, August 18, 1948, Earl Gammon (California Department of Agriculture).

Two imperfect males from Ft. Jones are also at hand. At Cold Springs in Trinity County on September 19, 1962 Buxton and Blanc collected a male and seven females which seem referable to this form but have the hind tibiae bright red. The male of this series when compared with the holotype is seen to be smaller and more intensively colored. The prozone of the pronotum is less tumid, with visible lateral carinae, and has a dark bar on the upper part of the lateral lobe. The cercus is more truncate than in the holotype, its upper distal angle more abruptly rounded. Length of pronotum 3.9 mm; of tegmen 4.5 mm; of hind femur 9.5 mm.

Melanoplus ascensus Scudder

(Figs. 24, 25, 29, 45)

Melanoplus ascensus Scudder, Proc. Davenport Acad. Sci., 7:196 (1800).

Hebard in 1912 chose a male specimen from Mt. Shasta as lectotype of this species, and in 1937 he discussed *ascensus* at length, placing *M. validus pinicola* Fulton as a synonym. In this latter work he illustrated the left dorsal aedeagal valve.

In *ascensus* and the forms which follow the cochleate portion of the dorsal aedeagal valves is coriaceous, appearing amber-colored even in cleared preparations. These parts are considerably larger in *ascensus* and *calapooyae* than in the other species of the group; the drawings of the aedeagus of these two is 5/6 the scale used in the other drawings of aedeagi. The drawing of the cercus of the McCloud specimen illustrates an extreme apical angulation; indeed the right cercus of this specimen has the lower apical angle more rounded. Possibly the right dorsal aedeagal valve, as illustrated, has suffered some displacment. In a specimen from Upper Klamath Marsh, Oregon the right dorsal valve has an appearance much like that of *calapooyae*.

Melanoplus calapooyae Hebard

Figs. 26, 27, 30, 46)

Melanoplus calapooyae Hebard, Trans. Am. Ent. Soc., 46:385 (1920)

In 1937 Hebard reduced this name to racial status under *ascensus*. I have not seen specimens which are definitely intermediate and have no strong opinions on the relationship of the two.

Melanoplus validus Scudder

(Figs. 22, 23, 31, 44)

Melanoplus validus Scudder, Proc. Davenport Acad. Sci., 7:197 (1899)

Hebard (1912:90) chose Grant's Pass, Oregon as the type locality and in 1937 placed *validus* as a race of *ascensus*. While the aedeagi are somewhat similar the phallus in its entirety indicates, I think, that if *validus* is of less than specific rank it is a race of *saltator* rather than of *ascensus*. Hebard appended the remark that "its racial validity may yet not be considered unequivocally established."

MELANOPLUS SALTATOR Scudder

(Figs. 38, 39, 41, 42)

Melanoplus saltator Scudder, Proc. U. S. Nat. Museum, 20:261 (1897)

Hebard chose a male from Portland, Oregon as lectotype and in 1938 illustrated the left dorsal aedeagal valve, evidently from a dry preparation. Gurney (1960:159) presented more detailed drawings from potash-glycerol preparations.

THE MONTANUS GROUP

In 1935 Hebard treated this group, in which he included *washingtonius, repetinus, idaho, salmonis* and *oreophilus* in addition to *montanus*. On the basis of aedeagal structure only the first and last of these should be associated, to which is added a third species recently discovered by Dr. Barr.

Melanoplus daemon Strohecker, new species

(Figs. 53-56)

Both male and female closely resemble the corresponding sexes of *M. washingtonius* Bruner. In both sexes the tegmina are slightly overlapping, their exposed portions a little longer than the pronotum with apex narrowly rounded. Face, genae and lower portions of lateral lobe of pronotum ochraceous with two dusky bands crossing outer, upper and inner faces. Hind tibiae and tarsi pink, tibial spines black, calcars yellow with black tips.

Male.—epiproct triangular, broader and longer than in *washingtonius*, its lateral margins reflexted at base and rather deeply sulcate on each side, median costae straight and ending apically in circular plaque bounded on each side by a semicircular ridge. This feature is more strongly developed than in *montanus* (Thomas) and *washingtonius*. Arms of furcula about as long as their segment, symmetrically tapering and bluntly rounded. Cercus similar to that of *washingtonius* but broader and with dorsal margin strongly concave. Dorsal valve with sclerite stout and dark, strongly recurved, the ventral valves long, tapering, aciculate, feebly sclerotized. Figures 54 and 55 were drawn from the phallus *in situ*.

Measurements (mm): length of body 20; of pronotum 4.3; of tegmen 4.6; of hind femur 9.7.

Female.—resembling female of *washingtonius* very closely but with valves of ovipositor more attenuate and acute.

Measurements (mm): length of body 24; of pronotum 5.4; of tegmen 5.6; of hind femur 12.5.

Holotype male and allotype female: 10 MILES WEST OF CUPRUM,

HELL'S CANYON, SHEEP ROCK, ADAMS COUNTY, IDAHO, August 13, 1953, F. V. Nonini (California Academy of Sciences). Three additional females have the same data.

Melanoplus papyraedus Strohecker, new species

(Figs. 50-52)

The following description is based upon a single male which is apparently in a teneral stage of coloration. Male pale tan with a dark bar on lateral lobe of prozone of prontum. Hind tibiae very pale pink. This species is similar to *oreophilus* Hebard but of stouter form. Pronotum with prozone slightly longer than metazone, median carina strongly developed behind principal sulcus but imperceptible on tumid prozone. Hind margin obtusely rounded. Lateral carinae very feeble on metazone and hardly perceptible on prozone. Tegmina broadly overlapping, shorter than pronotum, more broadly rounded at apex than in *oreophilus.* Arms of furcula broad and obtusely rounded at apex, about as long as tenth segment. Cercus twice as long as basal width, tapering rapidly in basal third by concavity of dorsal margin, thence subequal, apex obliquely rounded and externally convex. Subgenital plate short and shallow, broadly tuberculate at apex. Aedeagus without dark sclerotizations, ventral valves erect, acuminate at apex by arcuate excision of lateral margin.

Measurements (mm): length of body 18; of pronotum 4.9; of tegmen 3.8; of hind femur 10.3.

Holotype male: LEMHI PASS, LEMHI COUNTY, IDAHO, July 12, 1956, W. F. Barr (California Academy of Sciences).

The *oreophilus* group would include, besides its nominate species, *repetinus* Hebard, *idaho* Hebard, *salmonis* Hebard and *papyraedus.*

THE ARTEMISIAE GROUP

Hebard (1935) has discussed and figured the salient features of *M. artemisiae* Scudder and *M. lemhiensis* Hebard. To these two must be added another related species found, like the others, in a small area in eastern Idaho.

Melanoplus trigeminus Strohecker, new species

(Figs. 57-59)

Male.—of rather small size for the genus and of grayish general coloration; very similar to *artemisiae* and *lemhiensis.* Eyes prominent, their depth one and a half times length of genal groove. Fastigium much narrowed posteriorly and distinctly sulcate. Pronotum with prozona only a little longer than metazona, median carina feeble, scarcely evident between sulci, hind margin broadly subangulate. Tegmina shorter than pronotum, narrowly rounded at apex. Arms of furcula broad, shorter than tenth segment, rounded at apex. Cercus slightly more than twice as long as its basal width, lower margin almost straight, upper margin little concave, cercus thus narrowest at mid-length, apex evenly and broadly rounded, subtruncate. The cercus is a little incurved at mid-length and strongly flattened in its distal two-fifths.

Subgenital plate with short and broad tubercle at apex. Aedeagus with dorsal valves slender, their apices acute and decurved, ventral valves very broad basally, abruptly tapering distally to the acute apex.

Coloration: face pale, fastigium and occiput mottled with fuscous; post-ocular bar, continued on sides of prozona, black. Dorsum of pronotum dusky. Lower half of lateral lobes yellow. Meso- and metathorax yellowish, sutures black. Tegmina dusky with most of veins ivory. Abdomen gray, each segment with row of elongate dark markings on posterior margin and narrow, longitudinal dark bar on each side, below which are several brown spots. Sides of the second segment largely black. Hind femur with external face pale brown, inner upper pagina with two dark bars, continued onto inner face. Most of inner face and lower sulcus yellow. Hind tibiae glaucous.

Measurements (mm): length of body 17; of pronotum 3.5; of tegmen 3.2; of hind femur 8.5.

Holotype male: 3 MILES EAST OF BAKER, LEMHI COUNTY, IDAHO, July 12, 1956, W. F. Barr (California Academy of Sciences). Paratypes: a male with same data as holotype and 5 males taken at the type locality by Barr on June 24, 1961.

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MATING BEHAVIOR OF PSYLLA PYRICOLA FORSTER

(Homoptera: Psyllidae)

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The mating behavior of psyllids has been previously described in general terms by Knowlton and Janes[1] for the potato psyllid, *Paratrioza cockerelli* (Sulc.) The observation reported here differs in at least some respects, and presents more detail.

Eight or ten male and female pear psyllids (*Psylla pyricola* Förster) of the overwintering generation were aspirated into a glass tube and placed under a microscope. A male was observed to approach a female from her right, facing her, then turn to his right and back up so that he was beside her and facing the same direction as she. No contact of the two occurred until the male moved the posterior portion of his abdomen to beneath the female genital area, pushing upward on the ventral valve of the female with the tip of his abdomen. After several seconds the female turned the tip of her abdomen downward approximately 30° from the normal position. The male bent the tip of his abdomen upward approximately 135° so that it was nearly inverted (scorpion-like). The ventral valve of the male was placed between the dorsal and ventral valves of the female, its venter apposed to the dorsal valve of the female. The male proctigers appeared to grasp the ventral valve of the female on either side from above. The ventral valve of the female was inserted part-way into the dorsal region of the male genital area so that the tip of the ventral valve was not visible. The male forceps and other parts not mentioned were not visible. There was some movement back and forth of male abdomen, while the female remained relatively still. Movement of the antennae, as reported by Knowlton and Janes for the potato psyllid, was not noted. After approximately one minute the male disengaged and walked quickly away several inches. The female moved about ¼-inch and stopped.

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[1] Knowlton, G. F., and M. J. Janes, 1931. Studies on the biology of *Paratrioza cockerelli* (Sulc). Ann. Ent. Soc. Amer., 24(2):283-291.

DESCRIPTION OF THE EGGS OF LEPTOGASTER SALVIA MARTIN[1]

(Diptera: Asilidae)

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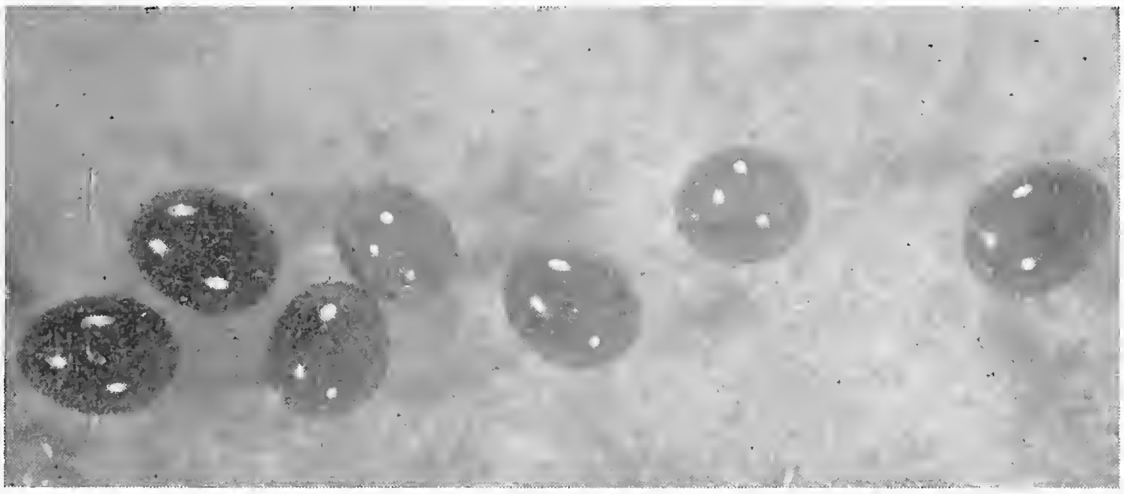
While making observations on June 25, 1962, of an extensive area of threetip sagebrush *(Artemisia tripartita* Rydb. subsp. *rupicola* Beetle), the author observed several individuals of *Leptogaster salvia* Martin. The area was located at an elevation of 6000 feet on the north slope of the Owl Creek Mountains at the north end of the Wind River canyon near Thermopolis, Wyoming. Associated plain species included *Agropyron spicatum* (Pursh) Scribn. and Smith, *Poa secunda* Presl, *Poa fendleriana* (Steud.) Vasey, *Phlox hoodii* Rich, and *Lupinus* spp.

One female was captured and it deposited 60 eggs in the bottom of the glass vial in which it was retained. The eggs were a bright orange and slightly oval, averaging 0.36 mm in length and 0.27 mm in width. The variation in size did not exceed 0.02 mm for the whole series of eggs. No sculpturing was visible on the egg chorion at 150X magnification.

L. salvia occurred in association with *Machimus occidentalis* Hine. This latter species was observed to capture three specimens of *L. salvia.*

The author wishes to thank Dr. Charles Martin of the University of Oregon for identifying the specimens of *L. salvia.*



EXPLANATION OF FIGURE

Fig. 1, Eggs of *Leptogaster salvia* Martin.

[1] Published with the approval of the Director, Wyoming Agricultural Experiment Station, as Journal Paper No. 189.

OBSERVATIONS ON LARVAL AND PUPAL HABITS OF THE JUNIPER CONE MOTH, PERIPLOCA ATRATA HODGES

(Lepidoptera: Gelechioidea)

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Members of the genus *Periploca* Braun are small, dark, shiny moths which are poorly known biologically. The species for which some information is available exhibit a variety of habits as borers in different woody plants. In his recent treatment of the genus, Hodges (1962) described *P. atrata* from specimens collected in the Santa Rita and Chiricahua Mountains, Arizona, and at Mt. Diablo, Contra Costa County, California. Among material examined by Hodges were specimens reared from fruit of *Juniperus pachyphloea* in Arizona and *Juniperus californica* at Mt. Diablo.

Collections from the latter area made during the spring of 1962 have produced some further information on the biology of this moth which is of interest, especially the characteristic emergence arrangement. Juniper was examined for affected ovulate cones at 2900 feet elevation on Mt. Diablo, January 21 and at Russelmann Park, located at 1100 feet on the north slope of the mountain, February 23 and again on April 6 and 13. In January and February although numerous berries were examined which showed brown spotting, were turning purple, or had a shriveled appearance, the few discovered containing *Periploca* showed no apparent correlated external effects. By April, however, infested fruits had a noticeable pale, wrinkled appearance and were found to be rather common on some trees.

Larvae of *P. atrata* were present in the January 21 and February 23 lots, although most individuals had pupated by the latter date. Feeding took place within the seed in a curling tunnel and eventually consumed most of the volume of the seed, but left the pulpy, fibrous outer cover essentially untouched. Variation was noted in disposition of the frass. Evidently much of the frass from younger larvae was expelled, since essentially frass free tunnels were observed. In one instance a tiny hole was present at a point where the tunnel touched the berry skin, while another larva was found in a clean burrow which led to a large round hole; yet in still another case some frass was found in a larval excavation which seemed to have no opening to the exterior. Feeding by mature larvae resulted in an accumulation of frass around the pupal chamber, and in all cases this was noted to be considerably more than was associated with any larva seen.

The presence of pupae within cones was always to be perceived from the external appearance of the emergence aperture. The hole was closed by a curious valve-like structure (Figs. 2, 3), evidently of silk origin, but exteriorly of a tough, smooth, leathery consistency. The apertures were oval and measured about 1.1 x 0.6 or 0.7 mm, and each was accompanied by a darkened area about twice that size surrounding it. Beneath the valve closure a silken tube trackway led away from the exit some distance around the seed, then into the pupation chamber inside the seed. In most cases the exit path comprised a full 180° turn from the direction of the pupal situation, and at times curved away from its plane by as much as 90°. At emergence the pupal shell, which has no cremaster, remained *in situ*, probably held by the tight confinement of the pupal chamber and the constricted exit trackway. When the emerging moth reached the surface, it caused the sides of the "valve" to part, evidently by forcing the sides of the silken trackway apart, pulling the exit cover inward. The apertures remained open after emergence of the moths, and such berries were easily distinguished from those with pupae still inside.

Cosens (1908) made no mention of any such closure of the emergence hole of *Periploca ceanothiella* (Cosens), a gall-maker in branches of *Ceanothus*. However, he noted that galls occupied by overwintering larvae were lined with silk. *P. atrata* seemed not to form any silk lining within the juniper cones other than the emergence trackway.

Whereas during early spring painstaking search was necessary to reveal the presence of emergence valves or frass ejection holes, by April affected berries had a distinctive appearance which enabled almost unerring selection of them from among healthy ones. In addition to the exit valve, cones containing pupae had by this time a pale, slightly yellowish, and slightly wrinkled appearance in comparison to normal, smooth green fruits. Berries with a conspicuous brown spot, which were common on the trees, were not

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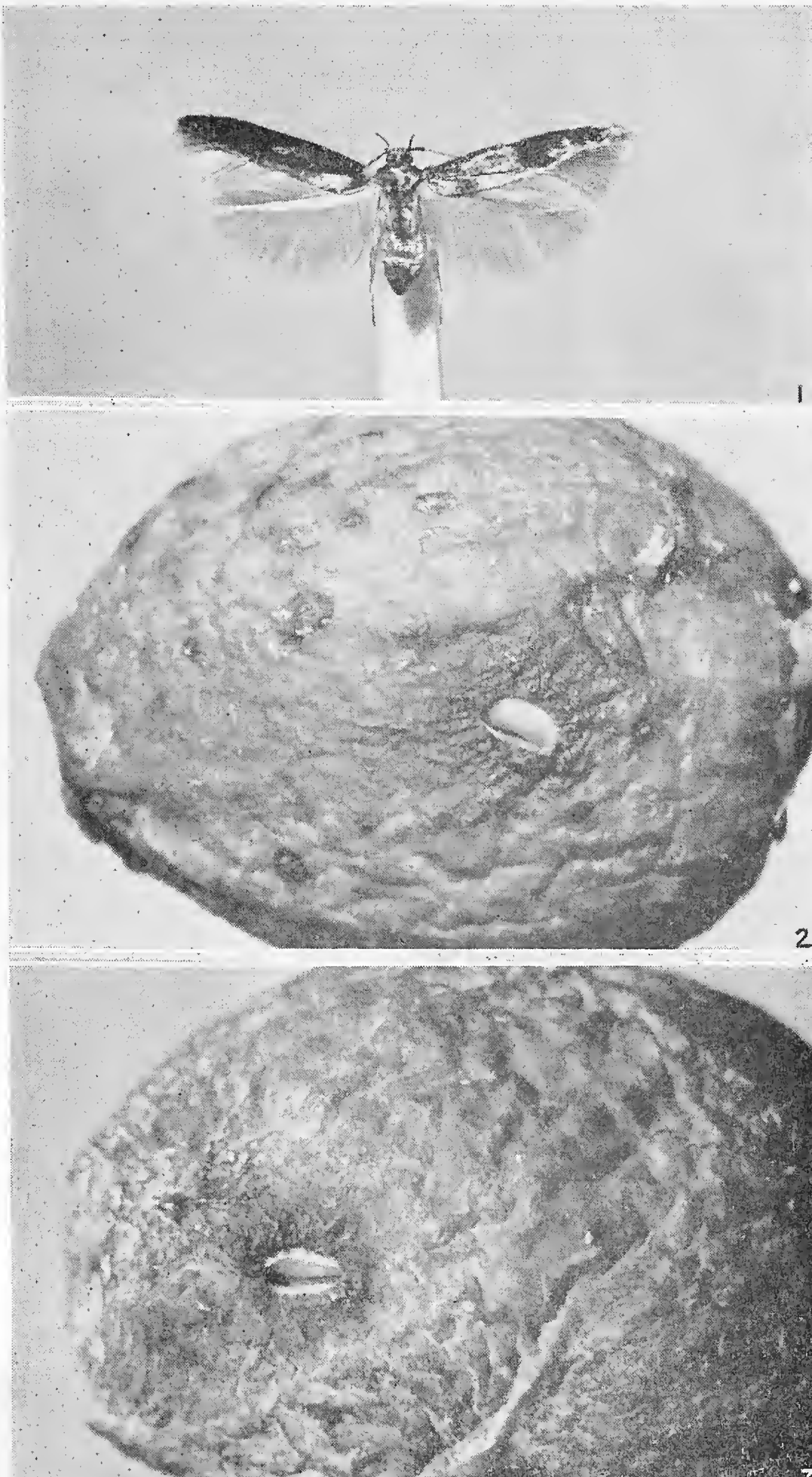
Explanation of Figures

Fig. 1, *Periploca atrata* Hodges, female (3.5X); Russelmann Park, Contra Costa County, California, II-23-62, reared from *Juniperus californica* berry, emerged III-16-62 (JAP-62B8). Figs. 2-3, ovulate cones of juniper (8.2X) showing exit aperture "valve" of *P. atrata* prior to emergence.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found to contain pupae, but at times pupae were found in cones having a purplish tinge. This led to an examination of purplish fruit from the ground under a tree, but none were discovered with signs of *Periploca*. The fact that nearly mature pupae within greenish berries were found on the trees in April suggests that affected fruits normally do not drop prior to the moths' emergences.

Apparently larval feeding is completed and pupation occurs well ahead of emergence. One teneral pupa was collected January 21, even though a light snow was falling at the time, and Mt. Diablo recorded its coldest temperature of the season (10°F) the following day. This individual emerged about three weeks after being brought into the laboratory, as did those collected as pupae in late February. However, moths were not seen at Russelmann Park by April 13, and no emergence had occurred from observed berries. Hodges (1962) gave a record of *P. atrata* taken at Mt. Diablo, April 5, 1937 (by E. C. Van Dyke), presumably as adults; and moths emerged from my April 13 collection between April 16 and 19, indicating that the flight period probably occurs in April and early May. This is somewhat earlier than that of *P. ceanothiella* (Cosens) and *P. nigra* Hodges (a cambium miner in ornamental juniper) in the area. Records of specimens taken at lights in Walnut Creek near Mt. Diablo during 1961 and 1962 indicate that both these species fly during the last week of May and in June. The latter species was taken as late as July 10. Adults of all three species are presumed to be noctural in behavior. Those of *P. atrata* emerged at night and remained quiescent during the daylight hours when housed in petri dishes.

Two specimens of an ichneumonid, *Pristomerus* sp.[1], were reared from the 1958 collection (Russelmann Park, I-4-58, H. Ruckes, Jr.) reported by Hodges. The specimens emerged from unsegregated berries, and no specific data were taken regarding the host-parasite relationship. No parasites were obtained from the 1962 collections.

Acknowledgment is made to R. W. Hodges, U.S. National Museum, who determined specimens of the three species of *Periploca*.

[1] Determined by G. S. Walley, Entomology Research Institute, Ottawa, and deposited in the Canadian National Collection.

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BOOK REVIEW

BUTTERFLIES OF THE AMERICAN TROPICS. THE GENUS ANAEA. By William Phillips Comstock. The American Museum of Natural History, New York, 1961. Printed in England, W. S. Cowell, Ltd., Ipswich. xiii + 214 pp., 30 colored plates. Price $25.00 cloth.

An aura of Old World nineteenth century splendor strikes one on leafing through this magnificently executed volume, with its heavy paper, broad margins, widely spaced lines of large, clear type, and its generously spaced fine colored reproductions. The work was begun over 20 years ago and carried out by the author with the enthusiastic interest and financial support of Mr. Frank Johnson of Griffin, Georgia. The manuscript was completed in 1949 following a preliminary paper on the Antillean species by Johnson and Comstock. As stated by Dr. F. H. Rindge in the preface to the present book, it is indeed unfortunate that neither of the persons primarily responsible for it lived to see the work finally printed. The book is undoubtedly one of the finest treatments, both in its scientific and mechanical aspects, to have been published on Neotropical Lepidoptera. The manuscript and plates have been edited and rearranged since the death of Dr. Comstock, but according to Rindge the text is virtually as originally written.

The work itself is a study of the species formerly assigned to the genera *Coenophlebia, Siderone, Zaretis, Hypna, Anaea, Polygrapha, and Protogonius* (=*Consul*), all of which are treated as subgenera. The group comprises some 120 species (with 38 additional subspecies), about four-fifths of which are included in the new subgenus *Memphis*. Six species and five subspecies, all members of this subgenus, are described as new. In addition to the rearrangement of the genera and the new forms, evidently considerable taxonomic change also has occurred through new synonymy, which, however, is not designated as such. Besides the systematic account, treatment of the following aspects of the genus *Anaea* are included: immature stages, distribution and origin, climates and population density, paleoclimates and paleogeography, phylogeny, etc. The taxonomic treatment is modern throughout; the classification is based on wing venation, wing shape, and genital morphology of the males and includes consideration of seasonal forms and geographical variation. All phases are illustrated by 250 line figures and maps as well as by the truly excellent colored plates. Artwork for the latter was done by Miss Marjorie Statham and Miss Dorothy Fitchew and depicts both upper and lower wing surfaces of 268 individual butterflies.

In a cursory examination of a number of species, representing all the subgenera, from various parts of the Americas, I find the work quite usable. The taxonomic and distributional treatments appear to be accurate and on the whole complete. Identification of species seems straightforward, especially due to the illustrations, which are exceedingly accurate both in form and color reproduction. As stated in the preface, the manner of handling literature is brief. References in general sections of the text are correlated with the short terminal bibliography. Those in discussions under individual species are usually to be found in the synoptic synonymy of the given species, but at times are not, and one is referred to the terminal literature cited (e.g., under *A. (Memphis) iphis,* p. 158).

As with almost any compilation of major proportions, a few minor ommissions are bound to have crept in. For example with regard to *A. (Zaretis) itys* (p. 30) the plate number reference (Plate 1, figs. 4, 5) has been omitted from the text; and the size of individuals, usually indicated by a range of fore-wing length, is not shown for this species. A curious omission of some sort has occurred in the subgenus *Anaea.* On the map summarizing the distribution of the subgenus (p. 184) the group is shown to range, in the broad sense, over the whole of Mexico and, in the western United States, into what appears to be parts of New Mexico, Arizona, and southern California. However, in the discussions of the species, none is reported from Arizona or New Mexico. As stated by Comstock (p. 43), Field[1] reported *A. (Anaea) aidea (= morrisoni)* from the "Sierra Madre of California" (a record which surely must have been based on erroneously labeled specimens); however, Field also listed *aidea* as occurring in Arizona, as have other general works (*e.g.* Holland[2]). Martin and Truxal[3] also give Arizona as source for material of this species; and both of Field's western records were repeated by Ehrlich[4], but Comstock does not relist the Arizona one. I have collected *A. (Anaea) andria* in Arizona (Sedona, 3♂, 1♀ VI-20-49) and had supposed that the species must be well known in Arizona, since I have done very little field work there. However, it appears that Comstock's current treatment is in agreement with general works on North American butterflies in not listing this species west of Texas. Also, Rindge's data[5] for *A. aidea* in Baja California represent southern localities, not the whole of the peninsula as indicated by Comstock's map of the subgenus. Similarly, *A. (Memphis) glycerium* (p. 76) is listed from Arizona (perhaps a doubtful record?), but the map of the distribution of the subgenus (p. 190) indicates no occurrence in northwestern Mexico or southwestern United States.

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1 Field, W. D. 1938. A Manual of the Butterflies and Skippers of Kansas (Lepidoptera, Rhopalocera). Bull. Univ. Kansas, 39(10): 1-329.

2 Holland, W. J. 1931. The Butterfly Book, rev. ed., Doubleday & Co., Garden City, N.Y. xii + 424 pp. & 77 pl.

3 Martin, L.M. & F.S. Truxal 1955. A List of North American Lepidoptera in the Los Angeles County Museum. Part I. Butterflies. Los Angeles Co. Mus., Sci. Ser. Vol. 18, Zool. No. 8, 35 pp.

4 Ehrlich, P.R. & A.H. Ehrlich 1961. How to Know the Butterflies. Wm. C. Brown Co., Dubuque, Ia., 262 pp.

5 Rindge, F.H. 1948. Contributions toward a knowledge of the insect fauna of Lower California. No. 8. Lepidoptera: Rhopalocera. Proc. Calif. Acad. Sci., 4th Ser., 24(8): 289-312.

It is regrettable that with the expenditure of such a monumental effort and expense, resulting in an excellent revision, that so little space has been given over to communication of author's opinions. All his discussions tend to be brief (a commendable quality for many taxonomic papers). The reader is given little detail on such complex problems as the geographical variation in *A. (Siderone) marthesia* and *A. (Zaretis) itys* and one is left to wonder what thoughts Comstock may have had concerning questions such as the possible doubtful records mentioned above.

The beautiful members of the genus *Anaea* have long been sought after and studied by students and admirers of the magnificent butterfly fauna of the New World tropics. That data on many species remains fragmentary is attributable mainly to difficulties involved with collecting in remote and dangerous regions. In addition to supplying a further stimulus for collectors this book provides a thorough and accurate treatment of this large and widely distributed group, which will be of value to those interested in the classification and geographical distribution of animals of the Neotropical Region.—JERRY A. POWELL, *University of California, Berkeley.*

DESCRIPTION OF THE FEMALE OF DILOPHOTOPSIS STENOGNATHA SCHUSTER[1]

(Hymenoptera: Mutillidae)

CLARENCE E. MICKEL
University of Minnesota, St. Paul

During the spring of 1962 I operated a light trap in the yard of my home at Tucson, Arizona for the purpose of attracting and collecting female Mutillidae. The trap consisted of a gallon can sunk in the ground so that the top rim of the can was even with the surface of the ground, and an ultraviolet electric bulb suspended over it about four feet above the ground. This trap not only attracted and trapped female Mutillidae but also attracted males. Females of a species of mutillid were taken numerous times. On one occasion a copulating pair was captured while I observed the insects coming into the trap. The male was identified as *Dilophotopsis stenognatha* Schuster. On several other occasions males of this species were observed pursuing the large females, but a copulating pair was observed only once. The description of the female follows:

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[1] Paper No. 5055, Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul 1, Minnesota

Dilophotopsis stenognatha Schuster

Female.—Testaceous, except second tergum beneath felt lines, posterior margin of second tergum and sternum, abdominal segments beyond second, and all femora, castaneous; entire body and legs clothed with erect pale hairs, front and vertex also with appressed pale hairs, dorsum of thorax and disk of second tergum with appressed, dark golden hairs; posterior margin of head, anterior margin of thorax, and posterior margin of all abdominal segments with dense fringes of very pale plumose hairs. Mandibles edentate at tip, deeply excised beneath near base forming a conspicuous rounded, blunt tooth, dorsal carina terminating one-third the distance from base to apex, in a small acute tooth; clypeus obscured by dense pubescence; first segment of flagellum one and one-half times the length of second; antennal scrobes not carinate above; genae rounded into postgenae, not carinate; front, vertex and genae densely, confluently punctate; dorsum of thorax coarsely, densely, confluently punctate, disk of posterior face of propodeum weakly rugose and with sparse, distinct, moderate punctures; sides of pronotum, posterior face of mesopleura and sides of propodeum punctate, anterior face of mesopleura and all of metapleura glabrous, impunctate; first abdominal segment very short, subsessile, but with a distinct constriction between first and second segments; first and second terga densely punctate, anterior forth of second coarsely, rugosely punctate; puncturation of terga three to five obscured by pubescence; pygidial area well defined, large, covering all of exposed surface of last tergum, very finely, delicately rugose, appearing granulate under low power; second sternum with large, close punctures throughout; remaining sterna with small, close punctures; legs densely clothed with long, pale hairs. Length, 11.5 mm.

Allotype female: Tucson, Arizona, May 15, 1962 (C. E. Mickel) in copula with male, in collection of University of Minnesota, St. Paul, Minn. Paraallotypes: Seventeen females, Tucson, Arizona, May 10, 12, 13, 14, 16, 17, 19, 20, 23 and 29, 1962 (C. E. Mickel), in collections of University of Arizona and University of Minnesota.

MEETING NOTICE

Greetings from the Pacific Coast Entomological Society were sent to the Entomological Society of Canada and to the Entomological Society of Ontaria in recognition of the celebration of the centennial of organized entomology in Canada. Meetings will be held September 3-6, 1963 at Carleton University, Ottawa.

A NEW SPECIES OF ASTATA FROM SOUTHERN ARIZONA

(Hymenoptera: Sphecidae)

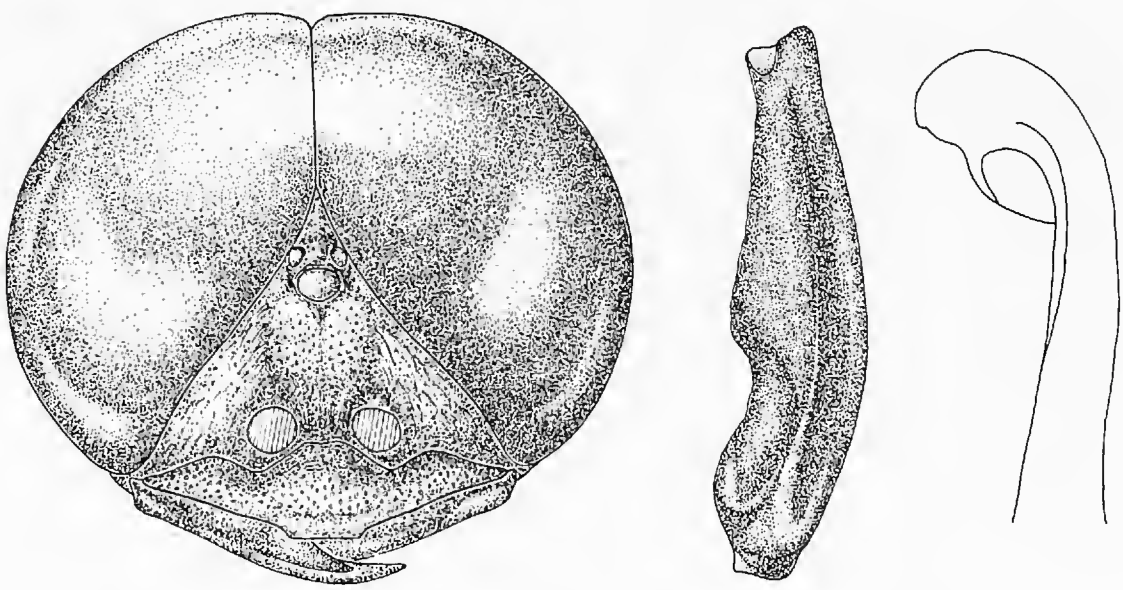
F. D. PARKER
University of California, Davis

Since my previous studies on *Astata* (Parker, 1962. Ann. Ent. Soc. Amer. 55(6):643-659) a new species has been collected in southern Arizona. In order to make information on the genus more complete, the following description is published at this time.

Astata femorata Parker, new species

(Figs. 1-3)

Male.—Black; posteriorly on tergite I, all of tergite II, basally on tergite III, red; wings hyaline. Pubescence silvery-white, that of sternites III-V light tan, medial, brush-like, recumbent, and projecting posteriorly. Punctation on head, pleura reticulate, becoming faintly striate posteriorly on pleura; scutum entirely pitted; scutellum pitted except for shiny summit, postscutellum shagreened; dorsal propodeal surface moderately, evenly reticulate, reticules radiating laterally from median carina; sides of propodeum heavily reticulate dorsally, fading to striae ventrally; tergites finely punctate, that of sternites coarse; mesosternum shiny, evenly punctured. Flagellomeres IV-VIII with double tyloides, the anterior one larger; interocellar area swollen; tangential line between compound eyes equal to length of flagellomeres V-VII taken together; median clypeal lobe truncate (Fig. 1),



1 2 3

EXPLANATION OF FIGURES

Figs. 1-3, *Astata femorata* Parker: 1, head. 2, hind femur. 3, apical portion of aedeagus (lateral view).

slightly produced, apically as wide as length of fourth segment of maxillary palpus; midcoxa with a small tubercle on ventral surface; ventral margin of hind femur deeply incised (Fig. 2), depressed basally, width of incised area slightly longer than the length of second hind tarsal segment; sternite II sharply humped medially; sternites III-VI slightly depressed medially; aedeagus figured (Fig. 3). Body length 8.7 mm, wing length 6.2 mm.

Female.—unknown.

Holotype male:—PEÑA BLANCA, SANTA CRUZ COUNTY, ARIZONA, VIII-17-61, Werner, Nutting. Type deposited in collection of the California Academy of Sciences.

In my key to the North America species this runs to *A. bakeri* Parker. It is easily distinguished from *bakeri* by its larger compound eyes and incised hind femora. In all probability it is a Mexican species which only occasionally enters the United States.

TWO NEW SPECIES OF CHYPHOTES FROM SOUTHWESTERN UNITED STATES[1]

(Hymenoptera: Mutillidae)

CLARENCE E. MICKEL
University of Minnesota, St. Paul

The two species described below have come to my attention while working over the mutillid collections of the University of Arizona.

Chyphotes minimus Mickel, new species

Male.—Body pale testaceous, antennae and legs stramineous, ocellar area infuscated; third abdominal tergum castaneous, darker than remainder of abdomen; head almost impunctate, with a few, small, scattered punctures; mandibles slender, dorsal carina weakly developed, not wider medially than elsewhere; clypeus convex, distal margin lying above dorsal edge of mandibles; front with a deep pit anterior to anterior ocellus, a faint depressed line extending from pit to antennal tubercles; ocellar area distinctly elevated; head triangular behind eyes; pronotum dull, with scattered, setigerous punctures, except a broad posterior margin glabrous, impunctate; sides of pronotum faintly rugoso-reticulate; propleura dull, with a cluster of setigerous punctures at ventro-lateral angle adjacent to coxae; mesonotum dull, faintly granulate, with scattered setigerous punctures; scutellum faintly rugoso-punctate, punctures setigerous; mesopleura weakly rugoso-reticulate, with a

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[1] Paper No. 5054, Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul 1, Minnesota

few setigerous punctures; propodeum distinctly, irregularly reticulate, closely so on sides, reticulations elongate on dorsum, posterior face transversely rugose; mesosternum dull, faintly granulate, with scattered, setigerous punctures, depressed at midline, and with an extremely minute tooth in front of each middle coxa; metasternum with a median longitudinal carina, but without teeth in front of hind coxae; dorsum of petiole of first abdominal segment transversely rugose, swollen posterior area with elongate reticulations, each reticulation with a setigerous puncture at its anterior margin, posterior margin of tergum longitudinally rugose; first abdominal sternum rugoso-punctate; surface of second abdominal tergum faintly longitudinally striate, and with moderate, oblique, setigerous punctures; remaining abdominal terga shagreened and with scattered, small, setigerous punctures; second abdominal sternum glabrous, except narrow, distal margin shagreened, with moderate, oblique, well separated setigerous punctures; remaining sterna shagreened and with small setigerous punctures; wings hyaline, with only two submarginal cells and one discoidal cell; marginal cell subtruncate distally. Length, 5 mm.

Holotype male: ORGAN PIPE NATIONAL MONUMENT HEADQUARTERS, ARIZONA, light trap, April 17, 1955 (J. Eden), in collection of University of Minnesota, St. Paul, Minn. Paratypes: Three males, Organ Pipe National Monument HQ, Arizona, light trap, April 19, 1955 (J. Eden); four males, Organ Pipe National Monument, Pima County, Arizona, light, April 14, 1956 (G. D. Butler and F. G. Werner), two of these without abdomens. In collections of University of Arizona and University of Minnesota.

Distinguished from both *pallidus* and *attenuatus* by the elongate reticulations of the first tergum, the fine longitudinal striations of the surface of the second tergum, and the transversely rugose posterior face of the propodeum. The paratypes vary in length from 5 to 8 mm.

Buzicky's key to the males of *Chyphotes* (1941) may be modified as follows to include *minimus* Mickel:

15. Dorsal mandibular carina elevated and conspicuous at the middle, thus the mandible broadest medially.......................... *attenuatus* (Blake).
    Dorsal mandibular carina weak throughout, the mandible slender, not broader medially 16
16. Posterior face of propodeum reticulate; first tergum coarsely punctate to the posterior margin; surface of second tergum weakly shagreened between the punctures...................... *pallidus* Buzicky.
    Posterior face of propodeum transversely rugose; first tergum with elongate, narrow reticulations posteriorly; surface of second tergum finely longitudinally striate between the punctures .... *minimus* Mickel.

Chyphotes nitidus Mickel, new species

Female.—Body, antennae and legs, stramineous, distal half of mandibles castaneous (postero-lateral fifths of second tergum, posterior half of second sternum, and all of third sternum, castaneous, apparently discolored by internal body fluids); head subovate, slightly wider than prothorax, but narrower than widest part of mesothorax; compound eyes ovate, one and one-half times as long as wide; first segment of flagellum distinctly shorter than second; head entirely glabrous with a very few scattered punctures, each puncture with a short semi-erect hair; pronotum glabrous throughout, dorsum almost impunctate, but lateral edges of dorsum defined by a row of setigerous punctures; sides of pronotum weakly, vertically rugose; propleura with a tuft of erect setae adjacent to the anterior coxae; mesothorax completely fused with the metathorax and propodeum, the dorsal and lateral surfaces evenly rounded into one another and glabrous throughout, with a very few scattered, setigerous punctures, and the anterior face of mesopleura separated from the shallowly punctate posterior face by a vertical row of setigerous punctures; anterior portion of first abdominal sternum slender, subterete, slightly greater in diameter posteriorly than anteriorly, the dorsum glabrous, the sides obliquely rugose; junction of first abdominal sternum and tergum forming an obtuse angle; all the abdominal terga glabrous, with a very few scattered setigerous punctures, the second to fifth terga each with a thin, distal fringe of pale hairs; pygidial tergum weakly shagreened. Length, 6 mm.

Holotype female, 13 MILES WEST OF WINTERHAVEN, CALIFORNIA, May 23, 1956 (V. Roth), in collection of University of Minnesota, St. Paul, Minn.

Differs from all other described females in the glabrous surface of the body and the sparse, scattered puncturation.

Buzicky's key to the females of *Chyphotes* (1941) may be modified as follows to include *nitidus* Mickel:

6. Femora and tibiae piceous or infuscated........................*albipes* (Cresson).
Femora and tibiae testaceous or light yellow........................6½

6½. Pronotum and mesonotum-propodeum distinctly punctate throughout ....*epedaphus* Buzicky.
Pronotum and mesonotum-propodeum glabrous throughout and with only a very few scattered setigerous punctures........*nitidus* Mickel.

LITERATURE CITED

BUZICKY, A. W.
1941. A Monograph of the Genus *Chyphotes* (Hymenoptera, Mutillidae, Apterogyninae) of North America. Ent. Amer., 21 (n.s.): 201-243.

DESCRIPTIONS OF NEW SPECIES AND SUBSPECIES OF ONAGRANDRENA, PRINCIPALLY OF THE ANDRENA OENOTHERAE COMPLEX

(Hymenoptera: Andrenidae)

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University of California, Berkeley

Eight years ago, we commented on the wide distribution and morphological variability among specimens then identified as *Andrena oenotherae* Timberlake (Linsley and MacSwain, 1955). In the meantime we have made an intensive effort to collect representative series from as many localities as possible. With this new material it is now possible to recognize a number of distinctive populations in the complex.

Along the western edge of the Mojave Desert, two such populations overlap in a broad area of sympatry and compete for pollen from the same species of *Oenothera*. These, obviously, may be regarded as distinct species. The remainder, however, appear to be completely allopatric, and, in the absence of genetic data, might equally well be regarded as species or subspecies.

These are described below together with a more distantly related species from Baja California.

ANDRENA (ONAGRANDRENA) OENOTHERAE Timberlake

This is one of the smaller species in the complex. The female varies in length from 9.5-12 mm (mean of 25 individuals 11.12, S.D. $\pm$ .41) with the anterior wing from 7.5-8.5 (mean 8.06, S.D. $\pm$ .09). The apex of the process of the labrum in the female is parallel-sided, nearly twice as long as broad and the propodeal enclosure is coarsely and irregularly rugose—a distinctive combination of characters. It is distributed from coastal Santa Barbara County, California (Goleta) to northern Baja California (Santo Tomás) extending inland in southern California to the western edge of the Colorado Desert (Palm Springs, Borrego). Females collect pollen from *Oenothera cheiranthifolia suffruticosa*, a perennial of the coastal strand from near Goleta to near Ensenada in northern Baja California, which blooms in the spring and summer, and *Oenothera bistorta*, a spring blooming annual of the coastal bluffs and coastal sage scrub of southern California and northern

[1] The authors express appreciation to the National Science Foundation for support of research on bees associated with Onagraceae through NSF Grant G-7193. We are indebted to Peter H. Raven, Department of Biological Science, Stanford University, for identifying the species of *Oenothera*.

Baja California, which extends inland to the edge of the desert. Our collections of *A. (O.) oenotherae* range from early February to late July, with two peaks, suggesting the possibility that two generations may be involved.

Of the specimens recorded as *oenotherae* by Timberlake (1937), Linsley (1938), and MacSwain (1955), those from the following localities in California are assignable to the species as here restricted: Ventura County: Saticoy; Los Angeles County: Claremont, Glendale, El Segundo Dunes; Orange County: Newport, Balboa Island; San Diego County: Carlsbad, Newton; Riverside, Wineville, Hemet, the Gavilan, Saboba Hot Springs, Palm Springs; and San Bernardino County: 10 miles west of San Bernardino.

Recent collections of this species include the following: 20 ♀ ♀, 1 ♂, Goleta, Santa Barbara County, May 2, 1959, at flowers of *Oenothera cheiranthifolia suffruticosa*, 6:30-7:28 a.m. (P. H. Raven); 24 ♀ ♀, 3 ♂ ♂, Ventura Ventura County, April 10, 1959, at flowers of *Oenothera cheiranthifolia suffruticosa*, 7:36-10:59 a.m. (P. H. Raven); 6 ♀ ♀, 2 ♂ ♂, south end of San Buenaventura State Park, Ventura County, June 8, 1959, at flowers of *Oenothera cheiranthifolia suffruticosa*, 6:50-7:20 a.m. (E. G. and Juanita M. Linsley); 13 ♀ ♀, same locality, May 24, 1959, taking nectar from *Chaenactis*, 7:50-8:22 a.m. (E. G. and Juanita M. Linsley); 23 ♀ ♀, 2 ♂ ♂, Point Dume, Los Angeles County, April 18, 1959, at flowers of *Oenothera cheiranthifolia suffruticosa*, 7:35-8:45 a.m. (P. H. Raven); 26 ♀ ♀, same locality and date, at flowers of *Oenothera bistorta*, 6:36-7:27 a.m. (P. H. Raven); 79 ♀ ♀, same locality, April 5, 1959, at flowers of *Oenothera cheiranthifolia suffruticosa*, 6:57-10:17 a.m. (P. H. Raven); 29 ♀ ♀, 16 ♂ ♂, Carlsbad, San Diego County, April 30, 1959, at flowers of *Oenothera cheiranthifolia suffruticosa*, 6:35-8:30 a.m. (P. H. Raven); 208 ♀ ♀, 73 ♂ ♂, same locality, April 21, 1962, at flowers of *Oenothera cheiranthifolia suffruticosa*, 6:30-8:00 a.m. (E. G. and Juanita M. Linsley), 8 ♀ ♀, 2 ♂ ♂, same locality, March 29, 1963, at flowers of *Oenothera cheiranthifolia suffruticosa*, 8:06-8:21 a.m. (E. G. Linsley); one female, one mile north of Oceanside, San Diego County, March 29, 1963, at flowers of *Oenothera cheiranthifolia suffruticosa*, 9:00 a.m. (E. G. Linsley); 1 ♀, 5 ♂ ♂, two miles northeast of Lakeside, San Diego County, March 13, 1963, taking nectar from *Salix* (J. A. Chemsak); 3 ♀ ♀, Claremont, Los Angeles County, April 29, 1959, at flowers of *Oenothera bistorta*, 6:58-8:30 a.m. (P. H. Raven); one female, seven miles east of Temecula, Riverside County, April 23, 1959, at flowers of *Oenothera bistorta*, 6:27 a.m. (P. H. Raven).

Andrena (Onagrandrena) convallaria Linsley and MacSwain, new species

Female.—Integument black; pubescence black. *Head* with clypeus convex, densely punctate, without indication of a median longitudinal smooth line; labrum with apex of process convex, somewhat arcuate, slightly longer than wide to nearly one and one-half times as long as broad, sides diverging to apex which is subtruncate with a very faint median notch; antennae with flagellum black, first segment, measured along anterior margin, as long as second and third combined. *Mesosoma* with mesoscutum dullish, finely and closely punctured, punctures mostly less than one diameter apart, interspaces finely reticulate, areas enclosed by reticulations more or less round, not elongate oval; mesoscutellum and mesopleura more closely punctate than mesoscutum, punctures contiguous; propodeum coarsely rugoso-punctate, basal enclosure with a strong median longitudinal carina extending most of the distance from base to apex, apical one-third rugose, lateral carinae numerous, oblique, moderately coarse; wings tinted with blackish; legs with scopa of posterior tibiae one-third wider than tibia, very dense, erect. *Metasoma* moderately slender, shining, second tergum with most anterior hairs long, minutely but distinctly plumose, surface finely punctate, most punctures separated by from two to four diameters, terga two to four with apical impression finely, sparsely punctate, impunctate margin narrow but distinct, shining. Body length approximately 12 mm, anterior wing 8.75 mm.

Male.—Integument black; pubescence of head erect, black, except for a few pale hairs on vertex; dorsal pubescence of thorax long, erect, yellowish-white; pubescence of legs and abdomen black, except for first metasomal tergum. *Head* with apical process of labrum emarginate, bilobed; antennae with flagellum black, first segment slightly longer than second. *Mesosoma* with mesoscutum opaque, very densely punctate, punctures mostly separated by less than half a diameter; mesoscutellum more densely punctate than mesoscutum, punctures subcontiguous; propodeum sculptured much as in female, apex rugose. *Metasoma* with punctures of second tergum mostly separated by two to four diameters, terga with a distinct apical margin. Body length approximately 11 mm, anterior wing 7.75 mm.

Holotype female and allotype male (California Academy of Sciences, Entomology) from 2.5 MILES SOUTH OF LIVINGSTON, MERCED COUNTY, CALIFORNIA, March 20, 1960 (G. I. Stage), and 103 paratypes (California Insect Survey and R. R. Snelling collection) from the same locality as follows: 32 ♀♀, 17 ♂♂, March 20, 1960, at flowers of *Oenothera campestris,* (= *Oe. dentata* var. *campestris)* 7:42-10:14 a.m. (R. R. Snelling and G. I. Stage); 9 ♀♀, 22 ♂♂, March 21, 1960, at flowers of *Oenothera campestris,* 7:38-10:55 a. m. (G. I. Stage); 6 ♀♀, 9 ♂♂, March 24, 1960, at flowers of *Oenothera campestris,* 9:57-1:32 p.m. (R. R. Snelling); 20 ♀♀, 11 ♂♂, April 2, 1960, at flowers of *Oenothera campestris,* 7:29-9:21 a.m. (R. R. Snelling, G. I. Stage); and 4 ♀♀, 3 ♂♂, April 6, 1960, at flowers of *Oenothera campestris,* 7:30-8:15 a.m. (R. R. Snelling). Additional paratypes, from two miles southwest of Livington, are as follows: 32 ♀♀, 1 ♂, April 4-5, 1959, at flowers of *Oenothera campestris,* 6:55-9:59 a.m. (G. I. Stage);

37 ♀♀, April 17, 1959, at flowers of *Oenothera campestris*, 7:13-9:17 a.m. (J. W. MacSwain and G. I. Stage).

Additional material, not designated as paratypic, has been examined as follows: 1 ♂, Antioch, Contra Costa County, California, April 25, 1936 (M. A. Cazier[2]); 1 ♀, Blackwell's Corner, Kern County, California, April 7, 1950 (P. D. Hurd)[2], 3 ♀ ♀, 20 miles east of Bakersfield, Kern County, California, March 28, 1953 (J. W. MacSwain)[2]; 96 ♀ ♀, 41 ♂ ♂, 18 miles east of Bakersfield, Kern County, California, on various dates in March and April, 1958-1962, at flowers of *Oenothera campestris* (E. G. Linsley, J. W. MacSwain, J. R. Powers, G. I. Stage and R. W. Thorp); 1 ♀, 9.6 miles north of Blackwell's Corner, Kern County, California, March 24, 1961, at *Oenothera campestris*, 8:20 a.m. (J. W. MacSwain); 8 ♀ ♀, 2.4 miles south of Tipton, Tulare County, California, March 29, 1960, at *Oenothera campestris*, 9:44-10:48 a.m. (E. G. Linsley and J. W. MacSwain); 2 ♀ ♀, Tulare Airpark, Tulare County, California, April 15, 1960, at *Oenothera campestris*, 7:22 and 7:23 a.m. (E. G. Linsley); 9 ♀ ♀, 6.8 miles southwest of Shandon, San Luis Obispo County, California, March 23, 1961, at *Oenothera campestris*, 7:55-9:10 a.m. (J. W. MacSwain); 6 ♀ ♀, same locality, April 2 and 3, 1961, 6:37-7:12 a.m., (E. G. Linsley); 25 ♀ ♀, 6 ♂ ♂, Creston, San Luis Obispo County, California, April 10 and 11, 1961, on flowers of *Oenothera campestris*, 7:20-9:50 a.m. (J. A. Chemsak and R. W. Thorp); 3 ♀ ♀, 2.5 miles south of Creston, San Luis Obispo County, California, April 11, 1961 on flowers of *Oenothera campestris* 7:46-8:37 a.m. (J. W. MacSwain); 2 ♂ ♂, Chuchupate Ranger Station, base of Frazier Mountain, Ventura County, California, May 8, 1959 (C. W. O'Brien and P. D. Hurd); 23 ♀ ♀, 14 ♂ ♂, 1.6 miles west and 2.6 miles east of Pine Canyon Guard Station, Santa Barbara County, California, April 23, 1959 on flowers of *Oenothera campestris*, 6:55-10:30 a.m. (J. W. MacSwain and G. I. Stage); 6 ♀ ♀, 1 ♂, Hungry Valley, 5 miles south of Gorman, Ventura County, California, April 10, 1960 on *Oenothera campestris*, 6:40-10:20 a.m. (G. I. Stage); and 22 ♀ ♀, 1 ♂, same locality, May 7, 1959, 5:43-7:14 a.m., (C. W. O'Brien, J. R. Powers and G. I. Stage); 52 ♀ ♀, 2 ♂ ♂, 10 miles west of Simmler, San Luis Obispo County, California, May 5-6, 1962 on *Oenothera campestris*, 6:00-8:00 a.m. (J. K. Drew, P. D. Hurd, J. A. Powell, R. W. Thorp and C. A. Toschi).

This species is larger on the average than *A. (O.) oenotherae*, and the females differ in the form of the apex of the process of the labrum, which is less than one and one-half times as long as broad, with the sides diverging toward the apex, which is finely notched. Whereas *A. (O.) oenotherae* is a species of southwestern California from the Colorado Desert edge to the sea coast, taking pollen from *Oenothera cheiranthifolia suffruitcosa* and *Oe. bistorta*, *A. (O.) convallaria* is a species of the San Joaquin Valley and western Mojave Desert, taking pollen from *Oenothera campestris*. Near

[2] Previously reported as *A. oenotherae* (Linsley and MacSwain, 1955)

Bakersfield, California, it occurs sympatrically with *A. (O.) vespertina,* and although the males may be readily distinguished by the color of facial pubescence, the females are difficult to separate, although they are quite different in habits, *vespertina* being active in the late afternoon, rather than the morning, and taking pollen from the white-flowered, evening-opening *Oenothera decorations* rather than the yellow-flowered, morning-opening *Oe. campestris* (a re-examination of the indivduals from *Oe. campestris* reported by us as *vesperina,* reveals that they should be assigned to *convallaria)*. However, in *A. (O.) vespertina,* the apical process of the labrum is narrow and parallel-sided, rather than broad, somewhat diverging and notched, and the interspaces between the mesoscutal punctures are shining and have elongate-oval rather than round reticulations. The two species appear to be siblings derived from a common ancestral stock with *A. (O.) oenotherae.*

Two subspecies are recognizable in our material, the females of which may be separated as follows:

1. Wings tinted with black; labrum with apex of process usually distinctly longer than broad; mesoscutum with punctures mostly separated by less than one diameter; tibial scopa about one and one-half times as wide as tibia, hairs dense, erect; body length 12-13.5 mm (mean of 25 individuals 12.38, S. D. $\pm$ .20 mm), anterior wing 8.25-9 mm (mean 8.76, S. D. $\pm$0.7 mm) San Joaquin Valley, California ....*convallaria convallaria*
   Wings almost clear; labrum with apex of process as broad or broader than long; mesoscutum with punctures mostly separated by from slightly less than one to slightly more than one diameter; tibial scopa about as wide as tibia, hairs a little less dense and less erect; body length 11.5-13.5 mm (mean of 25 individuals 12.11, S. D. $\pm$.33 mm), anterior wing 8.25-8.75 mm (mean 8.60, S. D. $\pm$0.2 mm). Southwestern Mojave Desert, California. .... *convallaria subhyalina*

Andrena (Onograndrena) convallaria subhyalina
Linsley and MacSwain, new subspecies

Female.—Form and coloration of integument and pubescence as in the nominotypical subspecies, but wings not tinted with black. Labrum with apex of process as broad as, or broader than, long. Mesocutum with most punctures separated by slightly less to slightly more than one puncture diameter. Tibial scopa about as wide as tibia, moderately dense, suberect. Body length 11.5-13.5 mm (mean of 25 individuals 12.11, S.D. $\pm$ .33mm); anterior wing 8.25-8.75 mm (mean 8.60 $\pm$ .02).

Male.—Form and coloration of integument similar to nominotypical subspecies, but dorsal pubescence of thorax brownish, rather than yellowish-white. Body length 10.5 mm, anterior wing 7.75 mm.

Holotype female (California Academy of Sciences, Entomology) BORON, KERN COUNTY, CALIFORNIA, April 3, 1959, on *Oenothera campestris,* 7:41 a.m. (J. W. MacSwain), allotype male, same locality and date, taking nectar from *Coreopsis californica,* 8:25 a.m. (J. W. MacSwain), 18 paratypes from the same locality: 2 ♀♀, March 27, 1959, taking nectar from *Coreopsis californica,* 9:59 and 10:15 a.m. (E. G. Linsley and J. W. MacSwain); 2 ♀♀, April 2, 1959, taking nectar from *Oenothera campestris,* 7:02 and 7:55 a.m. (J. W. MacSwain) 4 ♀♀, April 3, 1959, taking nectar from *Oenothera campestris,* 6:48-7:43 a.m. (E. G. Linsley and J. W. MacSwain); 3 ♀♀, same date, taking nectar from *Coreopsis californica,* 8:30-9:00 a.m. (E. G. Linsley and J. W. MacSwain); 4 ♀♀, April 10, 1960, taking nectar from *Oenothera campestris,* 7:02-7:31 a.m. (E. G. and Juanita M. Linsley); 3 ♀♀, same date, taking nectar from *Layia glandulosa,* 8:10-8:25 a.m. (E. G. Linsley). 40 females and four males, from the type locality on various dates in April, 1959 and 1960 (E. G. Linsley, J. M. Linsley, J. W. MacSwain) are stylopized, and hence not designated as paratypes (this represents 67 per cent stylopization of adults, a figure far exceeding any we have found for other species; further, although most of the unstylopized females from *Oenothera campestris* have some grains of pollen on the body, none was actively gathering pollen).

Available material from other areas, not designated as paratypic, is as follows: 6 ♀♀, Little Rock, Los Angeles County, April 25—May 14, 1956, at flowers of *Oenothera campestris* (2 with pollen) (E. G. Linsley, James M. Linsley, J. W. MacSwain[3]); and 23 ♀♀ (8 stylopized), same data, April, 1959 (E. G. Linsley, J. W. MacSwain).

Andrena (Onagrandrena) oraria
Linsley and MacSwain, new species

Female.—Integument black; pubescence black. Head with clypeus convex, densely punctate, with a feeble elevated median longitudinal smooth line; antennae with first flagellar segment, measured along anterior margin, slightly longer than second and third combined, flagellum black. *Mesosoma* with mesoscutum dullish, very closely punctate, most punctures separated by less than one diameter, interspaces finely reticulate, enclosed areas oval, impressed; mesoscutellum more densely punctate than mesoscutum, punctures contiguous; mesopleura more coarsely, densely punctate than mesoscutum, punctures contiguous; propodeum coarsely rugoso-punctate, basal enclosure with a strong, median, longitudinal carina extending two-thirds of distance from base to apex, apical third almost smooth, lateral carinae numerous,

[3] Recorded as *A. oenotherae* by Linsley and MacSwain (1956).

oblique, moderately coarse; wings tinted with blackish; legs with scopa of posterior tibiae distinctly wider than tibia, very dense, erect. *Metasoma* moderately slender, shining, second tergum with most anterior hairs long, minutely but distinctly plumose, surface finely punctate, most punctures separated by from two to four diameters, terga two to four with apical impression finely, sparsely punctate, impunctate margin narrow but distinct, shining. Length of body approximately 12 mm, anterior wing 8.5 mm.

Male.—Integument black; pubescence of head erect, black, except for a few pale hairs on vertex; dorsal pubescence of thorax long, erect, yellowish-white; pubescence of legs and abdomen black, except on first metasomal tergum. *Head* with apical process of labrum emarginate, bilobed; antennae with flagellum black, first segment slightly longer than second (6:5). *Mesosoma* with mesoscutum opaque, very densely punctate, punctures mostly separated by less than half a diameter; mesoscutellum more densely punctate than mesoscutum, punctures subcontiguous; propodeum sculptured much as in female, apex not rugose. *Metasoma* with punctures of second tergum mostly separated by two to four diameters, terga with a distinct impunctate apical margin. Body length approximately 10 mm, anterior wing 7.75 mm.

Holotype female (California Academy of Sciences, Entomology) from BEACH ONE MILE NORTHEAST OF POINT REYES LIGHTHOUSE, MARIN COUNTY, CALIFORNIA, April 19, 1959, gathering pollen from *Oenothera cheiranthifolia cheiranthifolia* at 8:59 a.m. (J. W. MacSwain), *allotype male,* same locality and date, flying over nesting area between 9:30 and 11:00 a.m. (J. W. MacSwain), and 31 *paratypes* (California Insect Survey), all from the same locality as follows: two females, at nest site, February 4, 1959 (J. R. Powers and R. W. Thorp); one female and two males, at nest site, April 14, 1959, between 12:45 and 2:00 p.m. (J. W. MacSwain); 8 females and 12 males, at nest site, between 9:52 and 11:00 a.m. and one female gathering pollen from *Oenothera ovata* at 11:17 a.m., April 19, 1959 (J. W. MacSwain); two females (one with pollen) at *Oenothera ovata,* April 21, 1959, 11:29-11:58 a.m. (E. G. Linsley); one female taking pollen from *Oenothera c. cheiranthifolia,* April 21, 1959, at 10:40 a.m., and one male cruising nest area at 11:10 a.m. (J. W. MacSwain); one male, excavated from pupal cell, October 10, 1959 (J. W. MacSwain). Two females, not designated as paratypes, were excavated from fresh burrows at Dillon Beach, February 12, 1939 (E. G. Linsley and J. W. MacSwain). Our flight collections were all made on cold, windy, overcast days (typical of the area during early Spring); presumably on clear warm days the flight is much earlier in the morning.

This species is closely related to *A. (O.) oenotherae* Timberlake, differing in the sculpturing of the basal enclosure of the propodeum, the longer first segment of the antennal flagellum in both sexes and the presence of a weakly indicated elevated median smooth line on the clypeus of the female. Two distinctive populations are recognizable in our material, females of which may be distinguished as follows:

1. Labrum with apex of process narrow, parallel-sided, twice as long as greatest width; clypeus with median longitudinal polished line feeble and incomplete; length 12-13.5 mm (mean of 12 indviduals, 12.65 mm, S.D. ± .15), anterior wing 8.5-9 mm (mean 8.75 mm, S.D. ± .07). Coastal Marin County, California (Pt. Reyes to Dillon Beach) .... *oraria oraria*

   Labrum with apex of process broad, wider apically, one and one-half times as long as greatest width; clypeus with median longitudinal polished line more distinct; length 11-13 mm (mean of 25 individuals, 12.12, S.D. ± .23), anterior wing 8-9 mm (mean 8.65, S.D. ± .08). Coastal San Francisco County, California .... *oraria actitis*

Andrena (Onagrandrena) oraria actitis
Linsley and MacSwain, new subspecies

Female.—Form, coloration, sculpturing and pubescence as in the nominotypical subspecies. Labrum with apex of process one and one-half times as long as width at apex, broader apically and not parallel-sided; clypeus with a distinct but weakly developed median longitudinal polished impunctate line. Body length 11-13 mm (mean of 25 individuals, 12.12, S.D. ± .23), anterior wing 8-9 mm (mean 8.65, S.D. ± .08).

Male.—Form, coloration, sculpturing and pubescence as in nominotypical subspecies, but average size smaller. Body length of 12 examples, 9.5-11.5 mm (mean10.33 mm, S.D. ± .33) as compared with a range of 9.5-11 mm for 17 examples and a mean length of 10.41 mm, S.D. ± .24, for males of *oraria oraria.*

Holotype female (California Academy of Sciences, Entomology from the SOUTHWEST CORNER, FLEISHHACKER ZOO, SAN FRANCISCO, CALIFORNIA, May 21, 1959, at flowers of *Oenothera cheiranthifolia cheiranthifolia,* 8:58 a.m. (J. W. MacSwain, *allotype* male, same locality, date, and flower association, 9:23 a.m. (J. W. MacSwain), and 49 paratypes, same locality, as follows: May 19, 1959, 16 females (two with pollen) 8:27-10:21 a.m., and 11 males 8:39-10:43 a.m., all at flowers of *Oenothera cheiranthifolia cheiranthifolia;* May 21, 1959, 21 females (9 with pollen) 7:29-9:05 a.m., one male, 9:46 a.m., all at flowers of *Oenothera cheiranthifolia cheiranthifolia.*

Andrena (Onagrandrena) eulobi
Linsley and MacSwain, new species

Female.—Integument black; pubescence black. *Head* with clypeus convex, densely punctate, with a feeble median longitudinal smooth line; labrum with apical process short, one and one-half times as broad as long, parallel-sided, truncate; antennae with flagellum black, first segment, measured along anterior margin, slightly longer than second and third combined. *Mesosoma* with mesoscutum dullish, finely and closely punctured, punctures one or less than one diameter apart, interspaces finely reticulate, areas enclosed by reticulations oval; mesoscutellum and mesopleura more closely punctate than mesoscutum, punctures contiguous; propodeum coarsely rugoso-punctate, basal enclosure with a strong straight median longitudinal carina extending one-half length from base to apex, otherwise enclosure is irregularly rugose; wings almost clear; legs with scopa of posterior tibiae only slightly wider than tibia, dense, erect. *Metasoma* moderately slender, shining, second tergum with most anterior hairs long, minutely but distinctly plumose, surface finely punctate, most punctures separated by from three to six diameters, terga two to four with apical impression finely, sparsely punctate, impunctate margin very narrow but distinct, shining. Body length approximately 12 mm, anterior wing 8 mm.

Holotype female (California Academy of Sciences, Entomology) from 14 MILES SOUTH OF SAN QUINTIN, BAJA CALIFORNIA, MEXICO, March 30, 1962 collecting pollen from *Oenothera crassfolia* at 7:55 a.m. (P. H. Raven), and 37 paratypes from the same locality also collecting pollen from *Oe. crassifolia* between 6:50 and 8:15 a.m.

This species varies considerably in size and a sample of 25 specimens ranges in body length from 10.5 to 13 mm (mean 11.52, S.D. ± .44), in length of anterior wing the range is 8 to 9:25 mm (mean 8.78, S.D. ± .09). The short, broad labral process is the most distinctive feature of *A. culobi* although details of punctation are also diagnostic. It is interesting to note that the type locality is at the northern limit of its host, *Oenothera crassifolia,* and it may be that the bee will be found several hundred miles farther south.

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MEETING NOTICE

The Royal Entomological Society of London will sponsor a Symposium on Insect Reproduction, September 19-20, 1963, at the Imperial College, London.

A NOTE ABOUT LETTERS FROM WILLIAM HENRY EDWARDS TO WILLIAM GREENWOOD WRIGHT, AND CLUES ABOUT CERTAIN DATES OF PUBLICATION CONTAINED THEREIN

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Colorado Springs, Colorado

In the archives of the Pacific Coast Entomological Society there is a hoard of well over seven hundred letters and postcards written by William Henry Edwards. These are addressed to William Greenwood Wright. The archives of the Society are housed at the California Academy of Sciences in San Francisco. Through the good offices of Mr. Hugh B. Leech I have had the pleasant opportunity to study this interesting collection of letters. I have arranged them in chronological order and numbered each, in red, in sequence. There is deposited with the letters a synopsis of the entomological comments in each letter. I prepared this to make access to the information a little easier and to protect the original letters from too frequent handling.

The exchange of letters began in 1882 and extended to 1905. Wright instituted the correspondence on 8 January of 1882 and Edwards first letter to Wright is dated 21 January. There are several lacunae in the collection. These are noted in the following tabulation of letters written by Edwards to Wright in each year of their correspondence:

Year	*Letters numbered*	*Year*	*Letters numbered*
1882	1- 16	1892	549-601**
1883	17-130	1893	602-650
1884	131-191A	1894	No letters
1885	192-221	1895	652-682
1886	222-275	1896	651, 682A-706
1887	276-327	1897	707-719
1888	328-376	1898	720-722
1889	377-404A	1899	723
1890	405-496	1900-1903	No letters
1891	497-548*	1904	724-726
		1905	727-728

* None for August, October nor November
**None for September through December

These letters came into the possession of the Academy through the offer of Mr. S. B. Parrish, Wright's executor, to Mr. Charles Fuchs of the Academy.

The bulk of information in the letters has been published by Edwards in various papers on the life histories of butterflies and in the last volume of his *Butterflies of North America*. It is quite evident from these letters that Edwards depended greatly upon the cooperation of such field collectors as Wright and David Bruce who devotedly spent year after year collecting eggs and larvae of butterflies and shipping them to Edwards in Coalburgh, West Virginia, for his studies. In the letters there are many items of interest other than those relating to the life history work of Edwards. For instance, in letter 372 dated 28 August 1888 there is noted that Hermann Behr never marked the types of his names and in later years had difficulty recognizing his various *Euphydryas*. According to letter 16, dated 27 December 1882, Part 14 (pages 125-134) of Strecker's "*Lepidoptera, Rhopalocera — Heterocera*" dated September 1877, actually reached the hands of the subscribers on 24 March 1878.

The publication dates of volumes 3 and 4 of "*Papilio*" have been suspect. Edwards letters to Wright go a long way to establish-ing firm dates for certain parts of these volumes. The following is the usual collation of the parts of volume 3 of *"Papilio"*:

No. 1, January, 1883, pages 1-26

No. 2, February, 1883, pages 27-44

No. 3, March, 1883, pages 45-66

No. 4, April, 1883, pages 67-84

No. 5 & 6, May and June, 1883, pages 85-124

No. 7-10, September-December, 1883, pages 125-193.

There is a published statement of the date of publication only for parts 5 and 6. This occurs on page 85 (*"Papilio,"* volume 3): "NOTE: Owing to the absence of the Editor Hy. Edwards from New York, it was impossible to produce the May number in proper time. It is hoped that the contents of this double number will compensate for the delay. (Issued July 10, 1883.)." By implication we may assume that the previous numbers of the Journal were issued during the months indicated on the masthead of each part. Nothing in Edwards' letters denies this assumption. However the quadruple number, "7 - 10," was not issued in December 1883.

Edwards' letter number 137, dated 26 January 1884, bears upon this problem. In it he wrote to Wright that within the week he had corrected proofs for three articles for *"Papilio"*: one on the life history of *Colias harfordii,* another in reply to Hagen's paper on *Colias,* and, the third about butterflies from the Judith Mountains. The last two of these papers appeared in No. 7 - 10 of *"Papilio"* for 1883. This affects the date of publication for Edwards' descriptions of *Papilio nitra* and *Colias hagenii.* They date from late in January or early February, 1884, not from December 1883. Also affected are the dates of publication for several names for moths proposed by Neumogen and others proposed by Hy. Edwards.

The dates of publication of the parts of *"Papilio,"* volume 4, appear as footnotes in that volume on pages 24, 62, 82, 114, 189. All of the evidence from Edwards' letters confirms the dates noted on these pages. Similarly the dates of publication of *"Canadian Entomologist"* from 1884 through 1893 are supported so far as comments appearing in Edwards letters can do so.

BIOLOGICAL NOTES ON MEGACHILE CONCINNA SMITH IN ARIZONA[1]

(Hymenoptera: Megachildae)

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This paper discusses the life history and nesting habits of a leaf-cutter bee, *Megachile (Eutricharaea) concinna* Smith, in southern Arizona. A closely related species, *Megachile (Eutricharaea) rotundata* (Fabricius), is a useful pollinator of alfalfa in the Pacific Northwest and in the Intermountain Region. Biological observations of this species were reported by Stephen and Torchio (1961) and artificial nesting sites and their management by Stephen (1961 and 1962), and Bohart (1962).

DISTRIBUTION

The distribution of *M. concinna* was discussed by Mitchell (1962:122): "Although *concinna* was described from the West Indies, it belongs to an Old World group and probably was introduced from Africa during the early part of the nineteenth century. It appeared in the United States after World War II and is now distributed from Florida and Alabama to Pennsylvania and Ohio in the East, and established as far west as California." In Arizona, *M. concinna*, determined by T. B. Mitchell, is distributed in the desert valley region of southern Arizona with a number of collections from the Yuma area, various locations in the Salt River Valley, around Tucson and single records from Patagonia and Bowie. This species has a long season of activity and adults were observed from mid-April to early November.

PLANT ASSOCIATIONS

The flowers that bees have been observed visiting are listed by Mitchell (1962) and include *Asclepias, Bidens, Melilotus* and *Polygonum*. The flowers from which bees have been collected in Arizona include: alfalfa, birds-foot treefoil, berseem clover, citrus, *Acacia, Heliotropium, Lepidium, Lippia, Onobrychis vicaefolia,* and *Senecio*. Leaves cut and used for nest construction were collected from alfalfa when the bees were working in cages over alfalfa. Due to the limited nesting activity observed outside of the cages, additional plant records are few, but it appeared as if leaf-cuttings from a number of different plants were used.

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[1] Journal paper. University of Arizona Agricultural Experiment Station technical paper No. 791.

Nesting Sites

M. concinna made nests in tubular holes, such as nail holes in wood, small holes in the mortar joints in brick walls, copper tubing, and the ears and folds of fertilizer sacks. In our experimental work bees nested in 3/16 to 1/4 inch holes drilled in wooden blocks, in milkshake straws (7/32-inch inside diameter) and also in milk straws (5/32-inch inside diameter), both black and white. During April, "trap nests" of blocks of wood with drilled holes and boxes of milk straws attached were hung up in a number of protected locations around Tucson and Yuma. The holes in the wooden blocks were used almost exclusively by two species of larger bees, *Chalicodoma (Chelostomoides) chilopsidis* Cockerell and *C. occidentalis* Fox (determined by T. B. Mitchell), which used resin for their cell construction. *Trypoxylon* wasps also nested in the holes in boards and in straws. Additional trap nests were put out in Tucson and Yuma during June but only a very few holes were utilized by *M. concinna.*

Cells

The structure of cells was determined by opening a number of nests made in milkshake straws. Sometimes we found that a space was left by the bees at the back of long straws, in which case a number of round leaf pieces were placed in as plugs before the first cell was started. The cells were formed with 2 to 4 round leaf pieces at the back end and 6 to 10 oblong pieces on the sides. In the long milkshake straws there were as many as 15 cells but usually fewer were constructed in a single straw. At the open end there was often an air space of from 10 to 80 mm between the last cell and an entrance plug made up of from 7 to 36 round leaf pieces. Sometimes entrance plugs were put in the ends of empty straws.

Adult Activity

Activity of the leaf-cutter bees was observed at a shaded nesting shelter placed at the edge of an alfalfa field at Tucson in early August. The bees spent the night in the wooden blocks and straws. They began their activity from 7 to 8 a.m., and sometimes spent up to 30 minutes during this period with their heads at the entrance of the straw before leaving. Later in the day the bees hesitated only a moment at the entrance before flying off.

The time required for a bee to collect a load of pollen varied considerably but the average time was between 10 and 20 minutes. The bee remained in the straw from 1 to 2 minutes depositing the pollen load. In the field the females tripped from 4 to 21 alfalfa flowers per minute, with an average of about ten flowers per minute. The bees tripped all of the flowers they visited. The number of pollen loads needed to complete a pollen ball was not determined, but one bee made at least 20 trips. After laying an egg on the surface of the completed pollen ball, the bee collected additional circular leaf pieces to close the end of the cell. The collection of leaf pieces in the alfalfa field required 1 to 2 minutes for each leaf piece. Towards 5 p.m., the activity of the bees became irregular. There was still some activity at 6:30 p.m. when observations were terminated.

The effectiveness of *M. concinna* as a pollinator of alfalfa was observed in large saran screen cages. Adult bees were collected from birds-foot treefoil and released in cages over alfalfa. Counts of tripped alfalfa flowers indicated that approximately 80 leaf-cutter bees were as effective as a small colony of honey bees.

EXPLANATION OF FIGURE

Fig. 1, front view of nest shade shelter with corrugated aluminum roof and with thermocouple wires in position for making temperature readings in the straws.

TEMPERATURE STUDIES

Bohart (1962) observed that the development of *M. rotundata* eggs and young larvae was limited by temperature in excess of 100°F. In southern Arizona the daily maximum temperature reaches 100°F and above during extended periods. Temperature readings were made in experimental nesting shelters constructed of different materials. Concurrently, laboratory studies were made to determine the effect of high temperatures on *M. concinna* eggs and young larvae.

Nest Shelters:—A basic nest shelter was constructed of a frame of 2x4's, four feet high, into which a wooden box holding 10 boxes of soda straws could be inserted. A layer of Celotex was put on top and at the back of the wooden box with a 3-inch air space between the Celotex and the experimental covering material on the top and back of the frame. The covering materials tested were corrugated aluminum, white painted half inch plywood, unpainted corrugated iron and white painted corrugated iron (Fig. 1).[2]

Temperature readings were made at hourly intervals with thermocouples on July 17 when the official maximum temperature reached 104°F. A comparison of the four types of shade materials with an unshaded structure indicated that the temperatures beneath the shades were 13 to 15 degrees cooler than the unshaded structure, in which the temperature reached 120°F. A variation of only 2 degrees between the different shade materials was not significant. There was also no difference between the temperatures in the soda straws in the top layers of the box and those in the center. The size and color of the straws did not affect the temperature either.

Laboratory Studies:—One-day-old *M. concinna* cells were collected from boxes of straws in cages with bees on alfalfa flowers. They were divided among three temperature cabinets at 85, 95 and 105°F, which had 43 to 55, 40 to 70 and 40 to 50 percent relative humidity, respectively. The cells were opened 6 days later and the mortality of the bees determined. At 85°F, there was no mortality in 34 cells and the bees were all in the larval stage. At 95°F, 3 cells of 40 contained dead bees and 63 percent of the bees were in the prepupal stage. At 105°F, the bees in all 40 cells were dead. They had died in either the egg or young larval stage.

To evaluate the effect of fluctuating temperatures, one-day-old *M. concinna* cells were put in three different temperature programs for six days. One group was at room temperature which rose to 90°F during the day from 1 to 5 p.m. and went down to 80°F at

[2] The authors wish to express their appreciation to W. C. Waterman of Bakersfield, California for assisting with the purchase of materials for shelters and to C. D. Owens, Agricultural Engineering Research Division, USDA-ARS, for providing and setting up the thermocouples.

night. There was no mortality in the 17 cells observed at this temperature. In the second treatment the temperature was raised to 113°F from 12 noon to 2 p.m. and allowed to fluctuate with the room temperature for the rest of the time. There was no mortality in the 13 cells in this treatment. The third temperature program was 113°F for a four-hour period each afternoon. During the first afternoon the temperature rose to 117°F from 1 to 4 p.m. but for the next five days it was held at 113°F from 12 to 4 p.m. and at room temperature for the rest of the time. There was a single dead bee out of 18 but its death may have been caused by careless handling. At the time the cells were opened, 6 days after collection, the bees had developed to the prepupal stage and some individuals had spun cocoons. Adult bees emerged from the cells used in this experiment in from 21 to 26 days, with an average of 23 days from egg to adult.

Parasites

A small metallic-green parasite, *Tetrastichus megachilidis* Burks, determined by B. D. Burks, parasitized 20 percent of the *M. concinna* cells obtained in early July from cages on alfalfa at Tucson. From each parasitized cell there emerged 35 to 90 parasites, with an average of 53 per cell. Adult parasites were in evidence around all of the *M. concinna* nesting sites at Tucson during the remainder of the summer. The type locality for the parasite is near Phoenix, Arizona (Burks, 1963). No parasites were observed in or around trap nests in the Yuma area in 1962.

Examinations of 32 straws with 266 cells from Tucson in mid-September revealed a parasitism of 42 percent and indicated that the parasite attacked the first-made or innermost cells. In this group of straws, 93 percent of the first cells were parasitized, while 48, 38, 16, 10, 7, 4, and 0 percent of the second through the eighth cells, respectively, were parasitized. In part of this series, female bees were developing in all the innermost cells, including the second, third and fourth cells, so the parasitism by *Tetrastichus* was almost exclusively in cells preducing female *M. concinna.*

Discussion

Megachile concinna is distributed throughout the alfalfa seed producing areas of southern Arizona. The natural nesting sites at present appear to be scattered. Numerous artificial nesting holes in different materials placed in many locations attracted only a few bees. Concentrated nesting in artificial nesting structures is necessary for the effective use of leaf-cutter bees for alfalfa pollination. However, concentration may favor the chalcid parasite, *Tetrastichus,* which apparently has a very high reproductive potential. It is possible that the tendency of *concinna* to disperse their nests may be a factor which enables the bees to survive in the presence of the parasite. The harmful effect of high temperatures in the desert areas may be reduced in the natural nesting sites as the nests are constructed in holes in various structures that provide shade. Mortality from high temperatures can be avoided in artificial shelters by providing shade and air circulation. The reluctance of the bees to utilize artificial holes for nesting and the presence of the parasite appear to indicate that *M. concinna* is not a potentially effective pollinator of alfalfa in southern Arizona.

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MEETING NOTICE

The first International Conference on Acarology will be held September 2-7, 1963 at Colorado State University, Fort Collins, Colorado.

SOME NEW NORTH AMERICAN CERAMBYCIDAE

(Coleoptera)

E. G. LINSLEY AND J. A. CHEMSAK[1]
University of California, Berkeley

The following species of *Callidium, Phymatodes* and *Megacyllene* are described at this time in order to make the names available for other studies.

Callidium powelli Linsley and Chemsak, new species

Male — Body small, elytra narrowly explanate behind humeri, subparallel; upper surface blue to violet-blue, pronotum often greenish, appendages and underside black, slightly metallic. *Head* densely, deeply, contiguously punctate, moderately clothed with thin, erect, dark hairs; antennae extending to about middle of elytra, black, segments narrow. *Pronotum* about 1½ times wider than long, narrower than elytra at base; sides broadly, evenly rounded, base constricted, narrower than apex; disk moderately shining, very densely, deeply, subconfluently punctate, sides with punctures deeper, larger or subequal to discal ones; pubescence fine, long, suberect; prosternum densely, deeply punctate, punctures smaller than those at sides of pronotum; meso- and metasternum moderately coarsely, shallowly punctate, episternum of metathorax moderately densely, shallowly punctate. *Elytra* slightly more than twice as long as broad at base, narrowly explanate; surface shining, densely, moderately coarsely, slightly rugosely punctate, punctures deep, finer and separated basally, contiguous toward apex but not strongly confluent; apices broadly rounded; scutellum glabrous, shallowly concave. *Legs* with femora moderately strongly clavate, posterior pair not attaining elytral apices, shining with a metallic lustre, sparsely punctate and pubescent; apex of fifth sternite broadly, shallowly emarginate. Length, 5.5-9 mm.

Female—Antennae extending over basal one-third of elytra; prosternum shining, finely rugulose; femora less strongly clavate than in male; apex of fifth abdominal sternite narrowly rounded. Length, 6-9 mm.

Holotype male, allotype (California Academy of Sciences, Entomology), and 29 paratypes (California Insect Survey) reared (J. Powell No. 60JI) on various dates in January, May and November, 1961, from branches of *Juniperus californica* collected October 17, 1960, at DESERT SPRINGS, SAN BERNARDINO COUNTY, CALIFORNIA (J. A. Powell). Additional paratypes include eleven females and eight males reared on various dates in February, March and April, 1935, 1936 and 1950, from branches of *Juniperus cali-*

[1] Appreciation is expressed to the National Science Foundation for the support of studies of North American Cerambycidae under NSF Grant G-19959. Material utilized in the present paper was kindly made available by J. F. Gates Clarke, United States National Museum; Henry F. Howden, Canadian National Collection; J. D. Lattin, Oregon State University; H. B. Leech, California Academy of Sciences; A. T. McClay, University of California, Davis; and J. A. Powell, University of California, Berkeley.

fornica collected at Palmdale, Los Angeles County, California, by A. T. McClay.

This species has thus far been found only on the Mojave Desert of California. It may be recognized by its small size, bright blue integument, and the distinctive punctation of the pronotal disk.

Callidium violaceipenne Linsley and Chemsak, new species

Male—Form small, elytra broadly explanate behind humeri; upper surface dark violaceus or bluish, underside dark reddish brown, appendages darker. *Head* coarsely, closely punctate, pubescence sparse, suberect and rather long; antennae extending to about apical one-third of elytra, segments gradually decreasing in width apically, basal segments not strongly incrassate, *Pronotum* about one and one-half, or less, times wider than long, slightly narrower than elytra at base; sides broadly, evenly rounded, base narrower than apex; disk shining, moderately coarsely, densely, confluently punctate, vague, glabrous calluses present, sides deeply, rugosely punctate, punctures subequal in size to discal ones; pubescence moderate; prosternum punctate like sides of pronotum; meso- and mestasternum shallowly, transversely rugulose, episternum of metathorax densely, shallowly punctate. *Elytra* at base about twice as long as broad, broadly explanate; surface slightly shining, densely, coarsely, rugosely punctate, basal punctures smaller, costae often vague; apices obliquely rounded; scutellum glabrous, impressed medially. *Legs* with femora moderately clavate, posterior pair not attaining elytral apices, shining, without a metallic caste. *Abdomen* sparsely punctate and pubescent; apex of fifth sternite broadly, shallowly emarginate. Length, 6-10 mm.

Female—Antennae extending over basal one-third of elytra; sides of pronotum very densely, rugosely punctate, prosternum shining, shallowly, transversely rugulose; femora weakly clavate; apex of fifth abdominal sternite narrowly rounded. Length, 6.5-10 mm.

Holotype male, allotype (California Academy of Sciences, Entomology), and 22 paratypes (14 males, eight females) reared from branches of *Sequoia sempervirens* collected at HARTSOOK GROVE, HUMBOLDT COUNTY, CALIFORNIA, June 25, 1939 and April 21, 1940, by A. T. McClay (California Academy of Sciences, Entomology; California Insect Survey; and University of California, Davis).

This species is more closely related to the juniper-infesting *C. hoppingi* Linsley, of the Pacific Northwest, than to the other species associated with redwood *(Sequoia)*. It differs in the smaller size and features of the pronotal punctation.

Callidium viridocyaneum Linsley and Chemsak, new species

Male—Form oblong, moderate sized, elytra narrowly explanate behind humeri, subparallel; upper surface dark bluish-green, underside and appendages black to dark piceous; pubescence coarse, black. *Head* coarsely, confluently punctate, moderately pubescent; antennae black, paler apically, reaching beyond middle of elytra, segments two to four robust, strongly incrassate at apices. *Pronotum* one and one-half times wider than long, slightly narrower than elytra at base; sides broadly, evenly rounded, base constricted, narrower than apex; disk slightly shining, very densely, moderately coarsely, confluently punctate, sides more finely, deeply, subrugosely punctate; pubescence moderate, suberect; prosternum less densely punctate than pronotum at sides; meso- and metasternum finely, densely punctate, finely, transversely rugulose. *Elytra* about twice as long as broad at base, narrowly explanate; surface shining, densely, coarsely, rugosely punctate, basal punctures finer, each elytron with two costae often evident basally; apices broadly rounded to suture; scutellum glabrous, deeply concave centrally. *Legs* with femora moderately strongly clavate, posterior pair not attaining elytral apices, shining, sparsely punctate and pubescent. *Abdomen* finely not closely punctate, thinly pubescent; fifth sternite broadly, shallowly emarginate at apex. Length, 6-11 mm.

Female—Antennae extending over basal one-third of elytra; prosternum shining, finely, shallowly rugulose; femora less strongly clavate; apex of fifth abdominal sternite narrowly rounded. Length, 8-11 mm.

Holotype male, allotype (California Academy of Sciences, Entomology), and 26 paratypes (21 males, 5 females) from PINE RIDGE, SHANNON COUNTY, SOUTH DAKOTA (W. S. Cook) (California Insect Survey).

This species is distinctive in the strongly incrassate basal antennal segments and dark blue-green color. The deeper discal pronotal punctures will distinguish it from the related *C. leechi* Linsley and Chemsak and *C. californicum* Casey.

Callidium leechi Linsley and Chemsak, new species

Male—Form oblong, moderate sized; elytra moderately broadly explanate behind humeri, often tapering apically; upper surface dark blue, blue-green or dark blue-violet, underside dark brownish black, legs and antennae darker. *Head* moderately coarsely, densely, confluently punctate, sparsely pubescent; antennae black, apices often paler, extending beyond middle of elytra, basal segments not strongly incrassate at apices. *Pronotum* about one and one-half times, or less, wider than long, narrower than elytra at base; sides broadly, evenly rounded, base narrower than apex; disk shining, densely, contiguously, rather shallowly punctate with vague glabrous calluses present, sides more coarsely, deeply, somewhat rugosely punctate; pubescence moderate, suberect; prosternum less coarsely punctate than sides of pronotum; meso- and metasternum densely, shallowly punctate, transversely rugulose. *Elytra* about twice as long as broad at base, moderately broadly explanate, often tapering slightly apically; surface shining, densely, coarsely, rugosely punctate, basal punctures almost subequal to apical ones, each elytron with a distinct median costa and often a shorter one toward suture; apices obliquely rounded; scutellum glabrous, shallowly concave centrally. *Legs* with femora strongly clavate, posterior pair not extending beyond elytral apices, feebly shining, without a metallic cast. *Abdomen* finely, not closely punctate, thinly pubescent; fifth sternite broadly, shallowly emarginate. Length, 7-12 mm.

Female—Antennae extending over basal one-third of elytra; sides of pronotum finely, rugosely punctate; prosternum finely, shallowly rugulose; femora less strongly clavate; apex of fifth abdominal sternite narrowly rounded. Length, 10-12 mm.

Holotype male, allotype, and 55 paratypes (26 males, 29 females) (California Academy of Sciences, Entomology), from MILL VALLEY, MARIN COUNTY, CALIFORNIA, reared from *Sequoia sempervirens* by H. B. Leech; emergence dates were as follows: May 9, 1950, March 15, 1951, March 28, 1951, March 29, 1951, April 4, 1951, April 20, 1951, April 23, 1951, April 24, 1951, and January, 1957.

The moderately broadly explanate and apically tapering elytra will separate this species from *C. californicum* Casey, to which it appears to be most closely related.

Phymatodes mohavensis Linsley and Chemsak, new species

Male—Form small, subparallel; color pale-brown to brown, usually with basal one-third of elytra paler; elytra bifasciate; pubescence long, sparse, pale. *Head* densely, coarsely, subconfluently punctate, pubescence fine, sparse, erect; antennae shorter than body, segments sparsely punctate, long, erect cilia fairly numerous, apical segments densely clothed with short subdepressed hairs, second segment about one-half as long as third, third subequal to fourth. *Pronotum* slightly broader than long, sides broadly rounded, base constricted and impressed; disk moderately coarsely, densely punctate, long erect hairs abundant, sides more deeply punctate, subopaque; prosternum deeply, coarsely punctate; meso- and metasternum coarsely, shallowly punctate, pubescence moderate. *Elytra* slightly more than twice as long as broad; surface coarsely, densely, subcontiguously punctate, the punctures over basal one-third much larger than those of pronotal disk, fine, erect, pale hairs numerous; fasciae ivory-white, subglabrous, anterior pair short, transverse or a little oblique, posterior pair oblique, slanting anteriorly toward suture; apices rounded. *Legs* slender, femora strongly clavate, sparsely punctate, long, erect hairs numerous. *Abdomen* shining, sparsely pubescent and punctate; apex of fifth sternite slightly emarginate. Length, 3.5-5 mm.

Female—Antennae slightly more than one-half as long as body; apex of fifth abdominal sternite rounded. Length, 5-7 mm.

Holotype male, allotype (Canadian National Collection, Ottawa), and 16 paratypes (9 males, 7 females) (California Academy of Sciences, Entomology, and California Insect Survey) reared on July 12, 1927 (a few specimens with no date), from *Juniperus californica,* MOJAVE, KERN COUNTY, CALIFORNIA (R. Hopping).

This species is closely related to *P. nitidus* LeConte which it resembles in color, size, and by possessing similar elytral fasciae. However, the very coarse, dense punctures of the elytra and pronotum and closely punctate head of *mohavenis* differentiate it from that species.

Megacyllene robusta Linsley and Chemsak, new species

Male—Form large, robust; integument black, legs brownish red, antennae rufo-piceous; pronotum with three transverse yellow bands, the first behind anterior margin, second behind middle, third basal; elytral pattern consisting of seven yellow or white and yellow transverse bands, basal very narrow, subbasal broadest, uniting at scutellum, ante-median roundly angulate, u-shaped, meeting subbasal band at suture, not extending to lateral margins, median band broken, extending down suture from ante-median band, lateral spots joining along extreme lateral margins to subbasal band, post median consisting of two sutural dots and larger lateral segments, subapical irregularly arcuate, apical small. *Head* with vertex densely, moderately coarsely punctate, densely pubescent; antennal tubercles prominent, finely, sparsely punctate, deeply canaliculate medially, apices obtuse; antennae reaching to about apical one-fourth of elytra, spines of distal segments short, eleventh segment appendiculate, almose divided. *Pronotum* densely, moderately coarsely punctate except for minutely punctate median callus and one on each side. *Elytra* slightly over twice as long as broad, very finely, densely punctate, subsutural carina evanescent; apices obliquely truncate, angles dentate. *Legs* with posterior femora falling short of elytral apices. *Abdomen* finely, sparsely punctate, densely yellow pubescent at sides; apex of fifth sternite emarginate-truncate. Length, 21 mm.

Female—Antennae extending over basal one-third of elytra; abdomen with fifth sternite broadly rounded at apex. Length, 20-21 mm.

Holotype male and allotype from COCHISE, COCHISE COUNTY, ARIZONA, XI-1-38 (G. Anderson) (California Academy of Sciences, Entomology); one female paratype, 8 miles S.E. Rodeo, Hidalgo County, New Mexico, X-26-55 (W. Miller) (California Insect Survey).

The species may be distinguished by its large size and the lack of subsutural carinae on the elytra. It differs from *M. angulifera* (Casey) by the different elytral pattern, longer antennae of the male, dentate angles at the apices of the elytra, and differently shaped apex of the fifth abdominal sternite.

Megacyllene powersi Linsley and Chemsak, new species

Male—Form moderate sized; integument black, appendages black, except antennae and tarsi apically; pronotum with four transverse bands, the first narrow, often whitish along anterior margin, the remainder broad, yellow, coalescing at sides; elytral pattern variable, usually consisting of seven yellow transverse bands, basal narrow, subbasal broad, uniting behind scutellum, ante-median angulate, V-shaped, extending to lateral margins, median band arcuate, directed anteriorly along suture, post median broad, arcuate or not, occasionally coalescing with median and/or subbasal bands to form a very broad band, subbasal and basal joined at suture, all bands joined at lateral margins by longitudinal band. *Head* with vertex moderately coarsely, not densely punctate, front and antennal tubercles very finely, sparsely punctate; antennae extending a little beyond middle of elytra, spines of distal segments short, eleventh segment slightly appendiculate. *Pronotum* densely, moderately coarsely punctate except for median callus and one on each side of disk. *Elytra* more than twice as long as broad, minutely, densely punctate, subsutural carinae prominent at apical one-half; apices obliquely truncate, slightly dentate at angles. *Legs* with posterior femora falling far short of elytral apices; apical segment of tarsi and claws brownish. *Abdomen* finely, sparsely punctate, sternites broadly yellow pubescent at sides; apex of fifth sternite broadly truncate. Length, 13-17 mm.

Female—Antennae extending over basal one-fourth of elytra; abdomen with fifth sternite rounded at apex. Length, 14-18 mm.

Holotype male and allotype from 7 MILES S.E. SHELDON, RANSOM COUNTY, NORTH DAKOTA, VIII-26-60 (J. R. Powers) (California Academy of Sciences, Entomology); 8 paratypes (4 males, 4 females), same locality, IX-3-60 (J. R. Powers) (California Insect Survey).

This is the species referred to by G. Hopping (Ann. Ent. Soc. America, 30:445, pl. 1, 1937) *as Cyllene infausta* LeConte (in part, at least). However, *infausta* LeConte was described from Georgia and is a junior synonym of *decora* (Olivier).

Structurally, *powersi* is difficult to separate from fully marked individuals of *decora*. This latter species is characterized by its tendency toward coalescence of the basal transverse bands of the elytra and usual reduction of the median group. In *powersi*, the basal bands appear to remain separated but the median and post median often unite and/or the post median and the basal ones. The smaller average size and very dark appendages of *powersi* will also help to separate the two species. *M. snowi* (Casey) differs from *powersi* by its reddish appendages and slightly different elytral pattern.

OBSERVATIONS ON THE ADULT BEHAVIOR OF XYLOTRECHUS NAUTICUS (MANNERHEIM)

(Coleoptera: Cerambycidae)

JOHN A. CHEMSAK
University of California, Berkeley

The members of the cerambycid tribe Clytini include some of the most colorful and interesting species in the family. Although the clytines are well represented in the New World, many of them are rare and poorly known. The biologies of some of the economically important species *(Megacyllene robiniae* (Forster), *M. caryae* (Gahan), *Glycobius speciosus* (Say), *Neoclytus acuminatus* (Fabricius), etc.) have long been known but information on adult activities such as mating behavior and oviposition is lacking for most of the group.

Observations on the adult behavior of *Xylotrechus nauticus* (Mannerheim) were made in the laboratory during the latter part of July and the beginning of August, 1962. A heavily infested log of *Quercus agrifolia* from which numerous adult cerambycids were emerging was kindly made available by E. G. Linsley. These beetles and the log were placed in a screen cage. Subsequent emergences of adults followed. On the following day a freshly cut oak log was also introduced into the cage. The behavior of the 20-30 individuals was then observed.

Activity within the cage was negligible during the morning hours but increased rapidly as the temperature rose and the outside overcast lifted. By the time the afternoon sun struck the cage directly, a peak of action was evident. It was at this time that all of the beetles were engaged in mating, seeking mates or oviposition. Almost all of the activity was taking place on the fresh log.

Mating was observed to occur repeatedly by the same individuals. The male, in coming into contact with a female, immediately mounts and attempts to join with her. His front legs grasp the female around the base of the elytra while the middle and hind pair remain in contact with the substrate. Almost immediately the male initiates a "licking" behavior on the female scutellum and the area behind it with his palpi. This apparently serves to quiet her and causes extension of the ovipositor for joining with the male. Similar behavior has been studied in lepturines by Michelsen *(in litt.)* in Denmark. The action was repeated whenever the female was disturbed or began walking. In the event of movement by the female, the male was able to retain his position with no difficulty. The firm grip with the front legs and free middle and hind pair allowed him to stay with her. When the situation appears satisfactory to the female, she extrudes her ovipositor straight out and the male by arching his abdomen joins with it. During mating, the antennae of both are placed straight out at a slight angle and curving slightly forward. The "licking" action by the male is frequently repeated.

The males appear to be quite aggressive and frequently attempt to dislodge another mating male and take his place. The larger of the two males either takes over or retains his position. In one instance when a female left him, the male immediately attacked a nearby couple, successfully dislodged the male and joined with that female.

After mating, the female walks rapidly over the log to seek suitable oviposition niches. Her antennae are placed before her touching the surface and the ovipositor is extruded. Both organs search and probe into cracks and crevices until a suitable one is found. The ovipositor is inserted and the eggs are laid. In most cases observed, a single egg was laid but more are probably deposited on occasion. Oviposition occurs even when a male is in mating position on the female. He waits until the ovipositor is withdrawn from the niche and then couples or attempts to couple.

Most of the caged adults survived for over a week. There was no food present and the only moisture available was that exuding from the fresh log. Although suitable and acceptable wood was present, a large number of eggs were deposited on the blotter covering the cage. A possible explanation for this unusual behavior may be the permeation of the blotter by volatile substances from the fresh log which deceived the ovipositing female.

These observations were made during the course of a NSF sponsored study on North American Cerambycidae (Grant G-19959).

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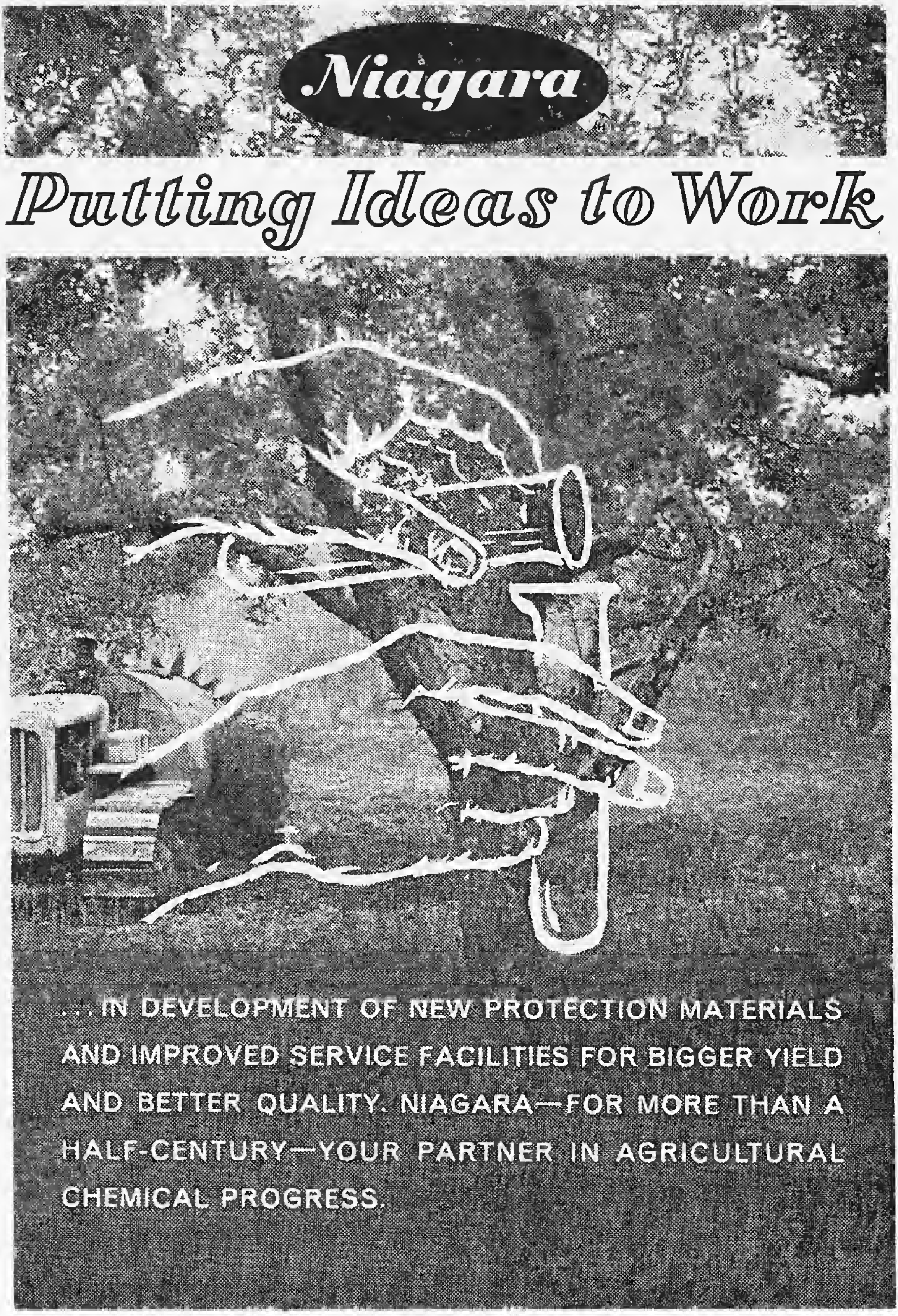
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OBSERVATIONS ON POPULATIONS OF ADULT BEAVER-BEETLES, PLATYPSYLLUS CASTORIS

(Platypsyllidae: Coleoptera)

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Introduction

While trapping beaver in the Mississippi River bottom-lands below Hastings, Minnesota in March, 1960, many of the two-year-olds were found to be heavily infested with the coleopterous ectoparasite, *Platypsyllus castoris* Ritsema. Since the beaver taken in previous years were old, mature beaver and did not have a heavy infestation, it was suspected that the beetles were segregating out on the two-year-olds. It was suggested that this could be a mechanism to insure infestation of the new colonies that would be established by the young beaver. If this segregation really existed, it was hypothesized that sampling of the population during the winter (when the beaver are icebound), and then during the spring (at the beginning of dispersal), would show differences in beetle densities per beaver that would be correlated with the age of the beaver and with the time of sampling. On this basis, two samples were taken; one during the December-January period (1960-1961) and the other during the late March and early April legal trapping season (1961). It was hoped that both samples would be similar in size and representation of colonies, but the spring work was partially interrupted by the activities of local fur trappers.

The previous published investigations dealing with *P. castoris* have been primarily of two types: taxonomic (Ritsema, 1869; Riley, 1892) and parasite surveys concomitant with investigations of beaver biology (Lawrence, Hays & Graham, 1961; Erickson, 1944; Parks & Barnes, 1955). Essentially no consideration has been given to parasite populations per beaver and there appears to be a complete lack of discussion of the behavior of the beetle. There appear to be some differences in the life history of the beetle between the Michigan Upper Peninsula (Lawrence, Hays & Graham, 1961) and the area below Hastings. Despite the fact that no evidence was gathered in support of differential infestation of beaver age-classes, it seems advisable to report the observations made on the beaver-parasite relationship and beetle behavior.

The author would like to express extreme gratitude to Dr. William Schmid of the Department of Biology, University of North Dakota, for his untiring labor in helping to set traps and to process the beaver. In the short time that was available for this study, the winter sample would not have been possible without the much appreciated loan of a dozen "Conibear" beaver traps by Mr. Don Gray of the Upper Mississippi Federal Wildlife Refuge. The author is deeply indebted to Dr. R. F. Smith, Department of Entomology and Parasitology, University of California, Berkeley, for reading the manuscript and offering a multitude of suggestions.

Methods

Study area: In those publications which deal with *P. castoris*, there has been little or no description of the area and circumstances under which the beaver were taken. This makes comparisons difficult and to avoid this a general description of the area is included.

The study area is a flood plain on the west side of the Mississippi River, between 10 and 15 miles south of Hastings, Minnesota. The action of spring floods has divided it into shallow lakes, marshes, and channels. The lakes have *Salix* and *Carex* borders, the marshes have dense stands of *Salix, Alnus, Carex, Scirpus fluviatilis*, and *Phragmites communis*, and the channels, while in general free of plant growth, pass through sand ridges which are covered with older *Salix* thickets, *Acer saccharinum, Populus deltoides, Acer negundo*, and *Ostrya virginiana*.

The area varies in width from one to two miles. To the west, it is restricted by rising farmland with streams which occasionally harbor beaver colonies. To the east, it is bounded by the main channel of the river which is in turn bounded by high limestone cliffs. The boundaries of the smaller water bodies within the area change from year to year because of fluctuating water levels. In the winter, the waters which are not directly connected to the main river current have six to fifteen inches of ice which restricts the beaver to their lodge area. Beaver which construct their lodges on the banks of the main river or at the mouths of channels which have strong current flow are normally not ice-bound during the winter and are known to range at least 200 yards from the lodge.

This area was chosen because of its high beaver population, relative isolation from other colonies, and familiarity to the author. During the course of the study all of the colonies in the area were discovered.

Since the spring samples were incomplete, it was also necessary to sample an old colony which was located in a very similar environment, four miles south of St. Paul, Minnesota, and an area two miles south of Coon Rapids, Minnesota. Both localities are on the Mississippi River. A few beaver were taken in each of these places. Any data presented that were taken from these animals will be so designated.

Beaver colony structure and movements: Two of the lodges in the area were in open water, built up from the bottom mud (No's. 6,9) and in shallower water than is the case with pond beaver. The other ten were bank dens in sandy silt or mudbanks. Winter food caches were established at all of the lodges but at those bank dens where there was open water, winter foraging over the snow was frequent, even though large food stocks were still present. Four of the lodges were built during the summer of 1960 (No's. 5,6,9,11). The other lodges were two or more years old. Some were very old as indicated by the number of times they had been rebuilt and the number of adjacent collapsed bank dens. The most common terrestrial foods were *Salix, Populus, Acer saccharinum,* and *Alnus.*

When the spring thaw occurs, the beaver in this area are subject to a disturbance which most non-river beaver do not experience; they are flooded out of their lodges. For a period of two to six weeks, the water varies from a depth about two feet below the top of the lodge to a depth of four to six feet over the top. This does not seem to disturb the beaver, as during the March and April season, a family could always be found within 250 yards of the flooded lodges that had been occupied during the winter months. Flooding does not prevent later use of the lodge, as many of them have been in use for several years. However, this inundation may well influence other occupants of the beaver lodge by the action of the water, effects of the layers of silt left by receding waters, and the temporary absence of the beaver.

It is generally accepted among mammalogists and trappers that the two-year-old beaver of a colony leave in the spring and wander widely. Apparently most of the crop of young beaver from this area pass up or down river to build new lodges, as almost every bay and channel in this study area has a lodge or the remains of one. A further indication that it is primarily the young which disperse in the early spring is that all the sixteen beaver caught by my wife and me in 1960, more than 500 yards from a lodge were two-year-olds. This represented 16/17 of the beaver that had disturbed the sets.

Trapping conditions: Between December 20, 1960 and January 4, 1961 the author and Dr. Schmid tried to take a sample representing both sexes and/or several age classes from each colony. Conibear traps were set by hanging them through holes cut in the ice over the deepest water in the vicnity of the lodge. They were baited with bundles of poplar twigs, but since the twigs were never eaten even in sprung traps, it is possible that the beaver swam through the traps by accident or curiosity. One young beaver was caught by the hind leg, rather than the usual head or chest hold. The beaver were drowned and their body heat often melted them into the ice, which then froze again. In these cases, the back muscles and hide were frozen hard. Apparently this did not greatly affect the beetles, because if one placed his warm hand against this frozen area, immediately there were active beetles crawling up out of the fur. The traps were examined every day or every two days. When taken from the traps, some beaver were still warm while others were in various stages of freezing. Twenty beaver were taken in this manner.

The beaver were laid on snow and skinned immediately. Every effort was made to keep the warmth of the skinner's body from reaching the beaver as the beetles are very responsive to warmth. Each hide was placed separately in a plastic bag with a card giving locality, date, sex, girth, length, approximate weight, and other ecological notes. At no time did one beaver come in contact with another after being removed from the trap. It was because of the definite possibility of contamination of one beaver by another that the beaver trapped by local trappers could not be used. The pelts were stored in snow and later placed in a refrigerator. No mention has been made in the published literature of precautions taken to avoid cross-contamination where more than one animal was involved.

In March and April, the area was entered by canoe and the beaver were taken in conventional steel traps, set in shallow water using a suspension of the castor gland as an attractant. Apparently, the use of this lure does not cause sample bias as the experience of fellow trappers and myself has been that all ages and both sexes come to castor scent piles. Drowning sets were made but due to water fluctuations and bad luck, only about half of the animals caught were drowned. Those still alive were dispatched and like the drowned beaver, were treated in the same manner as those taken in the winter period. However, in several cases, the entire beaver was placed in a plastic freezer bag and transported to a more convenient working place.

Age determinations were made on the basis of three size clusters which have appeared in every group of beaver that the author has trapped in Minnesota; the smallest are one year old, the next two years old, and the next three or over. These three are quite distinct and the last group occasionally has members which on the basis of their weight and length, are probably five years or older in age. The beaver were sexed by dissection and at this time of year, testes are easily distinguishable from castor glands. The beaver were considered as having been taken in the colony when caught within 50 yards of the lodge and were considered to be wanderers when taken further than 400 yards from a lodge or bank den; traps were set only in these ranges.

OBSERVATIONS ON LIVE PLATYPSYLLUS

Removing and counting the beetles: In the published investigations concerning *P. castoris*, the beetles presumably have been obtained by superficial examination of a dead or live beaver. Lawrence, Hays & Graham (1961) combed anesthesized and drowned beaver for all types of ectoparasites and apparently felt that they were obtaining a representative sample. In the present investigation, when the cold hide was taken from the refrigerator, the beetles responded to the presence of warm air and within 30 seconds many were found crawling over the guard hairs on all parts of the pelt. If the skin was flat on a table top, they remained dispersed, but if it was hung by one end, the beetles immediately moved upward and congregated at the uppermost end. All of the visible beetles were placed in alcohol or in vials with a bit of wet fur, which was then placed in the refrigerator (2° - 4° C.) for future experiments. The pelt was then combed with a fine toothed flea comb in an attempt to determine how many beetles were not responding to the heat stimulus. In three cases, no extra beetles were found; in the other 35, from 1 to 16 live beetles were found. The number of unresponsive individuals per beaver increased as the total number of beetles per beaver increased. In all of the combing, only four dead beetles and no larvae, eggs or pupae were found. These pelts had been in the refrigerator for one to three days. Beaver pelts with high populations of beetles had from six to 20 dead (drowned?) beetles in the water in the bottom of their plastic sacks.

All of the beaver pelts taken outside the regular trapping season were cut into strips and dissolved in KOH to extract additional beetles and any other arthopods present. The debris from this maceration was examined with a binocular microscope and the other arthropods noted. No eggs, larvae, or pupae of *P. castoris* and from 0 to 11 adult beetles per pelt were recovered (mean 2.2). The hair mite *Schizocarpus mingaudi* Trouessant was occasionally present in the hair combings and was found in large numbers (100 plus per beaver) on the lysed beaved pelts. Since this hair mite was combed from all parts of the body, it was considered to be a generally distributed ectoparasite. The hair mite *Prolabidocarpus canadensis* Lawrence was found only on the head when combing, and most commonly as clusters of 50-1000 individuals on the fine hair just inside the forward edge of the ear opening. They were stacked 5-10 deep per hair and every beaver examined had a cluster in one or both ears. No ticks, lice, fleas or other Coleoptera were presnt in combings or lysed pelts. Since the beaver taken during the regular trapping season were only combed, their beetle populations should not be taken as exact, but they probably can be considered to be within five per cent of the total number. The data are presented in table 1.

Beetle behavior: Characteristic activities by the beetles were noted while removing them from the cold skins. When the beetle senses heat, it crawls to the end of a guard hair, waves its front legs in the air, and often falls off. If it falls into the fur, it repeats the action. If it falls on its back on a flat surface, it can easily right itself. It will then crawl for about two hours at room temperature with occasional "rest" periods. Looking quite shriveled, it will cease movement during the third hour if not placed in a humid atmosphere. If the beetle falls into a cup of water, it always ends up on its back after a few seconds struggle. It then remains motionless until touched by an object or ripple, in which case it waves its legs very actively and will grasp the contacting object and crawl up it quickly. Those that were left in water were still plump and active after twelve hours.

The beetles are not always easy to capture while in the fur. If an exposed beetle is pinched with fingers or forceps, it burrows back into the underfur. The beetles are able to move very rapidly in the fur; this is a function of well developed legs, margins of many body and appendage sclerites heavily covered with posteriorly directed spines, and the dorso-ventral compression. The beetles can outrun a comb passing through a dense pelt. They are very responsive to disturbance in the fur and can move transversely across the pelt faster than one's fingers can follow.

Three hundred beetles preserved in alcohol had sex ratio of 1 ♂ :1.3 ♀ . They are easily sexed by observing the relatively large adeagus through the light brown integument. The gut contents of live specimens were examined and no hair fragments were found. The gut was packed with matter which upon removal and separation had the general facies of bits of epidermal tissue; i.e., flat and translucent particles, with irregular edges. No evidence of erythrocytes or mite parts was seen.

Resistance to temperature extremes and desiccation: Since ectoparasites are generally thought of as having narrow temperature and humidity tolerances, it seemed pertinent to determine what ranges were favorable for the beetles. Vials, each with 10 beetles and a tuft of underhair, were enclosed in jars with salt solutions producing relative humidities of 50, 75, 89, and 96 per cent at 36° C, and at 26° C. After 48 hours, there were no survivors at 36° C, and at 26° C with 50 and 75 per cent relative humidity. At 26° C and 89 and 96 per cent relative humidity, less than 50 per cent were dead after 48 hours (mean dead per vial = 4, S. D. = 2.4), and there was one beetle alive at 26° C, 89 per cent relative humidity, after 120 hours. Those beetles in the refrigerator at 4° C were living at a high relative humidity because there were drops of free water in the fur which did not evaporate. Two samples (312 and 102 beetles) at 4° C took at least 14 days to show 50 per cent mortality. Sixteen days after placing these vials in the refrigerator, some beetles still crawled about in the fur. The relationships indicated by these limited data is not surprising, since the beetles must survive relatively long periods of cold when the beaver is in the water or sitting on the ice. The fact that the beetles apparently could not tolerate temperature in the mammal body heat range, and that they are active in cold air (4° C) reflects the possibility that the steepest heat gradient across the beaver hide is from internal tissue to outer edge of epidermis rather than across the underfur layer which constitutes the beetle's environment. *A priori,* one might expect the underfur environment to be quite warm, as the water layer does not penetrate past the outer edge of the underfur. That the beetles are not resistant to desiccation is to be expected since the relative humidity in the underfur air spaces must be high.

An unsuccessful attempt was made to keep the beetles alive on laboratory white mice and guinea pigs. A mouse would ignore the beetle crawling on its skin (under the fur) for 10 to 60 seconds and then would turn as if bitten, grab, and eat the beetle. Sixteen live beetles were placed on the fur of the relatively defenseless guinea pig and the animal's cage placed over a catch

Table 1. Data on individual beaver and their beetle populations.

Colony Number	Sample: Winter=A Spring=B	Sex	Age in years	Beaver Live=A Dead=D	Lodge Age	Water Level	Number of Beetles	Combed=C Lysed=L
3	A	M	1	D	2 yr plus	Normal	104	L
	A	M	2	D		N	192	L
	A	M	2	D		N	142	L
	A	M	1	D		N	243	L
	A	F	1	D		N	47	L
	B	F	2	A		N	102	C
5	A	M	3+	D	1 yr	Drying	51	L
	A	F	3+	D		D	73	L
	A	M	1	D		D	41	L
	B	F	1	A		Dry	16	C
6	A	F	2	D	1 yr	N	7	L
	A	*F	3+	D		N	0	L
	B	F	2	D		D	5	C
7	A	F	2	D	2 yr plus	N	0	L
	A	F	3+	D		N	1	L
	A	M	2	D		N	0	L
	B	F	2	A		Dry	0	C

1	A	M	3+	D	1 yr	N	10	L
	A	F	3+	D		N	4	L
	A	M	2	D		N	1	L
	B	M	2	A		D	16	C
8	A	M	2	D	3 yr plus	N	0	L
	A	M	2	D		N	0	L
	B	F	1	D		D	10	C
4	A	*F	4+	D	3 yr plus	N	4	L
	A	M	2	D		N	76	L
W.	B	M	2	D		Flood	2	C
	B	M	2	D		Flood	82	L
	B	*F	4+	A		Flood	2	L
	B	F	3+	A		Flood	2	L
	B	M	2	A		Flood	14	L
	B	M	2	D		Flood	89	C
S.P.	B	M	3+	D		Flood	15	C
	B	*F	3+	D		Flood	83	C
	B	M	1	D		Normal	9	C
	B	M	2	D		Flood	3	C
C.R.	B	F	3+	A		Normal	9	C
	B	M	2	A		Normal	0	C

Legend:
* Pregnant
W. Wandering beaver more than 400 yards from any lodge or bank den
S.P. Beaver taken in the study area immediately below St. Paul, Minn.
C.R. Beaver taken in the study area immediately below Coon Rapids, Minn.

Colony Number
Sample:
Winter=A
Spring=B
Sex
Age in years
Beaver
Live=A
Dead=D
Lodge Age
Water Level
Number of Beetles
Combed=C
Lysed=L

pan. In the next three days, 13 of the beetles were found dead in the pan and the other three were not recovered by combing. Since the guinea pig lacks underfur, one would expect the relative humidity in the fur to be much lower than that of a beaver's. The beetles appear to have no inclination to leave a live beaver; one that was known to be infested with beetles was kept caged at room temperature for three days and no beetles were found in the pan under the cage.

Discussion

Platypsyllus: Riley (1892) has reported taking both larvae and adults from beaver fur. Lawrence, Hays & Graham (1961) found both of these stages in the fur throughout the entire year and express the view that the egg and pupal stages are passed in the lodge litter or walls, though they had no material evidence. Since no larvae were found on the Hastings area beaver either in winter or spring, there is the possibility of a biological difference between the two beetle populations considered to be conspecific. Lawrence, Hays & Graham (1961) report the probable food of the beetle to be lymph and skin secretions (and perhaps blood). They also report that the beetles cannot live on muskrats. In the present study, it appears that the beetle at least ingests loose epidermis, as was shown by examination of gut contents.

A number of general observations can be made and tentatively explained from the data presented in Table 1. The range of beetles per beaver is large. There are some colonies which are heavily infested (No's. 3,5) while others are not (No's. 6,7,1,8). The beetle populations per beaver vary much less among members of each colony than between the beaver of the entire sample taken as a whole. The beetle populations taken below St. Paul and Coon Rapids are not grossly different from those at Hastings. The beaver being drowned in the trap does not seem to influence the number of beetles on it, indicating that the beetles only leave a cooling animal in response to a warmer object. These observations are not surprising if we think of the entire beetle population as being represented by isolated units (the beaver lodges), some of which possess a more favorable environment for the immature stages than do others. The beetles in these lodges apparently infest the beaver in proportion to the amount of reproduction allowed by the environment and the lodges are periodically reinoculated by visiting host animals that have been infested in other lodges. Further, the range of the two-year-olds is very broad so that the total beetle population in a given set of lodges will not be so much a function of the possibility of beetles being carried into the area as of the favorability of the parasite environment. Since the beetles apparently will not leave a dead host except in response to warmth, water currents or crawling by the beetle is probably not instrumental in its dispersion. It should be noted that the spring sample is smaller than the winter sample, but this is taken into account in the statistical treatments and does not appear to influence the above general observations.

In addition, the following hypotheses were examined in a formal statistical manner: 1) that the bettle populations on female beaver are equal to the populations on male beaver (t=0.54, 36 d.f., not significant); 2) that the populations on one-year-old, two-year-old, and three-year-plus beaver are the same (variance not significantly different by Bartlett's test, F=0.16, 2.35 d.f., not significant); 3) that the populations on the wandering beaver are equal to those on the beaver taken at their lodges (t=0.14, 36 d.f., not significant); 4) that the populations on the winter caught beaver are equal to those on the spring caught beaver (t=0.68, 36 d.f., not significant); 5) that the mean numbers of beetles per beaver per colony are equal (F=7.05, 7,23 d.f., highly significant difference). Failure to reject the first three hypotheses with a very low statistic indicates that the beetles, at this time of year, do no favor any particular portion of the host population. That the fourth one is not rejected seems to indicate that either the bettles do not have an appreciable mortality rate during the period sampled (three months between samples) or else they are emerging during this period. This does not necessarily mean that eggs and larvae are also present.

The rejection of the fifth hypothesis is in support of the idea that the favorability of the lodge environment may determine the numbers of beetles that are present on the beaver in an area. If we compare the population means of each colony (Table 2) with the range of variation within each colony (Table 1), it appears that the particular lodge influences the number of beetles on a beaver. Duncan's Multiple Range test has been used to distinguish those means which are significantly different (Table 2). Those means connected by the underline cannot be distinguished from each other at the 95 per cent level of significance. While the possibility of genetically determined resistance of the individual beaver should not be excluded, the sample involved in this study is not large enough or sufficiently documented to test the hypothesis that the animal itself is unfit for the beetle.

Table 2. Significantly different mean number of beetles/beaver/colony.

Colony number	3	5	4	13	1	6	8	7
Mean beetles/beaver	138	45	40	27	8	4	3	.25

While their effect on beetle numbers can only be hypothesized, it seems relevant to mention some of the variables that exist in the environment in which the immature stages presumably are passed. During the spring floods (two to six weeks), when many of the lodges are submerged, and for about a month in late summer when the lodge entrances may be as high as five feet above the water level, the beaver do not occupy the lodges. Further, the flood water, being heavily laden with silt, will deposit a coat of mud over the interior of the lodge as it recedes. Those lodges off of large rivers are not so dramatically subject to this disturbance. The lodges may be constructed on a number of substrates such as mud, gravel, sand, and clay. The materials used as bedding will depend on those available to the beaver. The duration of occupancy of the lodges in terms of years will vary depending upon the mortality factors acting on the beaver (trappers, disease) and the materials out of which the lodge is constructed. It should be realized that in a given colony there may actually be several sleeping chambers in one lodge or bank den system; each of the above factors may influence each of these sleeping chambers to a varying degree.

Beaver are often observed combing their fur with the two split toenails of their hind feet. It is a leisurely activity and cannot be expected to remove many beetles. Since fur needs to be clean of oils and flotsam to be water repellent, it is undoubtedly done for cleaning. Bailey (1923) has arrived at this conclusion also. Further, I have never observed a beaver to undergo the characteristic searching or scratching for a biting ectoparasite; it appears that any abrading of the skin that may be done by the beetle does not bother the beaver.

While the beetles show characteristics that seem useful if a beetle becomes separated from its host (resistance to cold, ability and inclination to climb contacting objects from a water surface), no observations have been made of "lost" beetles in nature, nor is there any direct evidence that beaver-to-beaver transfer occurs except by host contact.

Other ectoparasites: It is interesting to note that while Lawrence, Hays and Graham (1961) list twelve possible arthropod ectoparasites of beaver, only three were found on the animals in this area. They found the hair mite *Prolabidocarpus canadensis* to be common on their beaver, yet found none of the hair mite *Schizocarpus mingaudi* which is abundant in the residue from the lysed beaver pelts. There is a definite possibility that they combed over these small and tight-clinging mites. While they found both *Ixodes banski* Bishopp and *Leptinillus validus* Horn to be common, these were completely lacking in the Hastings beaver. As both *I. banski* and *L. validus* were recovered by them from nest litter, there is the definite possibility that their absence in the Hastings area is a function of the frequent flooding. It would be interesting to examine those beaver in the Hastings area whose lodges are not flooded for the presence of these two arthropods. *L. validus* has been recorded from Minnesota (Parks & Barnes, 1955) and *I. banski* has been established to be a beaver ectoparasite in Northern Michigan and Western Ontario (Lawrence, Hays & Graham, 1961).

Conclusion: It is apparent that much work needs to be done with this ectoparatsite under many environmental conditions. One major problem is finding a way to legally procure representative samples of the host at all times of the year without depleting the population of beaver or aggravating the local trappers. Furthermore, the physical labor involved in trapping and handling the animals in their own environment is considerable.

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NOTES AND SYNONYMY OF SOME NEOTROPICAL SPHEX AND ISODONTIA DESCRIBED BY E. TASCHENBERG AND S. ROHWER

(Hymenoptera: Sphecidae)

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The following notes are based primarily on Taschenberg type material generously lent by J. O. Husing of the Zoologisches Institut, Martin-Luther-Universitat, Halle, East Germany. In addition, a recent visit to the United States National Museum allowed the author to examine the Rohwer types in that Institution. I am designating lectotypes for the following Taschenberg species: *Isodontia nigrocoerulea*, *Sphex argentinus* and *micans*.

ISODONTIA CYANIPENNIS (Fabricius)

Sphex cyanipennis Fabricius, 1793. Ent. Syst., 2:200 (Cayenne, French Guiana, type lost).

Sphex nigrocoerulea Taschenberg, 1869. Zeitsch. Ges. Naturw. Halle, 34:415 (Lectotype ♀ and paralectotype ♀, Venezuela, present designation).

Isodontia bipunctata Rohwer, 1913. Proc. U.S. Nat. Mus., 44:452 (holotype ♀, Canal Zone, Panama). *New synonymy.*

J. van der Vecht (1961) suggested that Fabricius' *cyanipennis* is the same species described by Taschenberg as *nigrocoerulea*. However, Richards (1937) described a metallic blue *Isodontia* from a male colected in British Guiana, which may be a synonym of *cyanipennis*. If Richards' description of *Isodontia bastiniana* is accurate his species is distinct from *nigrocoerulea*. Richards states that the holotype of *bastiniana* lacks the prominent transverse bands of pale ciliia found on the gastral sternites of *nigrocoerulea*. In addition, the flagellomeres of *bastiniana* do not possess the spicules found on the flagellomeres of *nigrocoerulea*. A possibility exists then that *cyanipennis* and *bastiniana* are synonymous and distinct from *nigrocoerulea*. All of the blue *Isodontia* that I have seen from the type locality of *cyanipennis*, Cayenne, are *nigrocoerulea* however, and it seems best to follow van der Vecht's interpretation of *cyanipennis* for the present.

In his original description, Taschenberg indicated that he was describing a male and a female, and the two syntypes sent to me are so labeled but both are females.

The type of *I. bipunctata* Rohwer is identical with Taschenberg's *nigrocoerulea*.

SPHEX TEPANECUS Saussure

Sphex tepanecus Saussure, 1867. Reise der Ost. Freg. Novara, Zool., 2:41. (holotype ♂, "Mextill," Museum d'histoire Naturelle, Geneva).

Sphex mexicana Taschenberg, 1869. Zeitsch. Ges. Naturw. Halle, 34:416 (holotype ♂, Mexico).

Examination of Taschenberg's type proves that Kohl (1890) was correct in synonymizing *mexicanus* with *tepanecus* Saussure. Specimens of *tepanecus* that I have studied from Arizona and Texas differ from the type of *mexicanus* only slightly. The legs are completely black on the type but the United States examples have the front femora reddish brown beneath.

SPHEX ARGENTINUS Taschenberg

Sphex argentina Taschenberg, 1869. Zeitsch. Ges. Naturw. Halle, 34:417 (lectotype ♂, Mendoza, Argentina; paralectotype ♀, Rozario, Argentina, present designation).

Willink (1951) correctly interpreted this species.

SPHEX MELANOPUS Dahlbom

Sphex melanopa Dahlbom, 1843, Hymenoptera Europaea, 1:27 (holotype ♂, Brazil, Zoologisches Museum, Humboldt Universitat, Berlin.)

Sphex proxima Smith, 1856. Cat. Hym. Ins. Coll. Brit. Mus., 4:258 (holotype ♀, Brazil, Brititsh Museum Natural History).

Sphex ruficauda Taschenberg 1869. Zeitsch. Ges. Naturw. Halle, 34:418 (holotype ♂, "Amer. Merid.")

Both Kohl (1895) and Fernald (1931) studied Dahlbom's type of *melanopus* and arrived at the above synonymy. Dahlbom mentioned that his type was in the collection at Lund, but Fernald could not locate it there, and stated, as did Kohl, that it was in Berlin. Fernald also studied Smith's type of *proxima*.

This species exhibits a north-south clinal variation in the amount and color of thoracic pubescence. On specimens from Brazil, the appressed pubescence is copper or tarnished silver and is confined to a small spot behind the pronotal lobe and above the meso- and meta-coxa, and to the scutal furrows and also a small spot at the side of the petiole socket. In these specimens the erect pubescence is dirty white. The area covered by the appressed pubescence increases on specimens found further north. In Venezuelan examples the pronotal lobe is covered with appressed silver pubescence and the posterior portion of the propodeum is entirely covered by appressed silver pubescence. Erect thoracic hair on these specimens is golden. In Panamanian examples the propodeum is completely covered and the thorax is extensively covered by appressed golden pubescence. Taschenberg's type of *ruficauda* agrees most closely with males from Venezuela.

SPHEX DORSALIS Lepeletier

Sphex dorsalis Lepeletier, 1845. Hist. Nat. Insect. Hym., 3:347 (holotype ♂, Cayenne, French Guiana, Museo di Zoologia, Universita di Torino (Turin).

Sphex singularis Smith, 1856. Cat. Hym. Insect. Brit. Mus., 4:261. (holotype ♂, Honduras, British Museum Natural History).

Sphex micans Taschenberg, 1869. Zeitsch. Ges. Naturw. Halle, 34:419 (lectotype ♀ and paralectotype ♀, Parana, Argentina, present designation).

Of the five female specimens sent to me for study, only two are clearly Taschenberg syntypes of *micans*. Taschenberg listed Parana, Mendoza, and Rio de Janeiro as type localities for the five females he described. Two of the specimens before me lack labels and a third is labeled Rozario. I am restricting the designation of lectotype to one of the two females labeled Parana.

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SPHAEROCERID FLIES FROM SOUTH AND CENTRAL AMERICA IN THE COLLECTION OF THE CALIFORNIA ACADEMY OF SCIENCES

(Diptera)

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On a recent visit to the Department of Entomology and Parasitology, University of California, Berkeley, I was able, owing to the kind cooperation of Dr. E. S. Ross and Dr. P. H. Arnaud, to examine the flies of the family Sphaeroceridae in the collection of the California Academy of Sciences. The species from South and Central American are dealt with here but it was not possible to determine all the species of the genus *Leptocera* Olivier. The types of all the new species (except one indicated below) are in the collection of the Academy. I am indebted to Mr. Curtis W. Sabrosky for help in examining certain types in the U.S. National Museum. The photographs of wings were kindly made by Mr. J. W. Siddorn. The nomenclature of the male genitalia is that of Richards (1961).

Genus ARCHIBORBORUS Duda, 1921

ARCHIBORBORUS (ARCHIBORBORUS) HIRTIPES (Macquart, 1843)

The commonest South American species. Chile, Arauco: Angol, 13.IX. 50, 1♀ (R. Gomez), 23.XII.50-1.I.51, 16♂, 24♀ (E. S. Ross and A. E. Michelbacher).

ARCHIBORBORUS (PROCOPROMYZA) SIMPLICIMANUS Richards, 1931

Known from Chile and Argentina. Chile, Nuble: 40 km east of San Carlos, 23.VII.50, ♂ ♀ (E. S. Ross and A. E. Michelbacher).

ARCHIBORBORUS (PROCOPROMYZA) SUBMACULATUS Duda, 1921

The species is so far known only from Chile and is sometimes a little short-winged. Chile, Arauco: Angol, 1.I.51, ♂ (E. S. Ross and A. E. Michelbacher).

ARCHIBORBORUS (PROCOPROMYZA) EDWARDSI Richards, 1931

This species was described from a single male captured at Chile, Llanquihue: Puerto Montt. The female first recorded below has been compared with the male type and seems to belong to the same species. Chile, Cautin: 22 km. east of Temuco, VI-VII.51, ♀ (M. G. Smith); Osorno, 30 km. east of Purranque, 15.I.51, ♀ (E. S. Ross and A. E. Michelbacher).

ARCHIBORBORUS (PROCOPROMYZA) CHILENSIS Richards, 1931

Previously recorded from Chile and Argentina. Chile, Bio-Bio: El Albanico, 31.XII. 59 2♂ (E. S. Ross and A. E. Michelbacher).

Archiborborus (Procopromyza) annulatus Richards, new species

Male and female.—Shining blackish-brown; face, front third of frons, buccae, part of second and third antennal segments, reddish-yellow; stripes through the dorso-centrals and thoracic sutures more or less brown; fore coxae, broad apical ring on all femora, yellowish brown, tibiae and tarsi rather darker, tibiae with indications of two darker rings. Halteres yellowish, base of knob darker. Wings (fig. 1) dark brown with five hyaline spots on R_{4+5}; the two cross-veins and the veins in the spots white, otherwise dark brown. Length about 4.0 mm, wing 3.75 mm.

Structure as in *A. albicans Richards* (1931:68) except in the following particulars: buccae rather narrower, only one quarter as wide as vertical height of eye; acrostichals in six rows; fifth sternite elongate, narrowed to apex which is not very deeply emarginate, emargination defined by weakly pointed lobes, lobes and emargination with whitish edges; hook at apex of fore basitarsus very small; mid tibia with anterior bristle at ⅔, three dorsals and a mid ventral, and a preapical ring of 4-5 bristles; hind femur with only three anterodorsal bristles.

Holotype male, allotype female: CHILE, NUBLE, 40 KM EAST OF SAN CARLOS, 23.XII.50 (E. S. Ross and A. E. Michelbacher).

In my key to the species (1961:57) runs to *A. submaculatus* Duda (couplet 14) but differs in the more narrowed fifth sternite of the male and in the pale femoral rings. Only one other species of the subgenus, *A. chaetosus* Richards, has maculated legs but this has greatly reduced wings and long bristles on the abdomen.

Genus FRUTILLARIA Richards, 1961

FRUTILLARIA species

I described this genus with five species from Chile in 1961 (loc. cit.:63). It is not possible so far to distinguish the females. Drs. E. S. Ross and A. E. Michelbacher captured one female at Chile, Cautin: 20 km. east of Temuco, 8.I.51. This is approximately 38° S. while previously the most northerly locality for the genus was 41° S.

Genus CEROPTERA Macquart, 1835

Ceroptera venozolana Richards, new species

The present species seems in structure to be an outlying member of the genus *Ceroptera* Meigen though if it does not prove, like the others, to be associated with scarabaeid bettles it will probably be better to place it in a new separate genus. Though generally resembling a *Leptocera* Olivier, the spur on the hind tibia and to a less extent the wing-venation shows affinities to *Copromyza* Fall. The numerous spines on the hind tibia are unique in the family and the scutellar bristles are unusual.

Male and female.—Blackish-brown with whitish bloom, sides of mesoscutum paler, lower half of pleura and base of legs, yellowish-brown. Abdomen reddish-brown, segments with whitish margins in female. Halteres very pale. Wings greyish-white, veins not darker. Length about 2.0 mm.

Head bristles as in *Leptocera* Olivier (but ♂ with three outwardly directed superior orbitals on left side only), four pairs of interfrontals (three large but not cruciate), head clearly wider than long, frontal knob distinct but not very large, facial keel moderately strong, without bristles; first antennal segment with quite strong forwardly directed bristle, antennae strongly diverging, third segment with white pubescence, arista subapical, three times as long as antenna, with moderately long pubescence; head not at all higher than usual, buccae at narrowest about two-fifths greatest diameter of eye, largest buccal bristle about one-third as long as vibrissa. Humeri with two long bristles, one pair of long posterior dorsocentrals, one much shorter

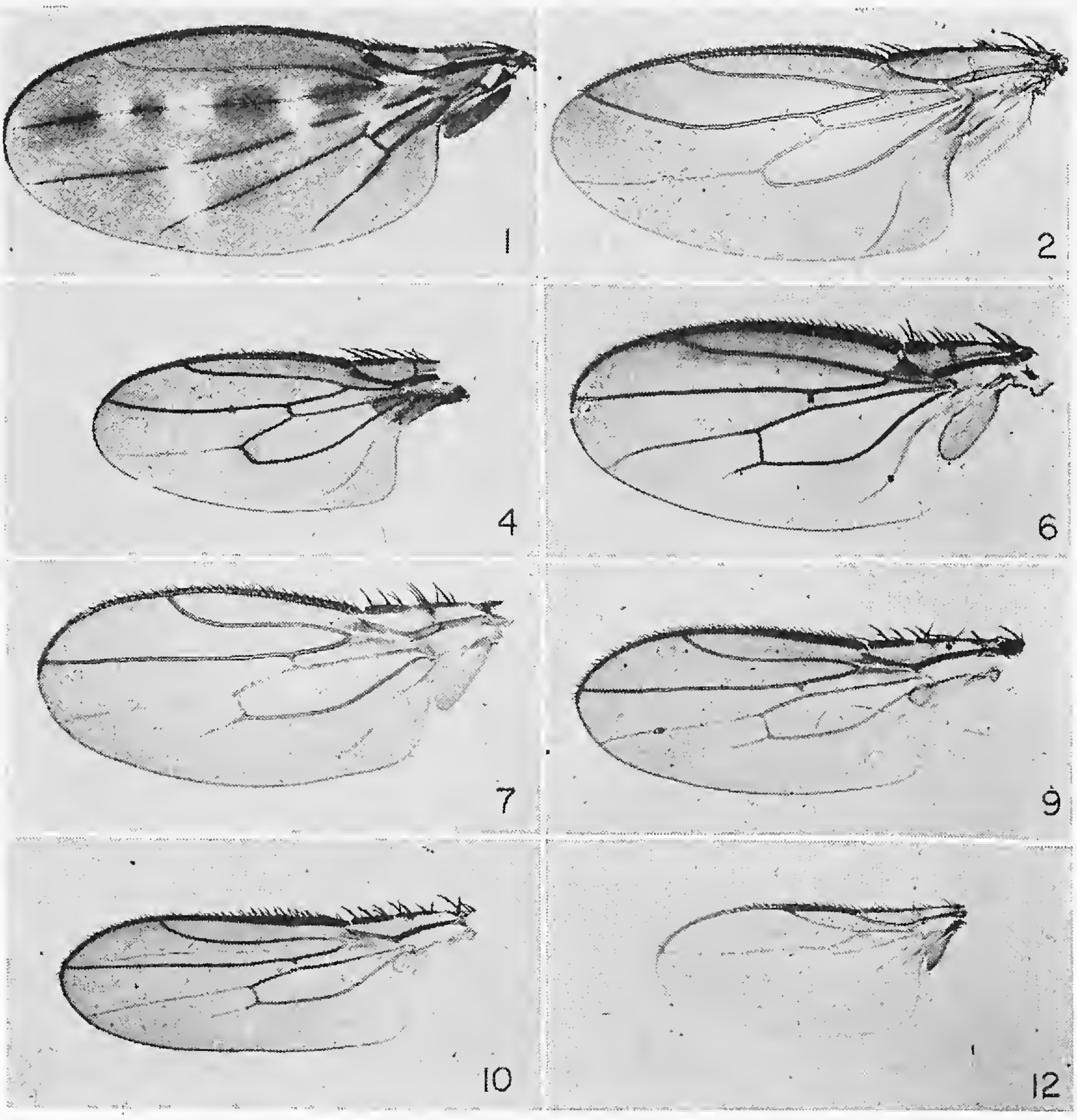


Fig. 1, left wing of *Archiborborus annulatus* Richards. Fig. 2, left wing of *Leptocera schlingeri* Richards. Fig. 4, left wing of *Leptocera rossi* Richards. Fig. 6, left wing of *Leptocera arnaudi* Richards. Fig. 7, left wing of *Leptocera dolichoptera* Richards, male. Fig. 9, left wing of *Leptocera phycophila* Richards, male. Fig. 10, the same, left wing of female. Fig. 12, left wing of *Leptocerca mollis* Richards, female.

pair in front and, just on suture, another pair hardly distinguishable from microchaetes, about six rows of acrostichals, scutellum elongate with four long bristles, one additional short one in front of basal and two additional short ones between basals and apicals on each side. Sternopleuron with one bristle and two or three minute setae. Legs with tarsi quite unmodified, pretarsus and claws not enlarged, fore legs with no bristles except usual dorsal and ventral rows on the femur; mid trochanter with no enlarged bristle, mid femur with four downwardly directed anterodorsals on distal half, mid tibia with three dorsal pairs of short stout bristles at ¼, ½, 5/6; an anterior at ⅔ and before the apex, a mid ventral and a very short apical ventral; mid basitarsus rather more than half as long as tibia with no enlarged setae; hind femur with two anterior bristles before apex, hind tibia with about seven bristles on dorsal surface, some more or less paired, a short, somewhat anterior ventral apical curved spur; tarsi normal, second segment clearly longer than first; male with longer and denser hairs on legs than female, with group of about three rows of seven bristles on the underside of the mid femur on the proximal quarter, distal quarter of mid tibia with some black ventral setae, hind tibia with thirteen bristles on dorsal side. Wings long and narrow with a narrow alula, veins little darkened, first sector of costa with longish bristles, second sector more than twice as long as the third, R_{4+5} almost straight, very little bent forwards, not overpassed by costa, intermedian cell very long and narrow, M_{1+2} extending as a fold almost to margin, other corner of cell almost rounded, anal vein (fold) gently concave forwards. Abdomen short and very bristly, male fifth tergite with long bristles, almost forming a brush on the left, overhanging the genitalia, sternites also very bristly, some of the bristles short, dense and outstanding; genitalia large, anal slit short oval, directed downwards, surrounded by short bristles, other details concealed. ♀ cerci orange-brown, retracted, each with a short, stout, inwardly-curved, black, hook-like bristle.

Holotype male, allotype female; VENEZUELA: GUANACE, ESTADO PORTUGUESA 10-13.IX.57 (B. Malkin).

Differs from all described species of the genus in having stout spines on the hind tibia.

Genus LEPTOCERA Olivier, 1913

LEPTOCERA (LEPTOCERA) NEOCURVINERVIS Richards, 1931

Previously recorded from Chile and Argentina. Chile: Talca, 22 mi. north of Talca, 22.XII.50, ♂; Nuble, 40 km east of San Carlos, 23.XII.50, 2♂ 1♀; Arauca, Angol, 1.I.51, ♂ ♀; Arauca, Sierra Nahuelbuta west of Angol, 1200 m, 3.I.51, ♂ (E. S. Ross and A. E. Michelbacher).

LEPTOCERA (LEPTOCERA) ABDOMINISETA Duda, 1925

The species is widespread in South America and also recorded from Hawaii and Tristan da Cunha. Peru: Callao, 17.XII.50, 17♂ 9♀ (E. S. Ross and A. E. Michelbacher).

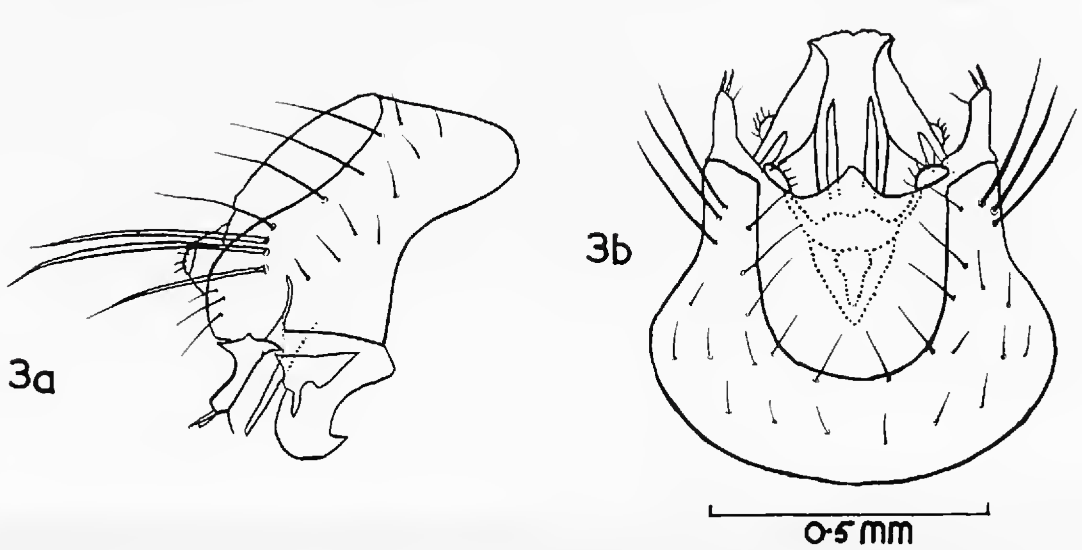
LEPTOCERA (LEPTOCERA) FULVA (Malloch, 1912)

This species is widespread in Central and South America. Peru: Pualba, 2.X.54, ♀. Ecuador, Napo-Pastaza: 2-8 miles north of Puyo, 953 m, 9.II.55, 11♂ 6♀. Columbia, Cauca: 27 miles south of Popoaya, 1750 m, 5.III.55, ♂2♀; Valle: 40 miles south of Cali, 1140 m, 6.III.55, ♀ (all E. I. Schlinger and E. S. Ross).

Leptocera (Leptocera) schlingeri Richards, new species

Male and female.—Velvety black, dull; extreme front of frons, antennae, much of face, buccae, palpi, reddish brown. Larger bristles arising from somewhat greyish spots. Notopleural region and base of wing, pale yellow. Stripe across top of sternopleuron pale reddish-brown. Legs reddish-brown, coxae and trochanters paler. Halteres yellowish-brown. Wings grey. Length 2.6-4.0 mm.

Head with longest buccal bristle not more than ¼ as long as the vibrissa. Three pairs of interfrontal bristles, front pair much longer and directed more fowards, other head bristles normal. Arista nearly five times as long as antenna, with long pubescence. Thorax with one very long and one short humeral bristle, three pairs of strong dorsocentrals, acrostichals very little enlarged but their length somewhat variable, not separated by a row of microchaetes, with about three rows of microchaetes on each side between them and dorsocentrals; scutellum with usual 8 bristles but one female has an extra basal bristle on each side; sternopleuron with one very strong and one weak bristle. Fore legs unmodified. Midlegs with bristle on trochanter distinct but not very long; femur with only the preapical anterior bristle; tibia with 3 anterodorsal and two posterodorsal bristles on basal quarter, the lowest anterodorsal being large, two long nearly paired bristles at 4/5 and a small posterior; at a silghtly higher level a small anterodorsal, a mid ventral and a preapical ventral; basitarsus with a long ventral at ¼. Hind legs unmodified, second tarsal segment nearly twice as long as first. Wings (fig. 2) with bristles on first costal sector practically not enlarged, second costal sector more than twice as long as third, R_{2+3} considerably sinuate, joining costal at a moderate angle, R_{4+5} strongly bent forwards, ending far in



EXPLANATION OF FIGURES

Fig. 3, *Leptocera schlingeri* Richards: a, male genitalia from the right: b, male genitalia in true dorsal (apparent ventral) view.

front of wing-tip, M_{2+3} produced beyond cell as a straight fold to margin, posterior angle of cell almost rounded. Abdomen in male with segment 1+2 much longer than 3, 4, or 5 which are short but of gradually increasing length; no long lateral bristles but tergite 5 with one very long curved bristle on each side; genitalia small and retracted, sternite 5 emarginate at apex, a small lobe bearing three short black spike-like bristles on each side of emargination. In a macerated specimen, genital forceps small, with one bristle and two spikes at apex; gonapophyses close together, spike-like; aedeagus defined by lateral plates which in side view are hooked below and dorsally bear a finger shaped process and a small lobe bearing short bristles. Anal split not closed, bearing long bristles. Abdomen in female with tergites 3-6 each a little longer than its predecessor, 4-6 with a moderate lateral bristle on each side, cerci fused into a single plate bearing a pair of short, down-curved pale bristles; sternites with short bristles.

Holotype male and allotype female: ECUADOR, NAPO-PASTAZA: 6-8 MILES WEST OF MERA, 1500 m, 10.II.55, and 2♂ 6♀ paratypes, same data (E. I. Schlinger and E. S. Ross).

The colour of this species is distinctive and the short bristles of the first costal sector are very unusual in this subgenus. In Duda's key to his subgenus *Paracollinella* (=*Leptocera Leptocera,* 1925: 15) it runs to couplet 43. None of the three species there *(L. abdominiseta* Duda, *L. fulva* Duda and *L. parafulva* Duda) has a velvety black, yellow-edged mesoscutum or short bristles on the first costal sector. None of the other more recently described species seems to be at all similar. The enlarged pair of frontal bristles is quite unusual.

LEPTOCERA (RACHISPODA) BIPILOSA Duda, 1925

The species was described from Bolivia. Columbia, Cundinamarca: 12 miles southeast of Bogota, 2930 m, 13.III.55, ♂; Meta: 3 miles west of Villovicencio, 920 m, 11.III.55, 19♂ 9♀; Narino: 32 miles north of Pasto, 4.III.55, 2♀; Valle: 40 miles south of Cali, 1140 m, 6.III.55, 42♂ 34♀; 17 miles west of Sevilla, 7.III.55, 28♂, 23♀ (all E. I. Schlinger and E. S. Ross).

LEPTOCERA (RACHISPODA) AEQUIPILOSA Duda, 1925

The species is widespread in South America but has not before been recorded from so far north. Peru: Pucalba, 2.X.54, 2♀. Columbia, Valle: 40 miles south of Cali, 6.III.55, ♀; 17 miles west of Sevilla, 7.III.55, ♂ 3♀ (all E. I. Schlinger and E. S. Ross).

LEPTOCERA (RACHISPODA) STRIATA Duda, 1925

The species is recorded from Chile and Argentina. Chile, Coquimbo: 50 km. south of La Serena, 1.XII.50, 3♀, 20 km. southwest of Ovalle, 12.XII.50, ♀; Aconcagua: 10 km east of Papudo, 27.XI.50, 2♂; Nuble: 40 km east of San Carlos, 23.XII.50, 3♂; Bio-Bio: El Albanico, 31.XII.50, 1♂ 2♀ (all E. S. Ross and A. E. Michelbacher).

LEPTOCERA (RACHISPODA) LIMBINERVIS Duda, 1925

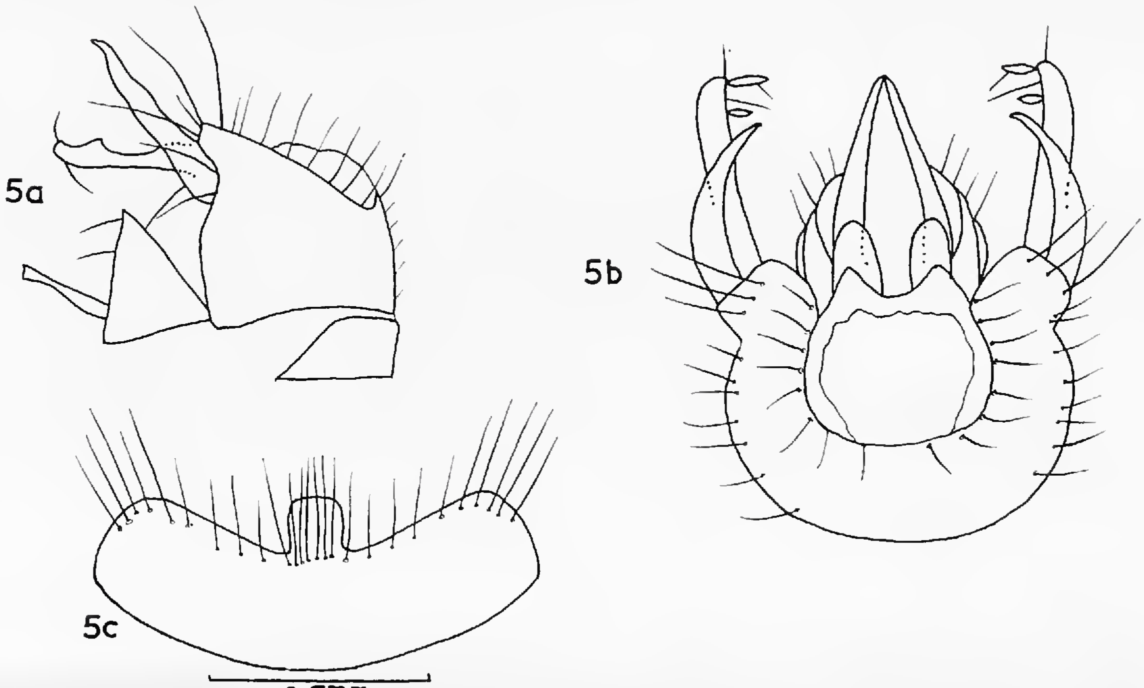
The species was described from Costa Rica. Mexico, Nuevo Leon: 20

miles west of Linares, 8.XI.46, 2 ♀ ; Colima: southeast slope of Mt. Colima, pine zone, XII.48, ♂ 6 ♀ ; San Luis Potosi: 5 miles north of Tamazunchale, 22.XII.48, ♂ (all E. S. Ross).

Leptocera (Rachispoda) rossi Richards, new species

Male and female.—Black, somewhat brown dusted, but mesoscutum rather shining; scutellum, pleura and dorsal side of abdomen dull. Halteres pale reddish. Wings moderately infuscate. Length 2.0-3.0 mm.

Head on each side with one vibrissa and one almost equally long upturned buccal bristle. Facial knob only moderately prominent but genae well-developed in front of eyes. Arista two and a half times as long as antenna, with moderate pubescence. Two long and 2-3 short interfrontal bristles on each side. Two or three pairs of slightly enlarged acrostichal bristles with two rows of microchaetes between them. Five pairs of dorsocentral bristles, counting the incurved scapulars. Scutellum with 8 marginal bristles, first pair very small, second and fourth very long, third moderate and a little more discal: disk with one pair of moderate bristles behind middle and in all about two dozen other minute bristles scattered on each side of mid line. One long and one moderate sternopleural bristle. Legs with normal bristles for this sub-genus, no special bristles in male; mid tibia with long dorsal bristle, surmounted by smaller one, at ⅓, three long bristles at ¾ surmounted by two smaller ones, a mid ventral and a preapical ventral; hind tibia externally with complete row of oblique bristles not quite as long as its diameter: bristles of hind trochanter not modified, second segment of hind tarsus nearly twice as long as first. Wings (fig. 4) with first costal sector with long bristles, second sector more than twice as long as the third, R_{4+5} moderately curved forward, not strongly divergent from M_{1+2}, posterior outer corner of cell weakly angular, sometimes almost rounded. Abdomen



Explanation of Figures

Fig. 5, *Leptocera rossi* Richards: a, male genitalia from the right; b, male genitalia in true dorsal (apparent ventral) view; c, sternite five, ventral view.

with plates 1+2, 3, 4 and 5 of about the same length but 1+2 rather longer, especially in ♀; genitalia (figs. 5a, 5b) somewhat large; anal split widening a little downwards and not closed below, bearing short, close bristles, becoming somewhat longer and denser below; in the unmacerated genitalia a shining dark brown inwardly-directed curved hook can be seen on each side; beyond this another dark brown, shining, downwardly directed, feebly curved process of which the end bears a short, stout, spike-like bristle; a narrow spike-like process protrudes from the aedeagus; fifth sternite (fig. 12b) with long marginal bristles becoming denser at mid-line where there is a tongue-shaped, downwardly bent projection. Female with end of abdomen protruding as a short cone, cerci with one pair of longish curved hairs and some shorter ones.

Holotype male and allotype female: CHILE, CAUTIN: 20 KM EAST OF TEMUCO, 7.I.51, and 15♂ 20♀; Arauca: Angol, 1.I.51, 2♀ paratypes (all E. S. Ross and A. E. Michelbacher).

In Duda's key (1925:15) to subgenus *Rachispoda* (= *his Collinella)* it runs to *L. octisetoca* (Becker) from Egypt which has not yet been adequately described. Duda's redescription (1938: 81) does not mention the two pairs of large acrostichals and there are said to be 8-10 small bristles on the scutellar disk (not about 40). *L. quadriseta* (Duda, 1938:81) which has the four acrostichals has a bare scutellar disk. Probably *L. rossi* is nearest to *L. downesi* Richards, 1944 (imported into England, probably from Argentina) but in the new species the disk of the scutellum has more bristles, the acrostichals are separated by two, not one row of macrochaetes, and R_{4+5} is rather more bent.

LEPTOCERA (POECILOSOMELLA) ANGULATA (Thomson, 1868)

Distribution: Southern U.S.A., Central and South America, Caribbean, Hawaii. Peru: Monson Valley, Tingo Maria, 9-10.X.54, 5♂ 12♀ (E. S. Ross and A. E. Michelbacher). Florida: Bradensville, March, 2♂ 1♀; Jacksonville, 31.III.19, 5♂ (M. C. Van Duzee).

LEPTOCERA (CHAETOPODELLA) MELANOGASTER (Thomson, 1868)
(= *Leptocera pulchripes* Duda, 1925)

The species is widespread in southern South America. Chile: Coquimbo, 3 miles north of Los Vilos, 13.XII.50, ♂; Arauca, Angol, 1.I.51, ♂ (E. S. Ross and A. E. Michelbacher).

LEPTOCERA (THORACOCHAETA) JOHNSONI SPULER, 1925

Spuler described *L. johnsoni* (1925: 121, fig. 2) from seaweed in several places in the state of Washington, U.S.A. He stated that the second costal sector is about the same length as the third. I have now examined a long series of his specimens including the now headless type ♀ from Seattle in the Melander collection in the U.S. National Museum and also one paratype from Seattle in the collection of the California Academy of Sciences. The males agree with his description but in the females the second costal sector, though somewhat variable, is nearer one and a half times as long as the third, as I stated earlier (1931:78) for specimens from Ancud, Chile, and as holds for other specimens seen (1961: 63) from Navarina Island, Chile.

Mexico, Baja California: San Bartolome (on coast), 12.III.53, ♂ 15 ♀ (P. H. Arnaud, C.A.S.). Chile, Santiago: El Tabo, on seaweed, 12.V.61, 18 ♂ 10 ♀ (G. Kuschel, coll. O.W.R.).

Leptocera (Thoracochaeta) arnaudi Richards, new species

Male and female.—Dull brownish-black with mesoscutum and abdominal tergites grey dusted; face, antennae, pleura (especially sutures), legs, brown to pale brown. Abdominal tergites with pale posterior segmental margins. Halteres pale with knob darker. Wings greyish. Length 2.5-3.0 mm.

Head without a facial knob; three pairs of interfrontal bristles, front pair small; antenna as usual in this subgenus with a distinct forwardly directed bristle on segment 1, arista nearly twice as long as antenna with short pubescence; eyes of nearly normal size, buccae at narrowest two-fifths as long as maximum eye-diameter. Thorax with two humeral bristles, four pairs of dorso-centrals, three front pairs directed obliquely inwards, about eight rows of acrostichals, scutellum about semi-circular, the four bristles rather short, apical pair about as long as scutellum; propleuron with two small bristles, sternopleuron with one bristle and two minute setae. Legs somewhat stout; fore legs with normal bristles, tibia dorsally with rather dense, short, oblique hairs, especially in male; mid femur with normal bristles, in male with complete row of short oblique antero-ventrals; mid tibia with four pairs of dorsal bristles, a midventral and an apical; mid basitarsus with short stout setulae; hind tibia without bristles, with 2-3 rows of short oblique setulae (considerably shorter than diameter of tibia). Wings (fig. 6) not specially elongate, alula moderately broad, costa without long bristles except a basal pair and a longish group on the first sector (4 ventral, 3 dorsal), second sector about twice as long as third, R_{2+3} gently curving and nearly parallel to costa, bending gradually toward it at the end, R_{4+5} straight, not overpassed by the costa, intermedian cell rather wide, M_{1+2} produced to costa, M_{3+4} also extending some way beyond *im*. Abdomen ovate, flattened above in ♀ with all bristles, including lateral ones short and not dense, cerci very long triangular, outer side dull, inner edge shining and reddish, outer edge with two short bristles, apex with stout reddish spike-like bristle, sternites with short bristles; ♂ with dense and moderately long bristles at side of each tergite after first, genitalia small, anal split directed obliquely downwards, surrounded by short, dense, rather woolly hairs; sternites with short bristles, fifth sternite with an apical row of somewhat longer bristles and in centre of posterior margin four short, black, backwardly-directed, stout bristles.

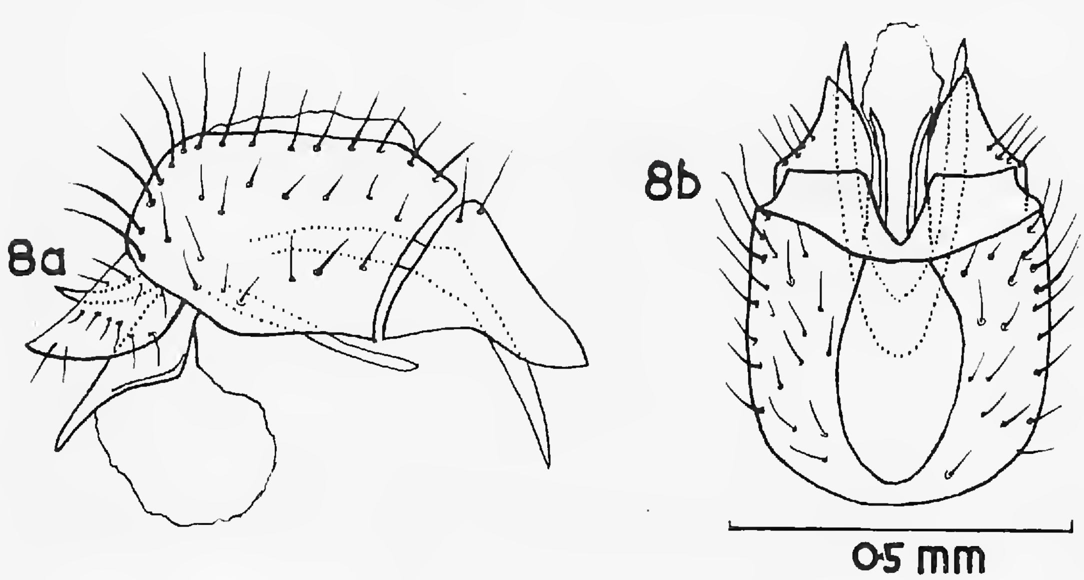
Holotype male, allotype female, 27 ♂ 20 ♀ paratypes, MEXICO, BAJA CALIFORNIA: SAN BARTOLOME, 12.III.53 (P. H. Arnaud).

In my key (1931:77), it would run to *L. johnsoni* Spuler but the second costal sector is twice as long as the third, the costa has not outstanding bristles in the female, and the size is considerably larger.

Leptocera (Limosina) dolichoptera Richards, new species

Male and female.—Dull black; antennae and front of head reddish-brown. Thoracic sutures and legs pale brown to yellowish, hind legs darker. Halteres yellowish. Head, mesoscutum and abdomen sowewhat greyish dusted, margins of abdominal tergites whitish, especially in ♀. Wings grey. Length without wings about 2.0 mm, ♂ a little smaller.

Facial knob moderately projecting, rather wide; antennae somewhat divergent; face obtusely keeled. Antenna with a distinct forwardly directed bristle on the first segment, a strong ring of bristles round the apex of the second segment, arista rather more than twice as long as the antenna, with moderate pubescence. Eyes rather small; narrowest part of buccae two-fifths the vertical height of eye; vibrissa stout; buccal bristle behind it equally stout and nearly as long, followed by a bristle half as long; one bristle half as long on mouth edge, close to vibrissa, and behind this a regular fringe of hair-like bristles. Four pairs of moderately long inter-frontal bristles, outside them at most one or two minute setae. A pair of diverging bristles between the posterior ocelli, behind the ocellars and half as long, other head bristles normal. Mesoscutum with two divergent humeral bristles on each side, three pairs of dorsocentrals, anterior pair well in front of suture and more than half as long as prescutellar pair, acrostichals rather strong, six rows between dorsocentrals, two central rows slightly enlarged and rather widely spaced; four long scutellars, two minute propleurals, two sternopleurals, both quite large. Fore legs normal, bristles on femur rather stout and prominent, on tibia somewhat dense. Mid legs with a short bristle on the trochanter, base of femur in ♂ with a dense group of short stout



Explanation of Figures

Fig. 8, *Leptocera dolichoptera* Richards: a, male genitalia from the right; b, male genitalia in true dorsal (apparent ventral) view.

bristles beneath basal quarter, ventral bristles fine and evenly spaced in ♀, mid tibia with a moderate posterodorsal surmounted by a smaller anterodorsal at $\frac{1}{4}$, a moderate anterodorsal at $\frac{1}{2}$ and a pair of almost equally long strong bristles at $\frac{3}{4}$, in ♂ with no mid ventral; tibia somewhat curved with short comb-like bristles on distal half beneath, apicoventral short, anterior apical very short, in ♀ a strong mid ventral and long apicoventral, no comb-like bristles, anterior apical bristle half as long as width of tibia. Mid basitarsus rather more than half as long as tibia, relatively longer in ♀, with coarser not very numerous setulae beneath, one ventral at proximal 1/5 distinctly enlarged. Hind tibia with small anterior apical bristle, basitarsus with distinct apical bristle, second tarsal segment one and a half times as long as first. Wings (fig. 7, ♂) rather elongate but considerably more so in ♀ (cf. figs. 9 & 10) with a narrow alula, bristles on first costal sector rather strong, one bristle on humeral cross-vein at some distance from costa, second costal sector about twice as long as third, costa extending to rather beyond R_{4+5}, R_{2+3} distinctly sinuate, R_{4+5} straight, M_{1+2} produced to margin, M_{3+4} extending nearly halfway to margin, cell rather narrow. Male abdomen with first four segments of about same length, bristles short, even at sides of tergites 4-5 not much longer than tergites, genitalia swollen and elongate in dorso-ventral direction, anal split twice as long as wide, fringed by short bristles, below the split genitalia (figs. 8a, 8b) forming two broad lips with short bristles between which two adjacent short brown spikes sometimes protrude, below these two short triangular brown processes; sternites little modified, not much projecting, with rather short bristles. Female abdomen with tergites 2-5 progressively a little shorter, no bristles long, end of abdomen somewhat troughlike with two long cerci lying in the trough, each cercus with two very long sinuous bristles.

Holotype male and allotype female: Peru, Lima: N.W. Caneto, at sea level (? on actual coast), 13.IX.54, and 7♂ 2♀, same data (E. I. Schlinger and E. S. Ross).

Some paratypes are now in my collection. The affinities of this species are discussed below.

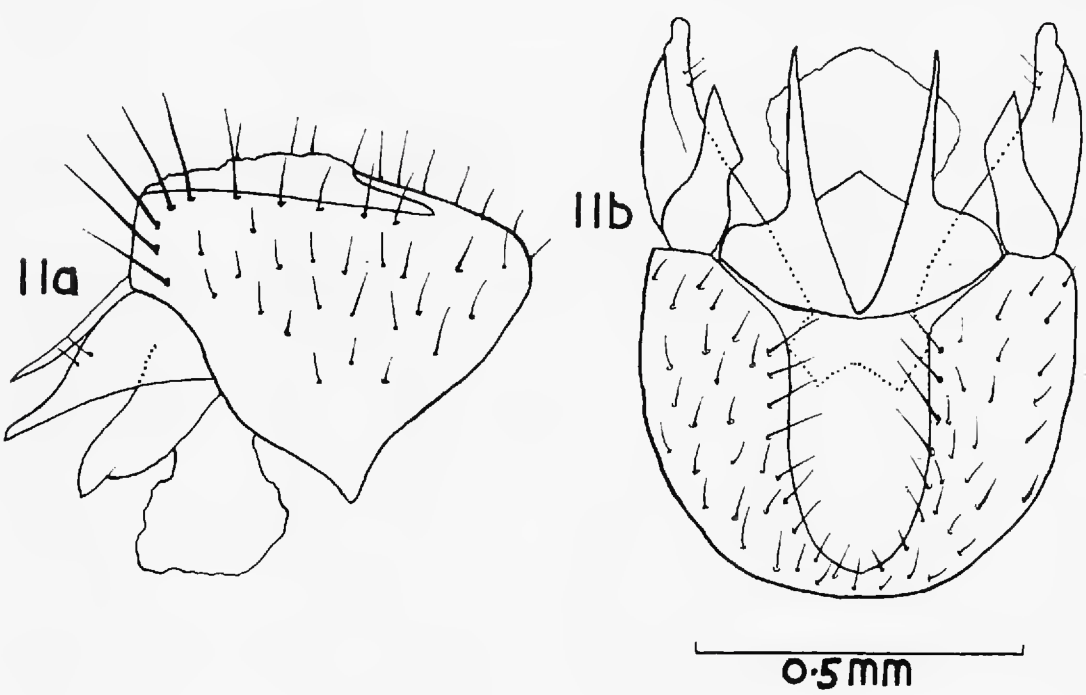
Leptocera (Limosina) phycophila Richards, new species

Male and female.—Dull black; third antennal segment brown. Thoracic sutures, leg-joints and tarsi pale to darker brown. Halteres pale yellowish. Dorsal side bluish-grey dusted, abdominal tergites with whitish apices. Wings grey. Length (without wings) 1.75-2.0 mm.

Close to *L. dolichoptera Richards* but differing as follows: facial knob longer and narrower, face divided by a more acute distinct keel. Antenna with arista rather shorter, just less than twice as long as antenna. Four or five pairs of short stout interfrontal bristles; outside the anterior pairs are 3-4 small bristles forming a second row. Divergent bristles behind ocellars considerably weaker. Dorsocentral and acrostichal bristles shorter, central rows of latter less widely spaced. ♂ mid tibia with comb-like bristles more concentrated toward apex. Wings (figs. 9, 10) with R_{2+3} somewhat less sinuous, bristle on humeral cross-vein weaker and nearer costa. Male genitalia (figs. 11,, 11b) even larger and more elongate, anal split in dry specimens normally hidden by collapsed sides of the ninth tergite (not held apart because cerci are not broadly fused across the mid-line), lower part of ninth tergite with a number of moderately long bristles, two or three of which are stout and point downwards; sternites projecting strongly as a spout-like structure, the centre of which bears short dense bristles, beneath the genitalia; other sternites with short bristles. Cerci smaller and more widely separated, genital forceps much stouter and less pointed, posterior gonapophyses not curved upwards. Female abdomen not essentially different.

Holotype male and allotype female: Chile, Santiago: El Tabo, on seaweed, 12.V.61 and 5♂4♀, same data, (G. Kuschel); Peru, N.W. Caneto; Lima, at sea level, 13.IX.54, 3♂ (E. I. Schlinger and E. S. Ross). The type will be deposited in the British Museum and some paratypes in my collection and that of the California Academy of Sciences. The species was sent to me by Father Kuschel who found it in some numbers on seaweed with *L. johnsoni* Spuler. It also occurred mixed with the previous species which may also have been captured on the coast.

In Duda's key to *Leptocera* subgenus *Limosina* (his *Scotophilella)* (1925:153) both *L. dolichoptera* and *L. phycophila* key to *L. longipennis* Duda (1925: 178, fig. 26) of Peru and Bolivia. Both differ from it as follows: three not two dorsocentral bristles, wings rather longer, veins paler, second costal sector fully twice as long as third (not distinctly less than twice as long), mid-tibia



EXPLANATION OF FIGURES

Fig. 11, *Leptocera phycophila* Richards: a, male genitalia from the right; b, male genitalia in true dorsal (apparent ventral) view.

with paired bristles at ¾, in ♂ tibia and femur with modified bristles, basitarsus with one enlarged bristle below, ♂ genitalia larger.

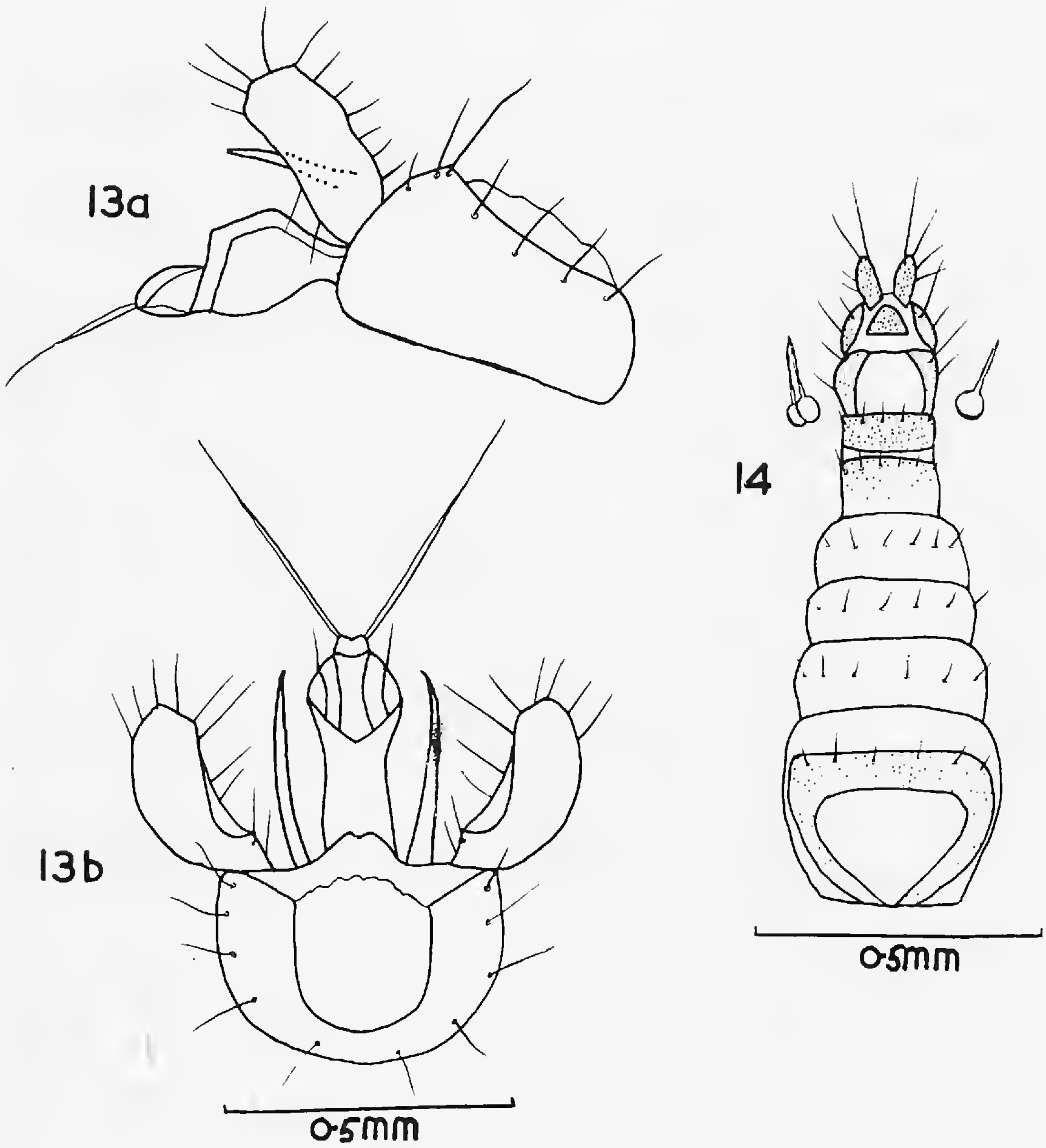
The three species together form a distinctive group known by the somewhat reduced eyes, very short arista and long wings with rather well-developed costal bristles. *L. empirica* (Hutton) (= *pectinifera* Villen.) does not seem to be very close in spite of Duda's remarks. The species seem to me to show rather a transition to the subgenus *Thoracochaeta* Duda in the antennae, eyes, head and thoracic bristles, and sexually dimorphic wing-length. However, the dorsocentrals are fewer and are not directed inwards as in that subgenus.

Leptocera (Limosina) mollis Richards, new species

Male and female.—Black, very shining; frontal orbits rather broadly, frontal triangle, buccae, most of the dorsal division of the mesepisternum, pteropleuron and dorsal stripe of the sternopleuron, grey-dusted. Antennae, femoro-tibial joint, tarsi and some suffusion of all tibiae, pale yellow-brown. Halteres yellow-brown. Wings hyaline. Length about 1.2 mm.

Buccae with one bristle about half as long as the vibrissa, greatest width hardly more than one-quarter vertical diameter of the eye; upper part of face not at all projecting; antennae strongly divergent, first segment without inner, forwardly-directed bristle, third segment with rather long pale pubescence, especially in male, arista nearly four times as long as antennae, with long pubescence; only one outwardly directed orbital bristle, head bristles otherwise normal, adfrontal bristles in three small pairs. Thoracic bristles somewhat brownish; humeral bristle very short, one posterior pair of dorso-centrals and one inconspicuous more anterior pair just behind suture, acrostichals somewhat widely spaced, with about six rows between dorsocentrals; scutellum transverse, more than twice as broad as long, bristles relatively short, apical pair less than twice as long as the scutellum; two minute sternopleurals. Fore legs with no special modifications; mid femur with all bristles very short, mid tibia with a short antero-dorsal at ¼, a short dorsal at 4/5, no mid-ventral, apico-ventral very short, tarsi with short setulae only, basitarsus long, more than half as long as tibia; hind legs normal, tibia without bristles, second tarsal segment not quite as long as first. Wings (fig. 12) with alula very narrow, costa without bristles, second sector hardly more than half as long as the third, darker than the rest of the costa, R_{2+3} gently bent onto the costa, R_{4+5} very feebly sinuate, just overpassed by the costa, ending well in front of wing-tip, distance between the cross-veins just longer than first sector of R_{4+5}, cell of moderate breadth and length, M_{1+2} produced as a slightly curved fold to near the margin, M_{3+4} just visible beyond the cell for a very short distance, anal vein feeble, hardly sinuate. Abdomen difficult to study before maceration because partly desclerotised and crumpled; ♂ genitalia small, anal split circular, surrounded by short bristles only, lower parts with denser short bristles, details concealed; ♀ with cerci rather prominent, each having one very long and about three short sinuous hairs. When macerated, the abdomen in both sexes is largely white and desclerotised, only tergite 6 and the genitalia in ♂, and segment 6 to some extent in ♀ being sclerotised. ♂ with sternite 5 visible as a light brown plate of which the posterior margin is shallowly emarginate and the surface bears a few short bristles; tergite 6 well-developed on the left side with very few bristles; genitalia (figs. 13a, 13b) with short but fairly numerous bristles below, genital forceps relatively short and broad, wider and incurved at apex, with short straight spike-like bristles, mostly pointing inwards, posterior gonapophyses fine, almost hair-like; curved a little downwards; aedeagus in dorsal view with a Y-shaped sclerite leading to a narrow projecting strut which ends in two very long diverging

13a



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Explanation of Figures

Fig. 13, *Leptocera mollis* Richards: a, male genitalia from the right; male genitalia in true dorsal (apparent ventral) view. Fig. 14, the same, female abdomen in dorsal view with spermathecae shown separately, more sclerotised parts stippled.

bristles; in side view with a small blunt projection beneath the narrow strut. ♀ (fig. 14) with sixth and more posterior plates feebly sclerotised, cerci each with 3 fairly long bristles, 2+1 spermathecae, oval with a long sclerotised stalk.

Holotype male and allotype female: HONDURAS: BRUS LAGOON, 25.IV.47, and 5♂ 27♀, same data (C. W. Cork).

This unusually distinct species should apparently be placed in the subgenus *Limosina* Macquart. In Duda's key to the species (= his *Scotophilella)* (1925:153), it runs to couplet 46, but although the second costal sector is shorter than the third, the alula is very narrow and the antennae are pale. Moreover one superior orbital bristle is absent. *L. piscina* Richards, 1938 which runs to the same couplet has the second and third costal sectors more nearly equal and the antennae and abdomen dark. The pale antennae and abdomen separate it from all the other species described since Duda's key was published. In Malloch's key to Costa Rican species (1914:9) it would run to *L. varicosta* Malloch but in that species the second costal sector seems to be much darker, there are two orbital bristles and the abdomen appears to be normal.

LEPTOCERA (LIMOSINA) DARWINI Richards, 1931

This species is widespread in western South America and is known from most others of the subgenus by having an additional minute bristle at the base of the scutellum. Chile, Valparaiso: 20 km north of Concon, 26.XI.50, ♀; Valdivia; 30 km south of Valdivia, 13.I.31, ♂; Cautin: 20 km. east of Temuco, 8.I.51, ♀; Bio-Bio: El Albanico, 31.XII.50, ♀; Nuble: 18-40 km east of San Carlos, 23-24.XII.50, 16♂ 14♀ (all coll. E. S. Ross and A. E. Michelbacher).

LEPTOCERA (COPROICA) VAGANS (Haliday, 1833)

This species is now cosmopolitan and widespread in South America. Chile, Coquimbo: coast road 70 mi south of Oralle, 13.XII.50, ♂ ♀ (Ross and Michelbacher).

LEPTOCERA (COPROICA) HIRTULA (Rondani, 1880)

This species is also cosmopolitan and known from North and South America. Mexico, Gulf of California: Monserrate Island, 13.VI.21, 27♂ 40♀ (E. P. Van Duzee).

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Book Review

THE SIPHONAPTERA OF JAPAN. By Kohei Sakaguti and E. W. Jameson, Jr. PACIFIC INSECTS MONOGRAPH 3: 1-169, figs. 1-66 May 20, 1962 $3.25 For sale by Pacific Insects, Bishop Museum, Honolulu, Hawaii.

A MONOGRAPH OF THE SIPHONAPTERA OF JAPAN by Kohei Sakaguti, pp 1-255, figs. 1-356, maps 1-7, plates 1-42 1962 (Received May, 1963) Limited edition of 200 copies $30.00 + $1.50 freight. For sale by Nippon Printing and Publishing Co., Ltd., Osaka, Japan.

These two books comprise an exhaustive treatment of these medically important insects in Japan. Both publications should be in the library of anyone who is concerned with Siphonaptera, and they should be used simultaneously since they are closely interrelated and complement one another.

Pacific Insects Monograph 3 by Sakaguti and Jameson does not provide more than brief morphological notes for a few species. However, factors concerned with ecology, host relationships, geographic distribution and possible migration with resulting hybridization are frequently discussed in detail under each species. These authors also list specimens examined and the geographic locality and host of each collection. A substantial section of the book is devoted to theories of evolution of flea fauna and zoogeography. Fleas in Japan may be placed in three groups according to geographic occurrence. Two of these groups may be related to proposed north and south faunal routes from the Asiatic mainland.

A Monograph of the Siphonaptera of Japan by Sakaguti provides synonymic references to literature regarding occurrence in Japan for each taxonomic category. Detailed descriptions are given for each species. Plates of photomicrographs of fleas are of amazing clarity and depth of field. There is a chapter on the geograhic distribution of fleas in Japan. Both publications have carefully prepared and detailed drawings—Harold E. Stark, *Training Branch, Communicable Disease Center, Public Health Service, Department of Health, Education, and Welfare, Atlanta, Georgia 30333.*

SOME SPECIES OF TYPHLODROMUS FROM DWARF MISTLETOES IN NORTH AMERICA

(Acarina: Phytoseiidae)

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University of California, Albany, California

Preliminary investigations into the possibilities of biological control of dwarf mistletoes *(Arceuthobium* spp.) during the past two years by Dr. C. B. Huffaker and Mr. J. Hamai of the University of California, Department of Biological Control, have led to the recovery of several species of Phytoseiidae from widely separated localities in North America.

To date, five species of the genus *Typhlodromus* have been recovered from dwarf mistletoes. Of these, two species are described for the first time and are placed in the subgenera of *Typhlodromus* as defined by Chant (1957a). A third species consisting of a single specimen from Red Bay, Ontario, Canada is considered by Chant as being very near *Typhlodromus (Amblyseius) rosellus* Chant. The remaining two species are *Typhlodromus (Typhlodromus) bakeri* (Garman) and *Typhlodromus (Typhlodromus) validus* Chant.

Typhlodromus (Typhlodromus) arceuthobius Kennett, new species

(Figs. 1, 2)

Female.—Dorsal shield narrowly ovate in outline, widest at posterior one-third, reticulate, with distinct concentric patterns opposite coxa IV; shield notched or constricted opposite seta S_2, bearing 16 pairs of setae, eight in lateral (L) series, two in median (M) series and six in dorsal (D) series. All dorsal setae very short and smooth except seta L_8 which is 32μ long and faintly pectinate. Seta M_2 (14μ) barely longer than L_7 and D_1. Remaining setae ranging in length from 8μ (D_6) to 11μ (L_6). Setae L_7 and L_8 arising from small tubercles, the only lateral (L) setae on posterior half of dorsal shield. Setae S_1 and S_2 on interscutal membranes, 14-18μ in length.

Fixed digit of chelicera with three teeth in addition to *pilus dentilis.* Movable digit with single denticle. Peritreme reaches anteriorly to base of seta L_1.

Sternal plate lghtly sclerotized, not readily distinguishable, with two pairs of setae. Third and fourth pairs of sternal setae arise from metasternal plates. Genital plate typical. Spermathecal vesicle rarely apparent, cervix as shown in figure 2, major duct not discernable. Ventrianal plate broadly vase-shaped, longer than wide, widest opposite anus, anterior margin rounded, lateral margins constricted anteriorly, with four pairs of pre-anal setae. Two pairs of metapodal plates, larger plate slender, slightly sinuate.

Setae and minute sclerotized platelets on postero-ventral membrane as illustrated in figure 2.

Basitarsus of leg IV with moderately long macroseta on dorsal surface.

Female measurements.—Dorsal shield, length 336μ, width 182μ. Larger metapodal plate, length 38μ. Leg IV macroseta, length 42μ. Ventrolateral seta, VL_1, length 24μ. (Average—10 specimens).

Male.—Smaller than female, dorsal setal pattern same as in female except seta S_2 on dorsal shield. Chelicera with spur-shaped spermatophoral process.

T. (T.) arceuthobius is readily distinguished from its near relative *T. (T.) pini* Chant by the shape of its ventrianal shield, the presence of but two pairs of ventro-lateral setae and the length of the larger pair of metapodal plates in *T. (T.) arceuthobius.* Seta M_2 is much shorter in *T. (T.) arceuthobius* than in *T. (T.) pini.*

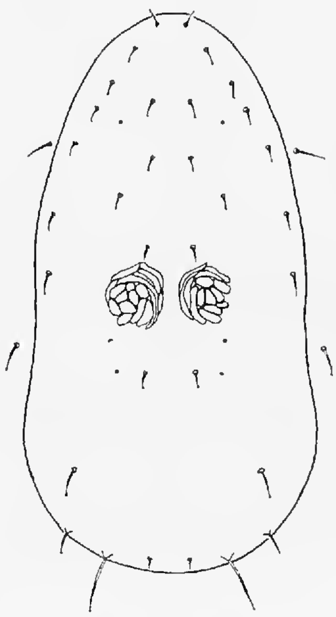
Holotype female, allotype and twelve additional female paratypes from dwarf mistletoe, *Arceuthobium campylopodum* Engelm., occurring on digger pine, *Pinus sabiniana* Dougl. from MT. DIABLO, CONTRA COSTA COUNTY, CALIFORNIA, December 14, 1960 by C. B. Huffaker and J. Hamai. The female holotype, allotype and seven female paratypes are in the collection of the University of California, Department of Biological Control. Additional paratypes have been deposited in the collection of the California Insect Survey and the United States National Museum. Additional records, all from dwarf mistletoe: Lake County, digger pine, March 28, 1961; Pinecrest, Tuolumne County, Jeffrey pine, March 28, 1961; Snow Lake, Plumas County, Jeffrey pine, May 9, 1961; Fiddletown, Amador County, digger pine, November 19, 1961.

In the several collections to date in California *T. (T.) arceuthobius* has been associated with a false spider mite, *Brevipalpus porca* Pritchard & Baker, described from dwarf mistletoe on Douglas fir in Utah. Pritchard and Baker (1958) also recorded this tenuipalpid from mistletoe on pinyon pine, ponderosa pine and Douglas fir in Arizona. Because of the difficulty in observing *B. porca* and *T. (T.) arceuthobius* on dwarf mistletoe it has not been definitely established, as yet, that this phytoseiid preys on *B. porca.* The absence of any other phytophagous species, however, lends support to a conclusion that *T. (T.) arceuthobius* is predatory upon this mite.

Typhlodromus (Amblyseius) pusillus Kennett, new species

(Figs. 3, 4)

Female.—Dorsal shield smooth, ovate in outline, widest at posterior one-third, faintly sclerotized, with distinct waist opposite seta S_2, bearing 16 pairs of setae, nine in lateral (L) series, two in median (M) series and five in dorsal (D) series. All dorsal setae minute except D_1 (35 - 39μ), L_1 (49 - 52μ), L_4 (63 - 67μ), L_9 (165 - 175μ) and M_2 (74 - 80μ).



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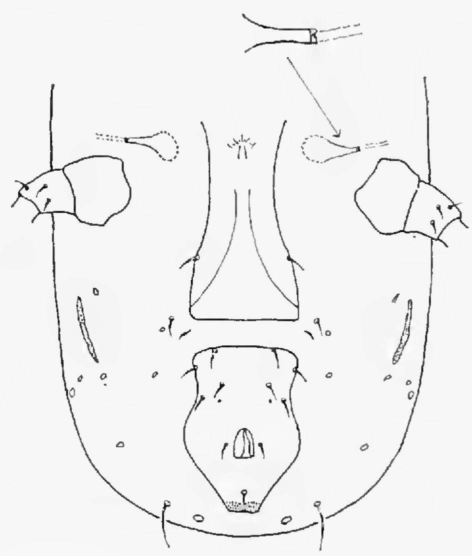

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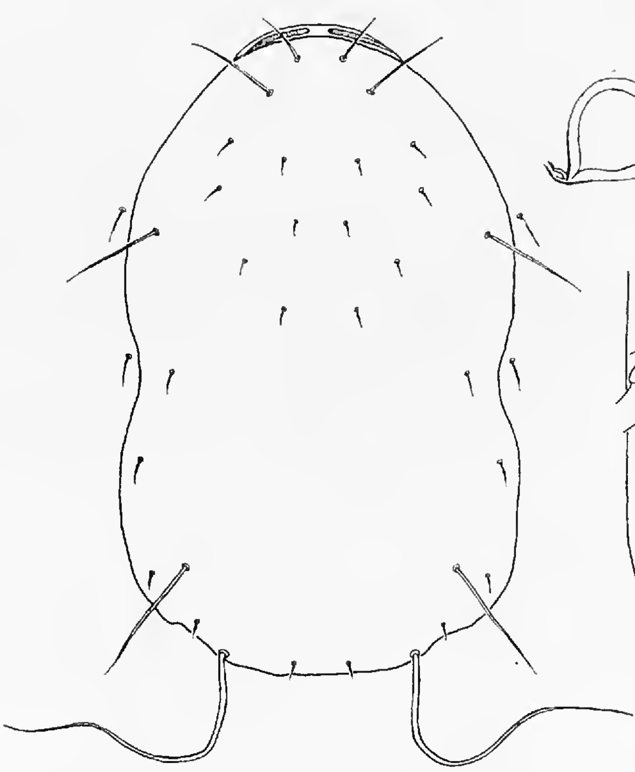

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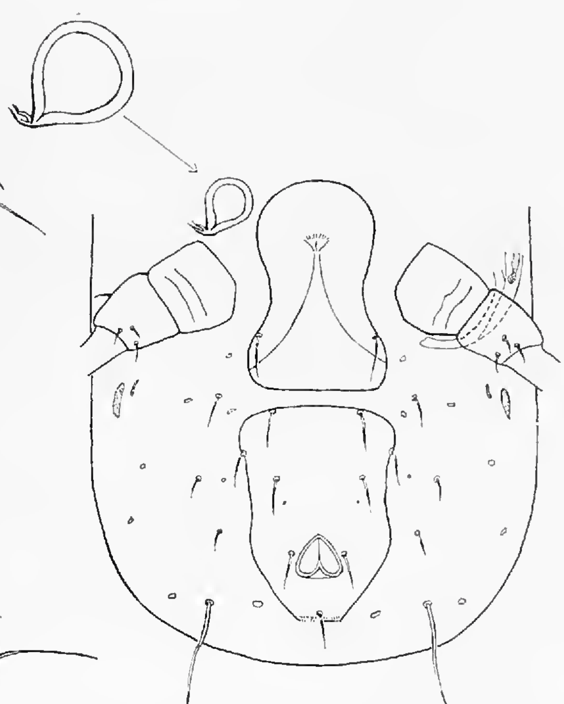

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EXPLANATION OF FIGURES

Fig. 1, *Typhlodromus (T.) arceuthobius* Kennett, female, dorsal shield; fig. 2, female, postero-ventral aspect. Fig. 3, *Typhlodromus (A.) pusillus* Kennett, Female, dorsal shield; fig. 4, female, postero-ventral aspect.

Setae D_2, D_3 and M_1, 6 - 7μ, L_5, L_7, L_8, D_4 and D_6, 10 - 12μ, L_2 and L_3, 10 - 14μ, L_6, 12 - 14μ. Setae S_1 and S_2 on lateral interscutal membrane.

Fixed digit of chelicera with three small teeth distad and one proximad to *pilus dentilis*. Movable digit with two minute teeth. Peritreme reaches anteriorly to base of seta D_1, peritremal plate ending in a blunt angle posterior to coxa IV.

Ventral plates lightly sclerotized. Sternal plate bearing three pairs of setae (25 - 28μ). Fourth pair of sternal setae arising from small metasternal plates. Genital plate typical, the single pair of setae 28μ. Spermatheca as shown in figure 4. Ventrianal plate longer (130 - 140μ) than wide (95 - 105μ), with three pairs of pre-anal setae (18 - 20μ) and a pair of minute pores. Two pairs of small metapodal plates, larger pair 23 - 27μ in length. Eight pairs of platelets and four pairs of setae on postero-ventral membrane surrounding vetrianal plate, posterior pair of setae (VL_1) 75 - 80μ in length.

Leg IV with macrosetae on genu, tibia and basitarsus. Genu of legs II and III with a seta larger than surrounding setae.

Female measurements.—Dorsal shield, length 410 - 427μ, width 238 - 252μ. Leg IV macrosetae, genu 77 - 84μ, tibia 63 - 75μ, basitarsus 81 - 88μ. Ranges - (6 specimens).

Male.—Smaller than female, dorsal shield ovate, its margin curves ventrally in mounted specimens. Dorsal setal pattern as in female except seta S_2 on dorsal shield. Ventrianal plate imbricate near anterior margin, bearing three pairs of pre-anal setae (16 - 18μ) and a pair of pores.. Chelicera with branched spermatophoral process. Dorsal shield length 330μ (1 specimen).

Typhlodromus (A.) pusillus is a member of the *T. obtusus* group as defined by Chant (1959). It is distinguished from similar species by the relative lengths of setae L_1, L_4, L_9 and M_2, absence of setae D_5, and dentition of the chelicera. A close relationship between *T. (A.) pusillus* and *Amblyseiulus dorsatus* Muma is exhibited by the similarity of their spermathecae.

Holotype female, allotype, and three female paratypes from *Arceuthobium pusillum* Peck, occurring on black spruce, *Picea mariana* (Mill.) BSP, from STOKES BAY, BRUCE COUNTY, ONTARIO, CANADA on July 13, 1961. One female and one male from *A. pusillum* at Howdenvale, Bruce County, Ontario and a single female from *A. pusillum* at Troy, Cape Breton Island, Nova Scotia on July 28, 1961. All collections by C. B. Huffaker and J. Hamai. Female holotype and allotype are in the collection of the University of California, Department of Biological Control. One female paratype is deposited in the collection of the California Insect Survey.

TYPHLODROMUS (TYPHLODROMUS) *bakeri* (Garman)

Seiulus bakeri Garman, 1948:15.

Typhlodromus bakeri (Garman), Nesbitt, 1951:36.

Typtlodromus (T.) bakeri (Garman), Chant, 1959:63.

Four females of this widely distributed species were taken from dwarf mistletoe, *A. pusillum*, occurring on black spruce in the province of Ontario, Canada, one specimen each from the following localities: Stokes Bay, Pine Tree Harbor, and Howdenvale, Bruce County on July 13, 1961, and one from Outlet Park, Prince Edward County, on July 17, 1961, by C. B. Huffaker and J. Hamai. *T. (T.) bakeri* has previously been reported from conifers in England and British Columbia by Chant (1956). The specimens agree with descriptions and figures of *T. (T.) bakeri* published by Garman (1948), Nesbitt (1951), Cunliffe and Baker (1954) and Chant (1958,1959). Determinations were confirmed by D. A. Chant.

The spermatheca as observed in the Canadian specimens bears a marked similarity to that illustrated by Dosse (1958) for *T. (T.) bakeri* in the shape of spermatophores within the vesicle. The cervix in the Canadian specimens appears to be longer, however, measuring 32μ from its base to the atrium.

TYPHLODROMUS (TYPHLODROMUS) *validus* Chant

Typhlodromus (T.) validus Chant, 1957b:290.

This species has been taken from dwarf mistletoe in California at two localities to date. Two females from dwarf mistletoe, *A. campylopodum*, on digger pine 10 miles east of Clear Lake Oaks, Lake County on March 22, 1961, by the author; and four females from the same host at Fiddletown, Amador County on November 19, 1961 by J. Hamai. Chant (1959) reported *T. (T.) validus* from California but made no reference to host plants or locality. Determination was confirmed by D. A. Chant.

ACKNOWLEDGMENTS

I wish to thank Dr. C. B. Huffaker and Mr. J. Hamai for making available a majority of the specimens studied herein and also thank Dr. Edward W. Baker for his determination of specimens of *Brevipalpus porca* and Dr. D. A. Chant for making determinations of *T. (T.) bakeri, T. (T.) validus* and the species near *T. (A.) rosellus*.

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ADDITIONAL RECORDS OF PLATYCLEIS TESSELLATA (CHARPENTIER) IN CALIFORNIA WITH BIOLOGICAL NOTES

(Orthoptera: Tettigoniidae)

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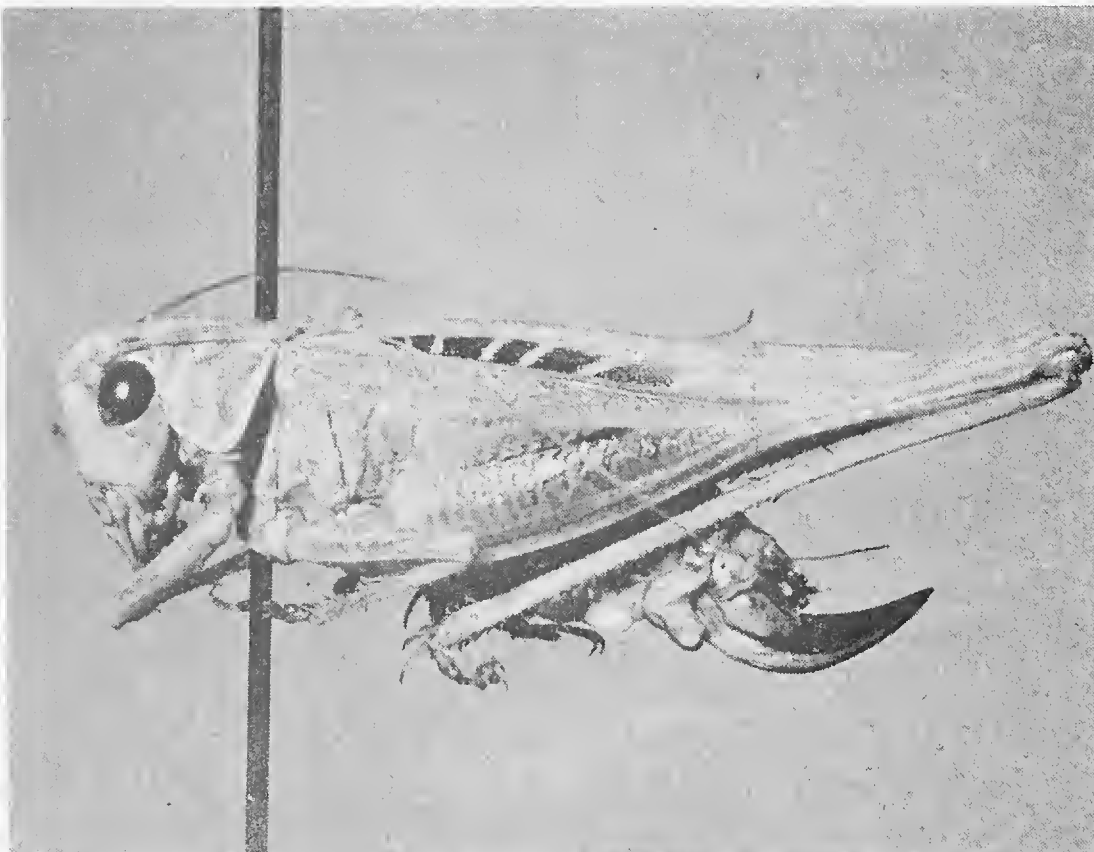
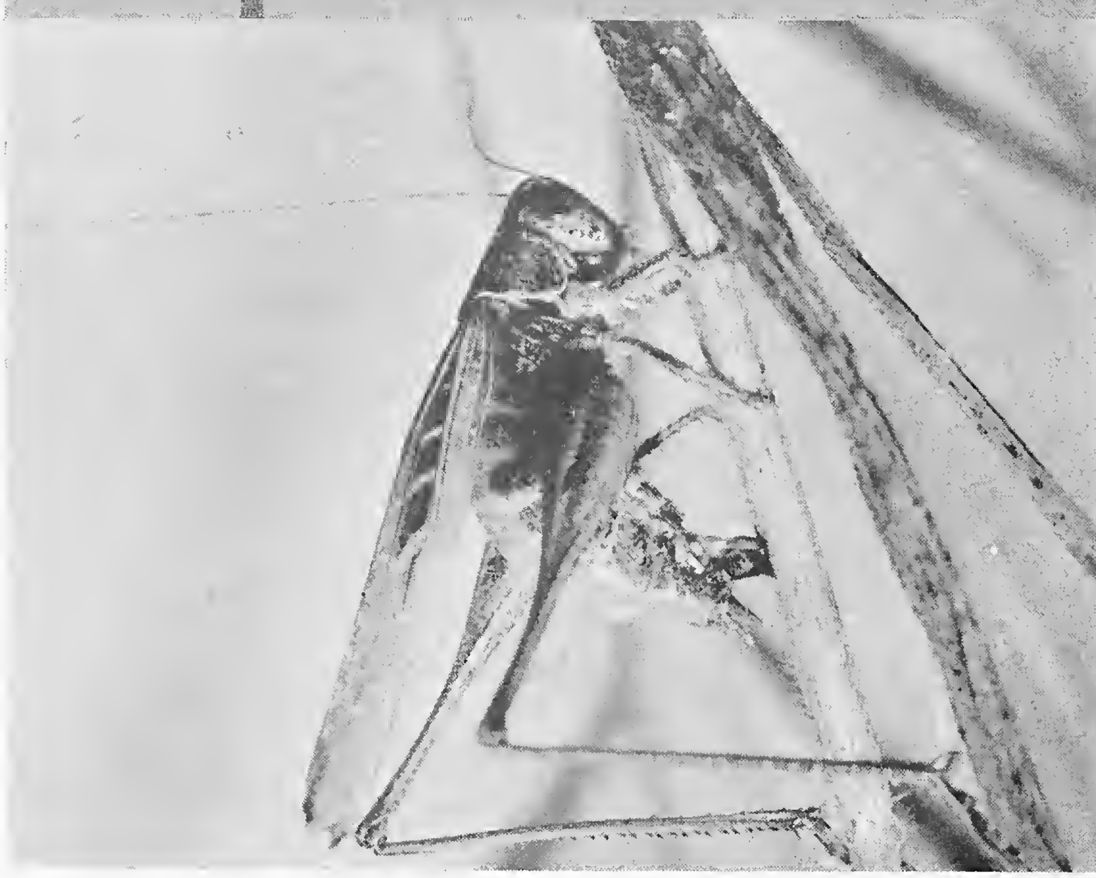
H. F. Strohecker (1955) first recorded the presence of the Mediterranean *Platycleis tessellata* (Charpentier) in California from a single male specimen collected in 1951. Many records have since become available indicating that the species is established in the state.

Specimens in the collection of the Bureau of Entomology, California State Department of Agriculture, Sacramento, were





Explanation of Figures

Fig. 1. Adult female *Platycleis tessellata* showing blade-like ovipositor and quadrate markings on the tegmen.

Fig. 2. Female *Platycelis tessellata* ovipositing in grass stem. The female chewed the stem before inserting the ovipositor.

supplied through the courtesy of Mr. George M. Buxton. These and others in my collection are from the following localities:

Amador County: Plymouth, 12-VI-1958, 29-VI-1953, 12-VII-1958. Calaveras County: Mokelumne Hill, 6-VII-1959. El Dorado County: Placerville, 13-VI-1959; Shingle Springs, 7-VI-1960. Nevada County: North San Juan, 2-VII-1960. Placer County: 8 miles Northeast of Lincoln, 3-VII-1953. Sacramento County: Sacramento, 31-V-1959. Tuolumne County: Iceberg Meadows, 9 mi. Northeast of Dardanelle, 6,450 feet elevation, 27-VI-1961; Twain Harte, 29-VI-1961. Yuba County: Beale Air Force Base, 23-IV-1961; Timbuctoo, VIII-1959.

These records indicate that the species is established in the west central Sierra Nevada Mountains to an elevation of 6,450 feet, and in the adjacent portion of the Central Valley. The author has collected the species in grassy areas near Shingle Springs, El Dorado County and it was extremely abundant in a similar habitat near Sacramento. Teneral adults and last instar nymphs were found at the beginning of June at Shingle Springs.

The species is active during the day, but appears to be most active at night. Caged specimens stridulate primarily at night. The stridulation is a very low prolonged "zwick" which is often repeated rapidly. Captive females readily oviposited in dry grass stems. Prior to oviposition the females frequently would chew a part of the stem, probably to facilitate insertion of the short, bladelike ovipositor (Fig. 2). The ovipositor resembles that of the genus *Decticita,* but is more dorsally recurved (Fig. 1). The eggs are quite elongate, uniformly black and are placed in the grass stem in small groups or in linear sequence depending upon the thickness of the stem. This is unusual since most North American Decticinae oviposit directly in the ground. Eggs were taken from a dry stem and were measured by means of an ocular micrometer. Average length was 4.05 mm; all eggs had a median width of 0.65 mm.

Platycleis tessellata seems to be related to the native genus *Decticita* in both morphology and in habits. As an adult the introduced decticid has long wings with dark brown quadrate markings laterally on the tegmina (Fig. 1).

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DESCRIPTION OF THE IMMATURE STAGES OF CRYPTOLABIS MAGNISTYLA ALEXANDER

(Diptera: Tipulidae)

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The genus *Cryptolabis* is one of the few crane-fly genera for which no immature stages have previously been found or described. At Salmon Creek, located in Monterey County 1.5 miles north of the San Luis Obispo County line on U.S. Hwy. No. 1, a number of larvae and pupae of this genus were collected and were then reared in the laboratory to the adult stage. Alexander found this fly to be a new species and has published a description of the adult (Alexander, 1962).

Collections were made with a plankton net. The immature forms were kept at cool temperatures until they could be transferred to an "artificial stream" for rearing in the laboratory. The recirculating water in the stream was kept at 16° C, which corresponded favorably with the temperatures in the natural stream.

Cryptolabis magnistyla is univoltine, emerging about the middle of June and reaching a population crest about the first week of July. Some adult specimens may still be found in late July and during the first part of August. They are found in great numbers on the vegetation along the stream.

The eggs are laid at the surface of the stream and, due to the presence of a hard slippery cuticle and to their shape, they sink rapidly in the water and work into the sand and gravel on the bottom. The egg develops in ten days at room temperature, and it is assumed that at the cooler natural stream temperatures (10° to 16° C), the developmental period would be somewhat longer.

The larvae are entirely aquatic and in Salmon Creek are found in sand and gravel beneath one to twenty-four inches of swiftly flowing water. During the rains of the winter season, the depth of rushing water over the same habitats is approximately eight feet. The larvae are very sensitive to changes in temperature of the water and soon die after removal from the natural habitat unless kept at a temperature of less than 17° C. Found associated with the larvae of *Cryptolabis* are members of the crane-fly genera *Hexatoma* and *Limnophila*. Whether the plentiful numbers of *Cryptolabis* larvae serve as food for these probably carnivorous species has not as yet been determined.

The pupae of *Cryptolabis* remain in the larval habitat until just prior to emergence of the adults. They then rise to the surface, and the adults emerge while the pupal case floats at the surface of the water or after it has been washed to the sides of the stream. These field observations coincide with those made on specimens reared in breeding cages in the artificial stream. Emergence under natural conditions and in the artificial stream was always observed to occur at night. Copulation and oviposition behaviors of these flies were observed in the breeding cages, and most of these activities appeared to be confined to the period between dusk and dawn. In the breeding cages pairs were observed to copulate while resting on the surface of the flowing water. Copulation in nature was most often observed on the undersides of leaves.

The following descriptions of the immature stages were drawn from observations made upon ten eggs, twenty-five larvae, and twenty-five pupae.

Egg. Length 0.31 mm; width 0.14 mm. Oval or nearly trapczoid; chorion black, smooth, hard and slippery. The dorsal surface convex, the ventral surface flattened.

Last instar larva. Length 8.3 to 11.4 mm; width 0.5 to 0.9 mm. Cuticle colorless and covered with very short, pale gold pubescence. On each segment are scattered a few very long setae. The spiracular disk (Figs. 5, 6) has four lobes, with the two dorso-lateral lobes being shorter than the two ventral lobes. All the lobes are variously pitted where the setae originate. The dorsal lobes bear setae only on the upper surface, while the ventral lobes have setae over the entire surface. The spiracles contain no pigment, and their position is indicated on the drawing by broken lines. Ventral to the spiracular disk are four anal lobes, which are clear, fleshy and pointed.

Head capsule: Length 0.345 to 0.391 mm; width 0.136 to 0.187 mm. Typically Eriopterine, consisting of a dorsal and two lateral plates. The dorsal plate is sclerotized heavily along the lateral and posterior margins. The lateral plates are also sclerotized along the margins which continue far caudad of the central membranous portions (Figs. 2, 3).

The labrum is a protruding, fleshy, nearly triangular structure; dorsally, it is clearly separated by a suture from the fronto-clypeal region. The entire anterio-ventral margin of the labrum bears a row of thick, blunt, recurved, golden setae forming the labral brush. Articulating with, and extending from, the ventral edge of the lateral plates of the clypeal region are two flattened rods (the tormae) which are borne on the epipharyngeal surface

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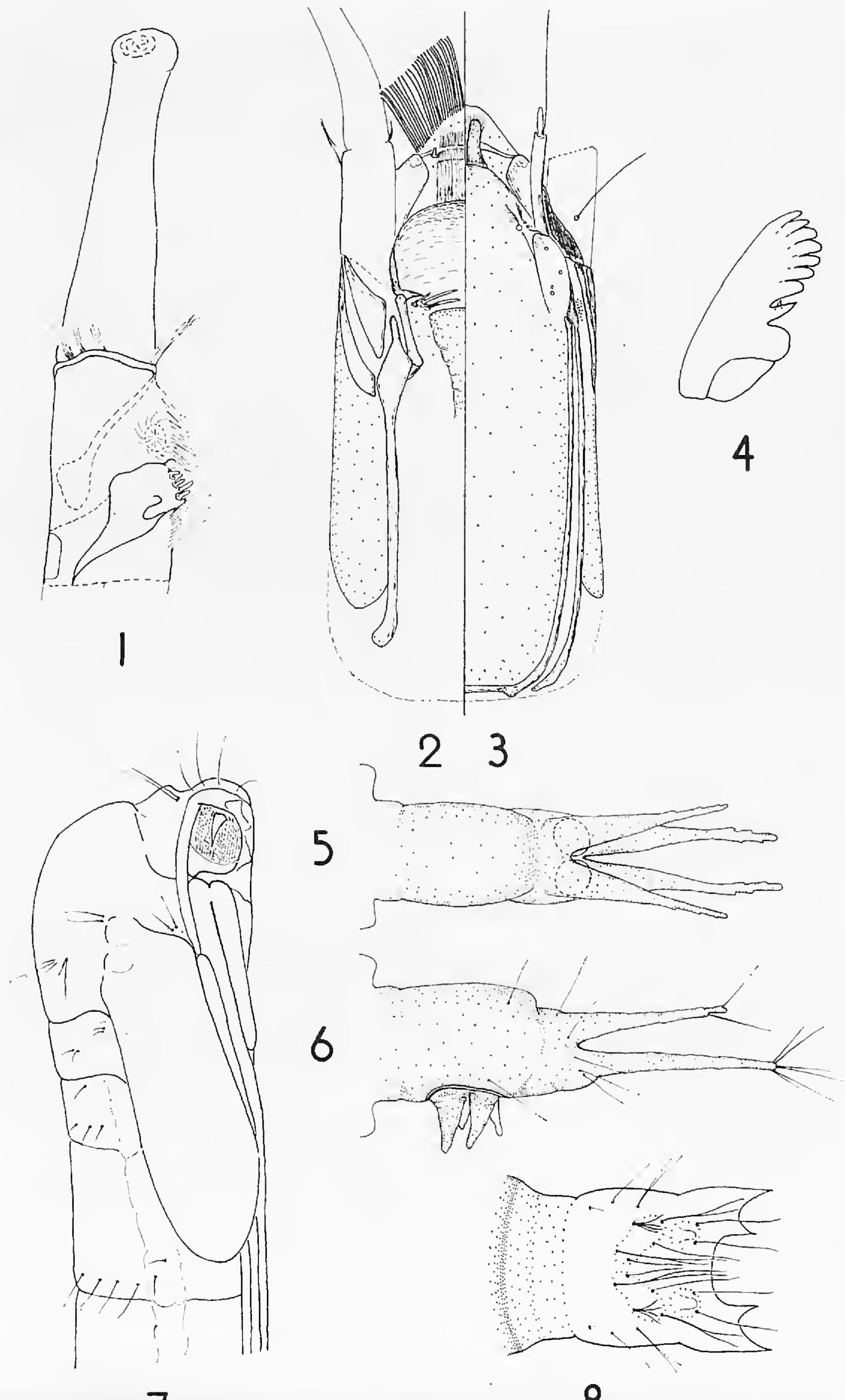
EXPLANATION OF FIGURES

Cryptolabis magnistyla Alexander. Fig. 1, Maxilla of larva, ventral view. Fig. 2, Larval head capsule, ventral view. Fig. 3, Larval head capsule, dorsal



view. Fig. 4, Larval mandible, lateral view. Fig. 5, Larval spiracular disk, dorsal view. Fig. 6, Larval spiracular disk and anal lobes, lateral view. Fig. 7, Pupa, lateral view. Fig. 8, Male pupal cauda, dorsal view.

of the labrum near the clypeo-labral suture. Dorsally, there are two large cylindrical papillae which arise near the clypeo-labral suture and which appear to belong to the labrum; the anterior third of each of these papillae is heavily setulose. The anterior rim of the fronto-clypeal area is composed of a semicircular central lobe with a triangular sclerite on each side. The palatal surface bears three rows of setae. The first row is about one-half as long as the second and is directed cephalad. The second row lies directly behind the area of the tormae and extends caudad to the mouth opening; a short stout papilla is located at either end of the row. The third row of setae is behind the second, directed caudad and extending to the mouth opening. The antennae are elongate, cylindrical, curved and slightly enlarged at the anterior end. At the tip of each antenna are located one large papilla and three setae, two ver yshort and one nearly as long as the antennae. The mandible (Fig. 4) has eight teeth along its ventral edge, the first (or apical tooth) through the seventh curving slightly mesad. The eighth tooth turns mesad forming a nearly perpendicular angle with the dorso-ventral axis of the tooth. At the base of this tooth is a much smaller tooth which is directed vertically. The maxillae (Fig. 1) are modified in that the palps are greatly enlarged, being longer than the basal stipes. The aboral margin of the stipes where it is fused to the palp is sparsely setulose. Along the mesal edge of the stipes is a long tuft of setae. From this tuft and continuing caudad along the oral surface of the stipes is a thick row of setae, which, in reference to the other mouthparts, is continuous with the labral brush. Nearly midway along the oral surface is found a group of lightly sclerotized tubercles. The aboral or dorsal articulation of the mandible and maxillae with the ocular plate has undergone a curious type of development in this genus. A sclerotized area in the form of a triangular plate extends from the base of the maxillae to a point at its distal end where it articulates with the flattened expansion of the ventral rod. This expansion of the ventral rod may represent a remnant of the maxillary plate. The previously mentioned triangular plate may be a fragment of the ocular lobe, or it may be the cardo. The mandible also articulates with another longer, triangular plate which curves caudally and ventrally to articulate with the remnant of the maxillary plate posterior to the fragment of the ocular lobe (or cardo). It is proposed that this plate be called the mandibular fragment of the ocular lobe. The hypopharynx is membranous, bulbous and possesses a triangular sclerite on each side which articulates with the rod-like vestiges of the submentum. Mesal to this articulation, on eac hside, is a group of fleshy papillae. The salivary duct opens into the alimentary tract between these vestiges of the submentum. The surface of the hypopharynx is covered with rows of spatulate, toothed, slightly curved setae.

Pupa. Length 5.4 to 6.6 mm; dorso-ventral width at base of wing pads 0.54 to 0.87 mm; dextro-sinistral width at base of wing pads approximately the same as that of the dorso-ventral width. Form terete, with abdominal segment 8 slightly, but abruptly, smaller than segment 7. Integument thin; details of the adult fly easily seen in older pupae. Color in life pale yellow, with thoracic dorsum darker; wing pads, eg sheaths and face darker brown in older specimens; eyes changing from reddish to dark brown as pupa matures. Body armed with long setae (Fig. 7). A row of six setae is present in a groove between the antennal sheath and median area of the prothorax. The mesothorax lacks breathing horns; the dorso-cephalic margin convex; carinate medially for nearly half its length; not armed with spines or tubercles; two setae located at the junction of the antennal sheaths and wing pads; two setae also occur just dorsad of the base of the wing pads. On the dorsum of the mesonotum two groups of setae occur at a point one-fourth the length of the mesonotum from the posterior margin of the mesothorax, the mesal group composed of four to five setae, the ventral group of two to four setae. The wing pads end anterior to the junction of the second and third abdominal segments. The leg sheaths extend nearly to the caudal margin of the third abdominal segment with the prothoracic and metathoracic sheaths subequal, the mesothoracic sheaths somewhat shorter. The chaetotaxy of abdominal segments 2 to 7 is a single transverse row of setae just cephalad of the posterior margin of the segment. The dorsum of the cauda (Fig. 8) bears four blunt mounds from which weakly sclerotized, finger-like lobes protrude, the anterior pair directed more caudad than the posterior pair, the posterior pair more prominent. The drawing shows from one to four setae arising from specific areas. In actuality, each of these areas from which setae originate may have pencils of from one to four setae, depending upon the condition of the specimen.

Cauda of the male with the ventral lobe bulbous, short, crenulate and bearing a long seta at the base of either side; dorsal lobes furcate with the outer spine longer, the entire lobe directed slightly dorsad. As in the adult stages, the female cauda are very similar to those of the male in external appearance.

Further work should be done on the morphology of the larval forms of members of the tribe Eriopterini before such information can contribute to the study of relationships among these flies. Upon the basis of adult characteristics, Alexander (1956) placed the genus *Cryptolabis* in a subtribe along with *Molophilus*, *Tasiocera*, *Ormosia* and *Erioptera*. The armature of the pupa and the characteristic long setae of the larval forms, along with the elongate antennae of the larval head capsule, suggest a close relationship with the genus *Rhabdomastix*. The peculiar fragmentation of the lateral extension of the ocular plate is similar to that found in the head capsules of the genera *Teucholabis* and *Gonomyia*, which are otherwise quite different larval forms. The absence of mesonotal breathing horns in the pupa and the elongated lobes of the spiracular disk of the larvae may be important in the placement of the genus within the Eriopterini; however, both of these characteristics are subject to interpretation. The pupae of certain other species which lack breathing horns have as their habitat swiftly flowing water. Notable among these is *Erioptera claripennis* Alexander of South Africa (Wood, 1952). *E. claripennis,* too, has elongate lobes of the spiracular disk. This latter condition is also found among members of the subgenus *Elaeophila* of the genus *Limnophila.* The members of this subgenus are found quite often in the same type of habitat described above for *Cryptolabis.* The extended lobes aid the larvae of *Cryptolabis* in maintaining their position in streams, with the long setae entwining in the filamentous algae which are adhering to the substrate. Consequently, these characters suggest a close correlation of structure to habitat, and this must be considered when using these characters in the placement of the genus within the Eriopterini.

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A NEW OEDIPODINE GRASSHOPPER FROM CALIFORNIA

(Orthoptera: Acrididae)

H. F. Strohecker and George M. Buxton
University of Miami and California Department of Agriculture

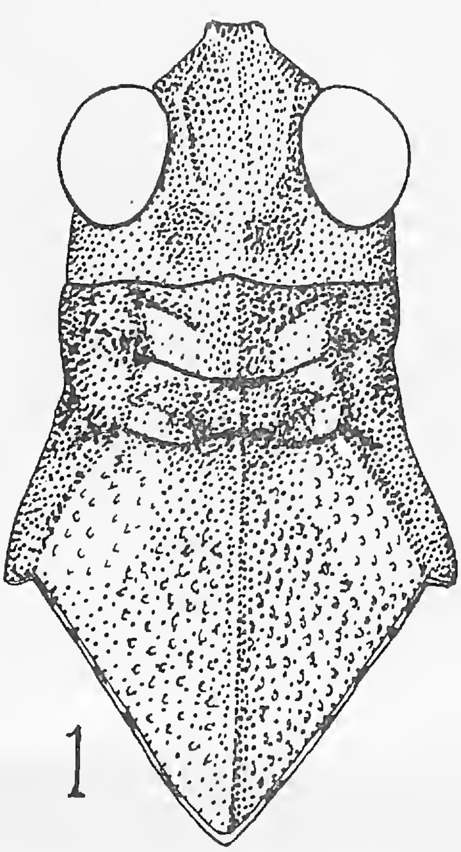
Field studies by personnel of the California State Department of Agriculture have resulted in the finding of *Aerochoreutes carlinianus* (Thomas) in California; two males and a female have been studied. These specimens, from Grass Valley in western Nevada County, are referable, on the basis of head structure, to the race *strepitus* Rehn, and the wing venation of one of the males also accords with the pattern of this race. The other male, however, presents a wing venation more like that of *carlinianus* proper. The wings are hyaline with dark veins and veinlets, the radiate veins with dark "pencilling" (Rehn 1921, Trans Amer. Ent. Soc. 47:171-197. The body and tegmina are dun colored, similiar in appearance to Great Basin specimens.

These field studies have also led to the accumulation of a series of *Aerochoreutes* from localities in the Coast Range of northern California. While the wing structure of these insects is that of *Aerochoreutes* the sum of their characters makes identification with either race of *carlinianus* unsatisfactory.

Aerochoreutes stenometopus Strohecker & Buxton, new species

(Figs. 1, 2)

Male: slender for the genus, compressed, its habitus that of a *Trimerotropis.* Antennae stouter than in *carlinianus,* a little longer than head and pronotum combined, basal articles, except first two, considerably flattened, those distal to mid-length subcylindrical, none twice as long as broad. Head with frontal costa deeply sulcate below the ocellus, which lies under a transverse ridge. Above this ridge the costa is moderately widened, tumid, with a circular impression. Fastigium as long as wide, no wider than the dorsal width of an eye, shallowly sulcate with weak median carina. Foveolae long-triangular. Eyes very large and prominent, their depth equal to or exceeding the length of the genal groove. Pronotum elongate, lateral carinae rather sharply developed on front of metazone, traceable as callosities on prozone. Median carina tumid on prozone, linear on metazone. Disc of metazone flat, granulate. Lateral lobes perpendicular, deeper than long. Anterior margin of pronotum subangulately advanced on the occiput, posterior margin acute-angulate (about 70°), the sides of the angle almost straight, the apex narrowly rounded. Tegmina surpassing tips of hind femora by less than one-third tegminal length, their contour and venation normal for the genus. Wing with contour and venation as in nominate *carlinianus,* all the superjacent radiate veins enlarged, 4-6 stouter than those preceding but narrowing basad and tapering distad. Ulnar vein very feebly undulate basad but producing no marked difference in the width of median and ulnar areas in



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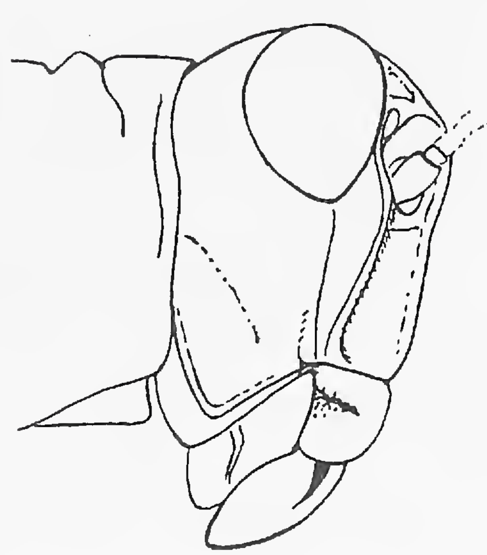

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Explanation of Figures

Aerochoreutes stenometopus Strohecker and Buxton: fig. 1, head, pronotum of male in dorsal view; fig. 2, head of male in lateral view.

its middle third. *Coloration:* dark gray overall, fastigium, occiput, disc of pronotum and thoracic pleura darker. Prozonal portion of lateral lobe fuscous with three more or less distinct white spots, two above and one below. A broad whitish band runs along each side of the dorsum from the front margin of pronotum to the humeral angle, the bands wider on metazone. Hind femur gray with some poorly defined dark areas on outer face, lower sulcus yellow with preapical dark band, inner face yellow with two black bands but in some specimens the basal half is suffused with black. Tegmen dark gray, the basal third darker. In some specimens there is an incomplete fuscous cross-band near the middle of the tegmen. Wing with disc and veins of radiate field pale yellow, the swollen veins with dark "pencilling" distad only and this lacking on 4-6. In the antero-distal portion of the wing the membrane is hyaline with dark veining, and a group of dark veinlets in the basal half of the median and ulnar areas appears as a diffuse cloud.

Measurements (mm.): length of pronotum 5.5-6.5 (5.92 ± .27); of tegmen 22-24; of hind femur 11-12.5 (11.70 ± .35). *Female:* larger, more robust and less compressed than male. Antenna slenderer than in male, some of its middle artieles almost twice as long as wide. Frontal costa deeply sulcate below the ocellus, slightly sulcate above, widened at level of antennal bases. Fastigium slightly wider than long, about as in male of *carlinianus strepitus.* Eyes large and prominent, dorsal width of eye slightly less than maximum width of fastigium, its depth hardly less than the length of genal groove. Pronotum generally similar to that of male, more widened behind, its posterior margin decidedly acute-angulate, the sides of the angle straight, the apex sharply rounded. The wing differs from that of the male in the usual sexual features, i.e. it is of narrower form and the radiate veins are less swollen.

Measurements (mm.): lengt! of pronotum 6.7-7.4 (7.04 ± .21); of tegmen 27-30; of hind femur 13.0-14.0 (13.5 ± .32).

Holotype male and allotype from Telephone Camp Ground, Glenn County, California, August 20, 1958, P. H. Arnaud and H. H. Keifer (California Department of Agriculture).

Paratypes: 15 males and 6 females with same data as holotype; 7 males and 1 female, 3.5 miles north of Black Butte Mts., Mendocino County, August 27, 1953, F. L. Blanc; 3 males and 4 females; 1 male and 1 female, Plaskett Meadows, Glenn County, September 14, 1960, G. M. Buxton; 4 males and 1 female, Cold Springs, South Fork Mt., Trinity County, September 18, 1962, F. L. Blanc and G. M. Buxton.

A. stenometopus may be distinguished from other forms of the genus by the pale yellow color of the wing disc and radiate veins. Its narrower fastigium, stout antennae and acutely angled pronotum are other distinguishing features. The similarity of all the specimens listed above is so great that material from all localities has been treated together.

Plaskett Meadows, Telephone Camp Ground, Grindstone Canyon, and the site three miles north of Black Butte are, in a broad sense, the same collection locale. These places are readily accessible by the Alder Springs Road, which proceeds from the Plaskett Ranger Station in a northwesterly direction through the northwest corner of Glenn County and into southeastern Mendocino County. The road and adjacent ridge and the highest part of the range between the ocean fifty miles to the west and the Sacramento Valley to the east. The ridge is particularly humid and the dwarfed vegetation along the crest attests the heavy snowpack. The wind, from the west, is constant and brisk. Vegetation is locally sparse and large dusty areas appear as the short summer season advances. The Cold Springs area of the South Fork Mountain of Trinity County is very similar to the Glenn-Mendocino County site. The elevation of these separate ridges is between 5,800 and 6,500 feet.

The flight habits of *A. stenometopus* are similar to those of *Circotettix* spp.; the insect after taking off rises to a height of perhaps fifteen to thirty feet, then snaps at irregular intervals before gliding down and alighting.

The Sacramento Valley apparently forms a barrier sufficient to separate this Coast Range form from more eastern populations of *Aerochoreutes*. The genus has not been recorded from Oregon but has been collected just east of Prineville by Mr. Kenneth Goeden and idenified by Dr. Ashley Gurney as *carlinianus*. Dr. Gurney has compared specimens of *stenometopus* with Oregon material of *carlinianus* and has assisted us further by sending a male from the Prineville area for our study. We have given specific designation to the Coast Range population since comparison of the series from this area with Oregon material and eastern California specimens of *carlinianus* gives no evidence of intergradation. The specific name is an adjective derived from *stenos* στενος (narrow) and *metopon* μετωπον (forehead).

Study of *Circotettix maculatus* Scudder along with the species of *Aerochoreutes* suggests that the latter genus may be broadened to include *maculatus,* which was removed from *Circotettix* by Rehn, without re-assignment. The wing of *maculatus,* while narrower and with less swollen radiate veins than that of *stenometopus,* shows considerable similarity of venation, and the two insects are in other features much alike.

A NEW SPECIES OF THE GENUS MALEZONOTUS FROM CALIFORNIA

(Hemiptera-Heteroptera: Lygaeidae)

PETER D. ASHLOCK
University of California, Berkeley

In 1958, I published a revision of the genus *Malezonotus* (Rhyparochrominae, Gonianotini) based on most of the important collections of Lygaeidae in the country. It was consequently a surprise to receive from Mr. Charles W. O'Brien four adult specimens of an eighth species of the genus (Fig. 3). Mr. O'Brien later returned to the collection locality and collected a total of 128 adult specimens and several nymphs. The bugs were found in and under a rotted fallen log in the company of an ant, *Formica (Proformica) limata* Wheeler (keyed in Creighton, 1950), one of a group that feeds on small arthropods and honeydew. The *Malezonotus* is a good mimic of the ant: Mr. O'Brien characterized its movements as exceedingly rapid, even for a lygaeid. Since the bug is a dry seed feeder, there seems to be no other intimate relation between the bug and the ant.

Malezonotus obrieni Ashlock, new species

Head punctate, with appressed golden pile; length, 0.80 mm; width, 1.02 mm; interocular space, 0.60 mm; antennal segment II slightly longer than IV; lengths: I, 0.32 mm; II, 0.90 mm; III, 0.71 mm; IV, 0.82 mm. *Pronotum* lightly punctate to rugose on posterior lobe, covered with appressed golden pile, sides nearly parallel to slightly constricted posteriorly; median length, 0.82 mm; greatest length, 0.95 mm; width, 1.08 mm. *Scutellum* obscurely punctate with appressed golden pile, impunctate and glabrous on midline; length, 0.75 mm; width, 0.86 mm. *Hemelytra* with small subappressed hairs in each puncture, in brachypterous form (only form known) claval suture absent, apical margin of corium straight, membrane more than half as long as apex of corium, attaining segment V. *Abdomen* with appressed golden pile ventrally and on tergites IV through VII (IV through VIII in female). *Fore femur* moderately incrassate; length, 1.14 mm; width, 0.30 mm; armed beneath with four spines, the most distal smallest, the next basal largest, no spines in basal quarter. Paramere as in figure 1; spermatheca as in figure 2.

Proximal two antennal segments, legs, labium, explanate lateral margins, and posetrior margins of prothorax dark castaneous. Acetabula yellow. Hemelytra white anteriorly to level of apex of scutellum, black beyond scutellum, claval commissure area testaceous; membrane white on basal half, black apically. Remaining parts black.

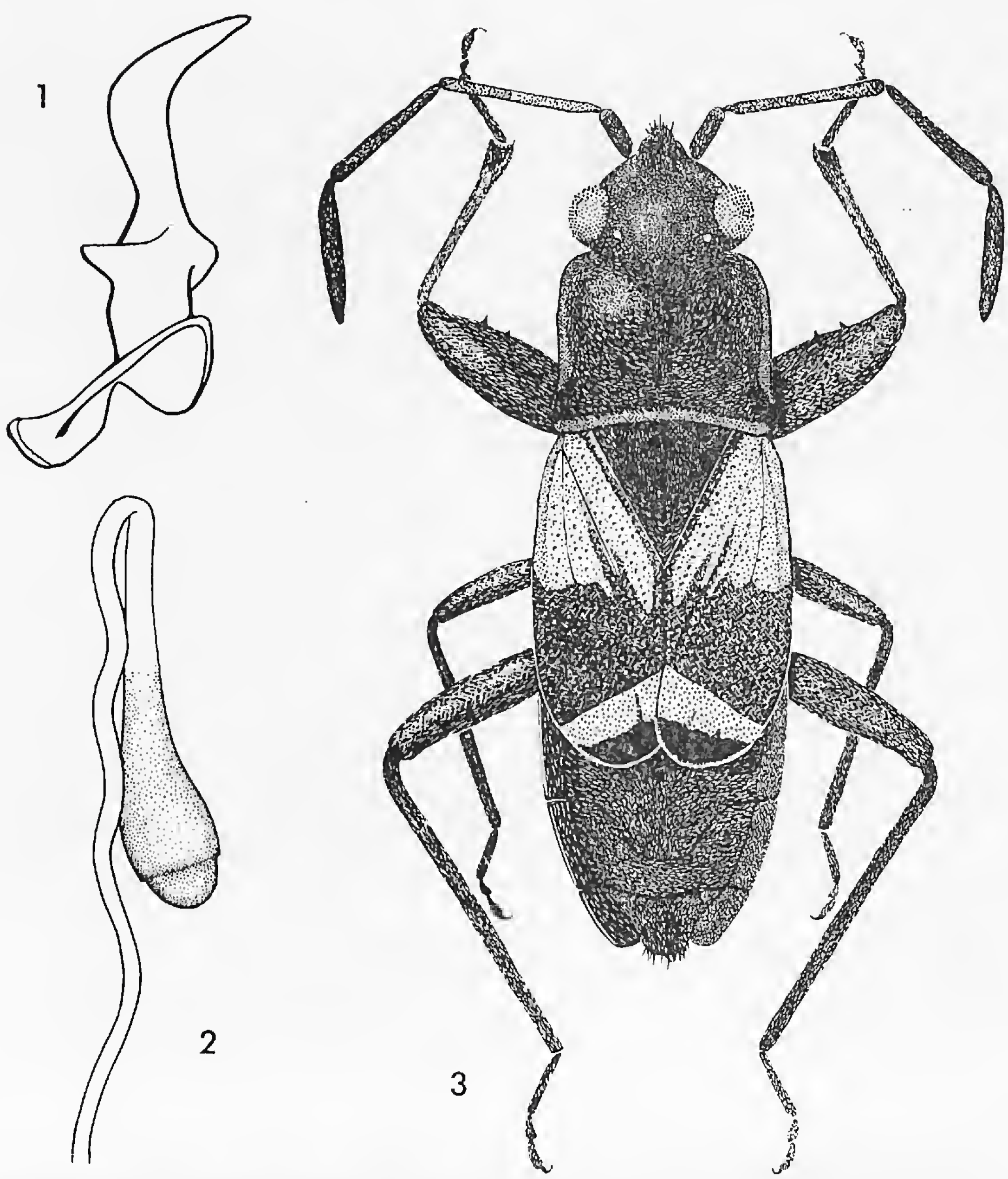
Size: male, length, 4.4 mm (4.1-4.5 mm), width, 1.3 mm; female, length, 4.8 mm (4.6-5.3 mm), width, 1.5 mm.

Holotype: brachypterous male, 5 MILES EAST OF SMITH MEADOW,

NINE MILE CANYON, 7,850 FEET, TULARE COUNTY, CALIFORNIA, VIII-17-1962, C. W. O'Brien, collector. Deposited in the California Academy of Sciences.

Paratypes: same data as holotype, 13 ♂♂, 9 ♀♀, 9 nymphs; same data but VII-22-1961, 3 ♂♂, 1 ♀, 1 nymph; VIII-5-1961, 23 ♂♂, 18 ♀♀; VIII-6-1961, 3 ♂♂, 5 ♀♀; VIII-19-1961, 32 ♂♂, 20 ♀♀, 1 (abdomen missing).

Malezonotus obrieni is a member of the *M. angustatus* group of the genus, as can be seen by the dorsal rather than lateral de-



EXPLANATION OF FIGURES

Fig. 1. Paramere, right, dorsal view. Fig. 2. Spermatheca.
Fig. 3. *Malezonotus obrieni*, dorsal view.

pression on the distal process of the shank of the paramere, by the vestiture of the abdominal dorsum, and by the prothorax, which is longer than the scutellum. In some ways, this species approaches the *M. rufipes* group of the genus: the blade of the paramere is narrow and the fore femur is similarly less incrassate. Moreover, the color pattern of the hemelytra is anteriorly pale and posteriorly dark. This species is most like *M. angustatus* in general appearance, but lacks the ferrugineous coloration on the hemelytra characteristic of that species. Like *M. barberi*, the brachypterous *M. obrieni* lacks a claval suture. The following key may be substiutted for the first two couplets of the previous key to the genus (Ashlock, 1958).

1. Pronotum one-fifth longer than scutellum 2
   Pronotum equal to or shorter than scutellum 3
2. Corium chiefly ferrugineous, occasionally infuscated; explanate lateral margins of pronotum concolorous with disk; hind tibia black, contrasting with castaneous hind femur; brachypterous form with claval suture present . . *M. angustatus* (Van Duzee)
   Corium black with pale markings; explanate lateral margins of pronotum paler than disk; hind tibia not black, concolorous with hind femur; brachypterous form with claval suture absent 2a

2a. Corium pale only along lateral margins and sometimes on claval suture; fore femur with a spine in basal quarter; hemelytra of brachypterous form about as long as exposed part of abdomen . . . . *M. barberi* Ashlock
   Corium anteriorly pale, posteriorly black; fore femur without a spine in basal quarter; hemelytra of brachypterous form nearly twice as long as exposed part of abdomen . *M. obrieni* Ashlock

It gives me great pleasure to dedicate this attractive new species to Mr. Charles W. O'Brien, of the University of California, not only in recognition of the fact that he discovered and collected all of the known specimens of the species, but also as public acknowledgment of the many specimens of rare Lygaeidae that have been the result of his careful collecting. I would also like to thank Mr. Dan Janzen for help with the identification of the ant.

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A NEW SPECIES OF ANTHIDIUM FROM CALIFORNIA

(Hymenoptera: Megachilidae)

Elbert R. Jaycox
Entomology Research Division, Agric. Res. Serv., U.S.D.A., Logan, Utah[1, 2]

This paper is presented to provide a name for use in a paper on the anthidiine bees of California being prepared by Dr. Albert A. Grigarick, University of California, Davis. The author examined material from the collections of University of California at Riverside, Berkeley, and Davis, University of Kansas, and the California Academy of Science. Thanks are due P. H. Timberlake, A. A. Grigarick, and G. I. Stage who provided specimens and to G. E. Bohart and Karl V. Krombein for their suggestions and review of the manuscript. The holotype will be deposited in the California Academy of Science and paratypes will be distributed to the U.S. National Museum and the collections listed above.

Anthidium pallidiclypeum Jaycox, new species

Male.—Length about 13 mm, forewing length 9 mm. Base body color deep brown to black. Hair white on venter, sides and clypeus, grading into off-white or tan on dorsum. Head: Black; clypeus, spot above each eye, lateral face marks to level of antennal sockets, mandibles except apical teeth, cream color; labrum with dorsal projections; facial hair heavy to level of ocelli; clypeus coarsely punctate overall with narrow translucent rim at apex. Mesosoma: Black; tubercles, tegulae except for central spot, two stripes on scutellum, basitarsi, external stripe on tibiae, various spots or apical stripes on femora, light yellow. Metasoma: Deep brown to black; four spots on first and second metasomal terga, medially interrupted broad bands with anterior notches on terga three to five, four spots on sixth tergum, lateral ones small and on straight lateral spines, two spots on pygidium, light yellow. Apical rim of tergum five without hair and bearing punctures in chainlike arrangement, one or less puncture width apart ,10-12 punctures/0.33 mm). Punctures on rest of tergum of two sizes, in less conspicuous chains two or more widths apart. Pygidium (fig. 1) narrowed caudally, processes broad, about same width as distance to central spine, broadly angulate apically, sinus shallow; seventh metasomal sternum (fig. 3) broadly rounded without lateral lobes but with central carina extending half way across sternum from anterior edge; ninth metasomal sternum (fig. 2) bifurcate at apex, the bifurcate portion bent ventrally; setal brush on fifth sternum off-white, about one-third as wide as sternum and with straight caudal edge.

Female.—Length about 10 mm, forewing length 8 mm. Basal body color and hair as in male, scopa white with dark brown apex. Head: Similar to male but differing as follows: clypeus with basal black area and anteriorly flattened black apical rim; clypeal margin sinuous centrally with paired

[1] In cooperation with Utah Agricultural Experiment Station.
[2] Present address: Department of Horticulture, University of Illinois, Urbana, Illinois.

lateral projections, small outer and prominent, smoothly rounded inner ones (fig. 4); stripe above each eye, lateral face marks triangular, mandibles sexdentate. Mesosoma: As in male but with narrow lines of yellow on scutum beside tegulae. Metasoma: As in male but differing as follows: pygidium with central notch as wide as deep; central section subtruncate, twice as wide as lateral sections; lateral portions broadly angulate without toothlike projections (fig. 5).

Holotype male (CAS), SAN BERNARDINO MOUNTAINS, CALIFORNIA, 3800 feet, May 15, 1937 on *Ceanothus* (E. G. Linsley).

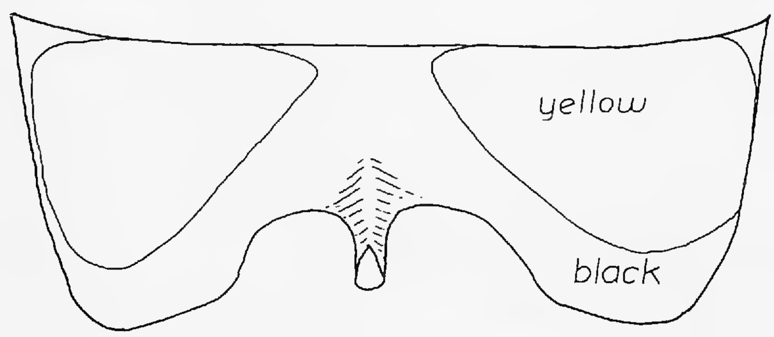


Fig 1. Pygidium, ♂

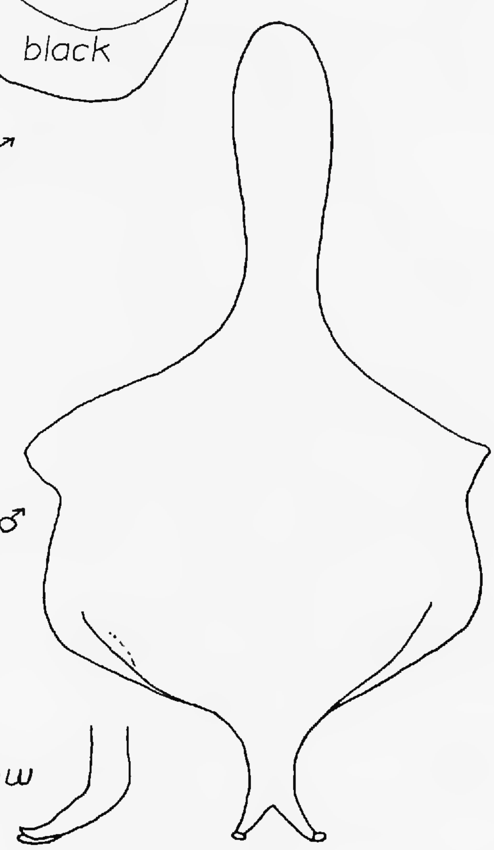


Fig. 2. Sternum IX, ♂

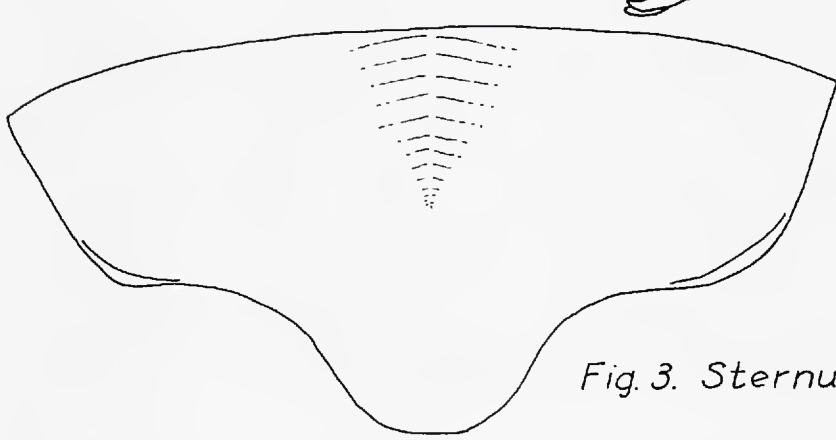


Fig. 3. Sternum VII, ♂

Figs. 1-3. Diagnostic characters of male *Anthidium pallidiclypeum*.

Paratypes, 23 males, 13 females, all from California, May 15 to July 12, as follows: Los Angeles Co.: Tanbark Flat, part on *Lotus* (R. L. Anderson, R. C. Bechtel, T. R. Haig, J. C. Hall, H. L. Hansen, P. D. Hurd, W. O. Marshall, H. L. Mathis, A. T. McClay, H. R. Moffitt, J. H. Nakata); Riverside Co.: Anza (H. R. Moffitt), Pinon Flat, San Jacinto Mts., (C. D. Michener, E. C. Van Dyke), Gavilan, on grass and *Lotus scoparius* (C. M. Dammers, P. H. Timberlake); San Bernardino Co.: Cajon Pass (E. C. Van Dyke), Lake Arrowhead 10 miles north, Desert Springs (P. H. Arnaud, Jr.), San Bernardino Mts., 3800 feet, on *Ceanothus* (E. G. Linsley), Deep Creek, on *Lotus scoparius* (P. H. Timberlake), Adelanto 10 miles south, at *Salazaria* (P. H. Timberlake); Monterey Co.; Hastings Nat. Hist. Res., Jamesburg, one on *Collinsia bicolor* (C. D. Michener).

The color patterns of specimens examined show considerable variation, the usual condition among *Anthidium* species. Para-

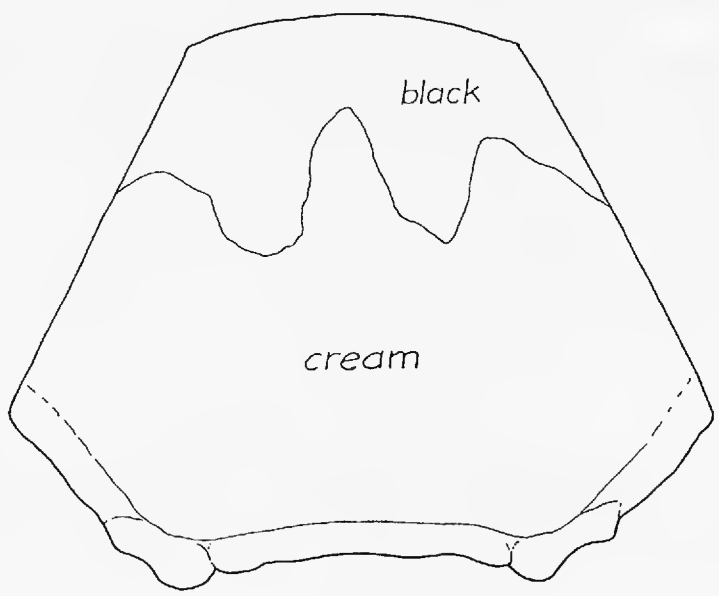


Fig. 4. Clypeus, ♀

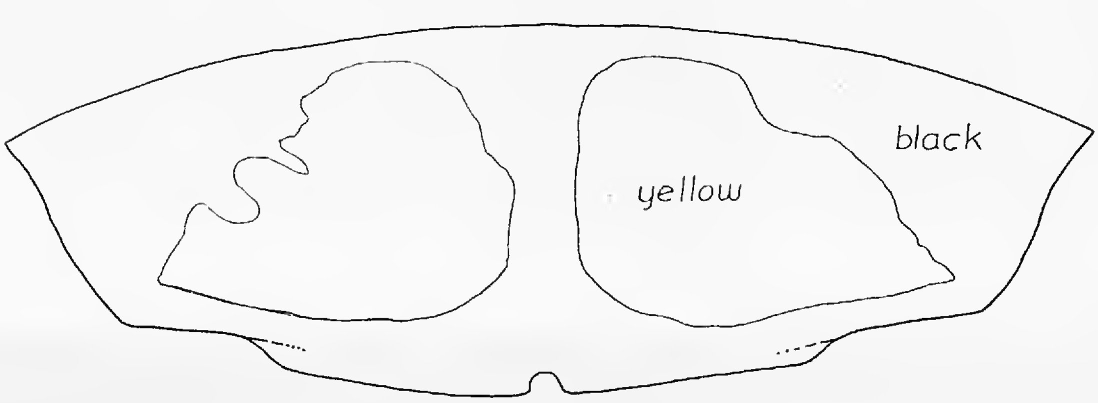


Fig. 5. Pygidium, ♀

Figs. 4-5. Diagnostic characters of female *Anthidium pallidiclypeum*.

type males differ from the type most often in having interrupted stripes on one or more tibiae, and in the metasomal maculation. Most specimens have four spots on the first metasomal tergum only rather than on the first two segments as on the type. About half also have uninterrupted bands on one or more terga. Female specimens are less variable in maculation than males. About half have two distinct black spots basally on the clypeus rather than an irregular area as described. Four paratype females have no color on scutum, while one has "L" shaped stripes at the anterior scutal edges and also has four spots on the scutellum.

The clypeal color of both sexes is pale cream, usually noticeably lighter than the yelow color on the rest of the body. This character, together with the striking black, flattened clypeal rim of the female, with its rounded marginal projections, and the single lobe of the male seventh metasomal sternum, facilitates the identification of *pallidiclypeum*. The lateral edges of the male seventh metasomal sternum curve downward and, unless viewed at right angles to the sternum, may appear to be lateral lobes or toothlike projections. The species does not appear closely related to others in the genus and is known only from California in Upper and Lower Sonoran zones.

UNUSUAL CERAMBYCID ANTENNA

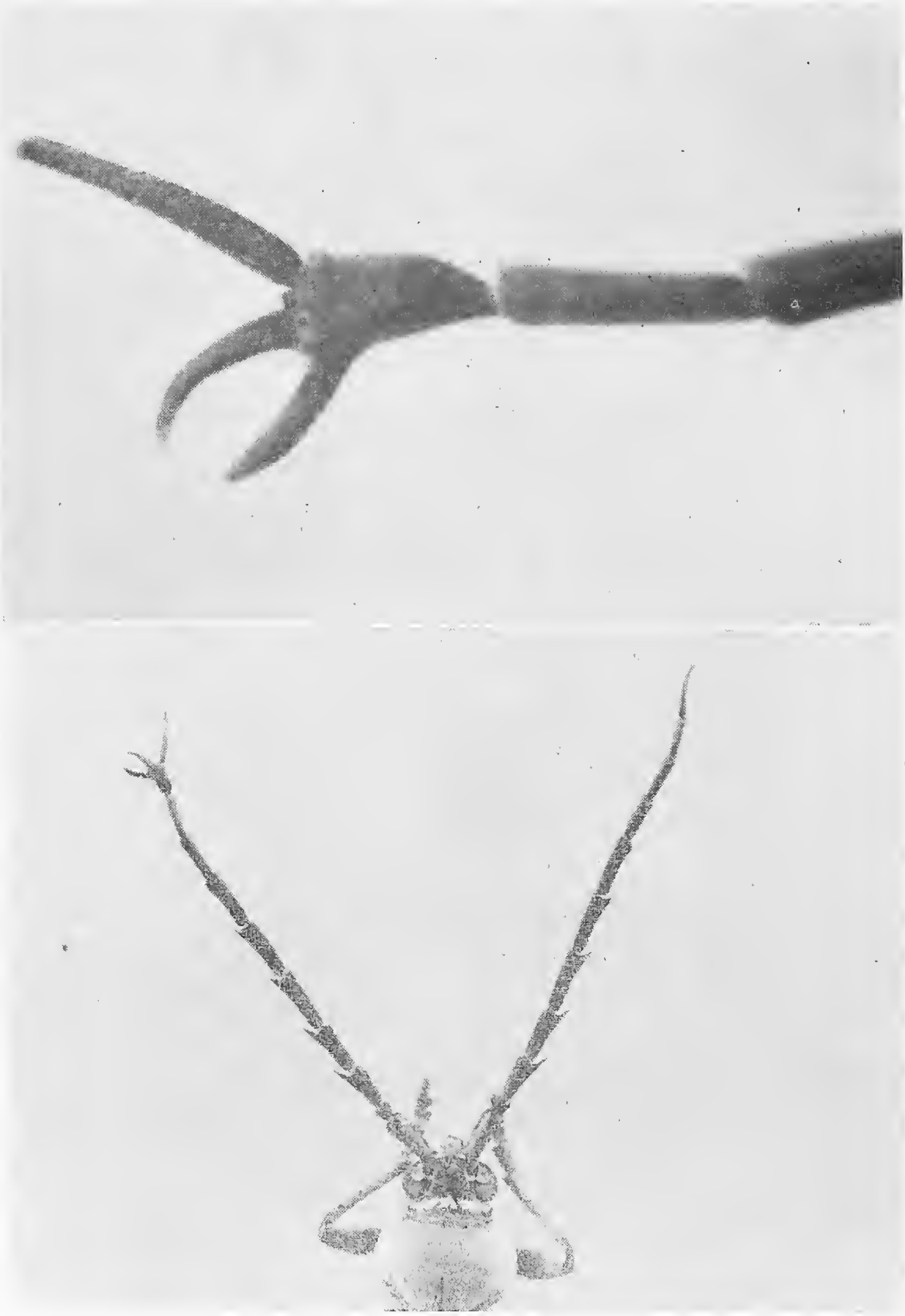
Paul D. Gerhardt and Don L. Turley[1]

A black light trap has been operated the year around for several years at The University of Arizona Mesa Branch Station. Its purpose is to observe and record the flights and activity of certain species of moths whose larvae are pests of economic importance in this area.

During a routine examination of one night's catch in September 1961, a trapped male cerambycid beetle, *Megacyllene antennatus* (White), was noticed which was different from others previously observed. The left antenna of this beetle appeared enlarged near the tip. A closer examination revealed that the 10th segment was enlarged and had a chelicera-like structure on its outer edge. Yet, the corresponding segment on the right antenna appeared normal. The antennae of this specimen as well as an apical closeup of the left antenna are shown in figure 1. Note

[1] The University of Arizona, Department of Entomology, Mesa Branch Station.

that the 9th and 11th segments appear normal, while the 10th is quite different having two extra appendages or segments. This segment is narrow at the base, then broadens rather abruptly



EXPLANATION OF FIGURES

Fig. 1. Head and antennae of *Megacyllene antennatus* (White) showing abnormal left and normal right antennae with apical enlargement of left antenna shown above.

toward the top. The attachment of the 11th segment is slightly to the right with two extra segments developed on the left or outside. The middle growth—extra segment—is moveable, narrower at the base, and fits into a socket. The other extra segment appears to be quite rigid. Also, on the upper side of the 10th segment, and near its base, is a small protuberance or tubercle.

No other deformity was observed on this beetle. Of the many specimens of this species taken in the light trap at Mesa, as well as other cerambycids collected throughout Arizona during the past few years, this is the first one observed to have had a deformed antenna.

SUPPOSED LARVA OF PROTANYDERUS VIPIO (OSTEN SACKEN) DISCOVERED IN CALIFORNIA

(Diptera: Tanyderidae)

JOSEPH H. ROSE

U.S. Fish and Wildlife Service, Seattle, Washington

A larva of the primitive crane-fly family, Tanyderidae, has been discovered in Mill Creek, a tributary of the Sacramento River, near Los Molinos, in Tehama County, California. The larva was found in a bottom sample collected in May of 1961. The sample consisted of gravel and silt taken from an area of slow moving water eight to ten inches deep. A search of literature concerning the family has revealed that the immature stages of Tanyderidae have not been reported in California. Adults of two species, however, are found in this state. They are *Protanyderus vanduzeei* Alexander, and *P. vipio* Osten Sacken.

The family comprises 10 genera, with about 35 known species to this date. The only Tanyderidae whose early stages have been

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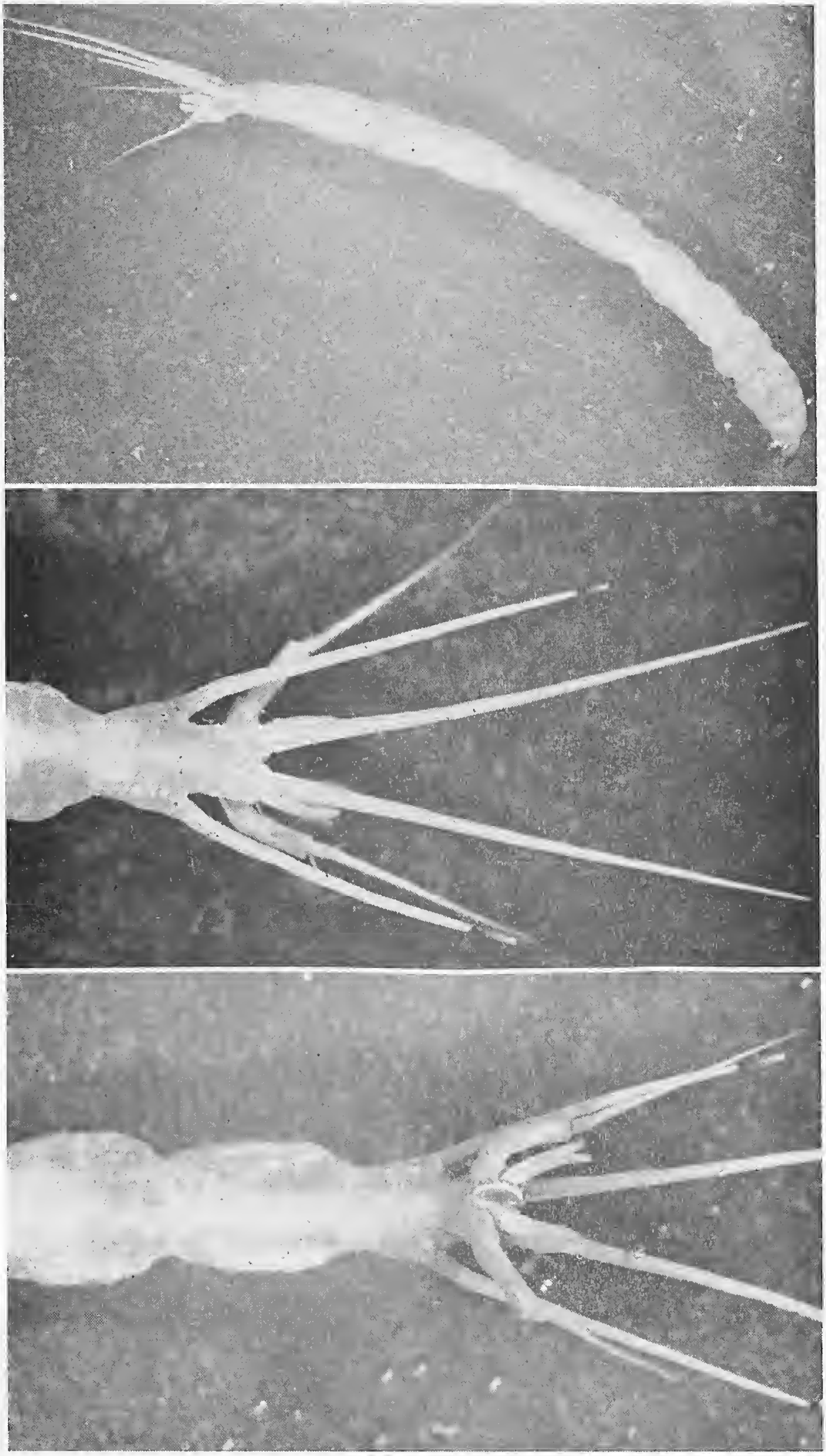
EXPLANATION OF FIGURE

Fig. 1 (Upper), larva of supposed *Protanyderus vipio,* showing complete organism with spiracle on prothorax. 5X. Fig. 2 (Middle), dorsal view of posterior region of larva of supposed *Protanyderus vipio,* showing six filaments and spiracle on eighth abdominal segment. 10X. Fig. 3 (Lower), ventral view of posterior region of larva of supposed *Protanyderus vipio,* showing the two fleshy pseudopods and four anal gills. 10X.



described are *Peringueyomyina barnardi* Alexander in South Africa (Wood, 1952) and *Protoplasa fitchii* Osten Sacken in eastern North America (Alexander, 1930). There are a number of similarities between the Mill Creek larva and those of the above-mentioned species.

Copies of the photographs included in this note were sent to Dr. Charles P. Alexander, Department of Entomology, University of Massachusetts, who unquestionably places the larva in the family Tanyderidae. Based on the geographical location of the collection, and the measurements of the larva, Dr. Alexander confirms the writer's supposition that the larva belongs to the species *Protanyderus vipio*.

Only one larva was found in the Mill Creek sample, and is preserved at the U. S. Bureau of Commercial Fisheries Biological Laboratory, 2725 Montlake Boulevard, Seattle 2, Washington.

Larva.—Length, from head to end of longest filaments, 22 mm. Longest filaments alone, 7 mm. Greatest diameter of body, 2 mm. General coloration, dirty white. *Body* (Fig. 1): Eucephalous; consisting of 12 terete segments, those of the thoracic region shorter and more dilated than those of the abdomen. Posterior end of abdomen with six long filaments, of which one pair is borne near the posterior end of a pair of anal pseudopods. Four simple anal gills. *Head:* A compact, chitinized capsule; antennae very short, apparently three-segmented (mouth parts of this larva damaged, no accurate description). *Thorax:* Prothorax longer than remainnig thoracic segments. Prothorax divided by a constriction into two rings; a small, black spiracle (Fig. 1) on posterior ring near mid-line of body. Mesothorax and metathorax are divided on dorsal surface into two portions by a small constriction. *Abdomen:* Nine abdominal segments that gradually increase in length to the eighth; eighth and ninth decrease rapidly in diameter. Abdominal segments separated by a narrow constriction or ring. Eighth abdominal segment (Fig. 2) with a small black spiracle on side near the posterior margin. Immediately posterior to the spiracle arises a long filament that has a black area near the tip. Ninth abdominal segment (Fig. 3) somewhat shorter than the eighth. From the posterior margin, and on the ventral surface, arise two fleshy pseudopods (Fig. 3), each giving rise to a long filament. *Setae:* Located on dorsal surface and each side of head; a row on each side of body near the ventral-lateral margin; each caudal filament bears from one to three. (A number of setae were broken off of this larva).

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A NEW SUBSPECIES OF XYLOCOPA TABANIFORMIS SMITH FROM MEXICO[1]

(Hymenoptera: Apoidea)

Lois Breimeier O'Brien and Paul D. Hurd, Jr.
University of California, Berkeley

The chiefly Nearctic subgenus *Notoxylocopa* is composed of mostly small but robust carpenter bees which are very reminiscent of certain large species of *Anthophora*. The males, unlike any other known subgenus of *Xylocopa*, have the bridge of the penis valves greatly produced posteriorly. The females of this group appear to be most closely related to the essentially Palaearctic subgenus *Rhysoxylocopa* (Hurd and Moure, 1963).

Although a critical study of the eleven described forms of the *Xylocopa tabaniformis* complex is underway, the new subspecies described below is offered at this time so as to make the name available for a comparative ethological study (Janzen, 1964).

Xylocopa (Notoxylocopa) tabaniformis melanosoma O'Brien and Hurd, new subspecies

Male.—Vestiture of head black, but with some intermixed pale pubescence especially between antennal sockets; vestiture of anterior one-third to one-fourth of mesonotum predominantly pale gray, usually tinged with brown and intermixed with some black hairs and consequently appearing medium gray, remainder of mesonotum dark pubescent; metasomal terga entirely dark pubescent, without pale pubescence; legs chiefly black or brownish

[1] One of a series of studies on carpenter bees made possible by a grant from the National Science Foundation (G-19385).

pubescent, occasionally with a few intermixed whitish hairs.

Female.—Similar to male in coloration of vestiture, except dorsum of thorax entirely brownish pubescent.

Holotype male, allotype and 3 paratypes (1 ♂, 2 ♀♀) FROM 52 MILES WEST OF THE PUEBLA-VERACRUZ BOUNDARY, HIGHWAY 150, PUEBLA, MEXICO, 6:35 to 6:45 p.m., August 30, 1962 (D. H. Janzen). Additional paratypes (16 ♂♂, 3 ♀♀) with the same data but collected from 5:50 to 7:00 p.m.; 8 paratypes (4♂♂, 4♀♀) from 10.2 miles west of the Puebla-Veracruz boundary, Highway 150, Puebla, Mexico, VII-11-1962, sunset (D. H. Janzen); 1 ♀ Tehuacan, Puebla, Mexico, VI-23-1951 (P. D. Hurd); 1♀, Rio Blanca, Veracruz, Mexico, XI-13-57 (R. and K. Dreisbach); 1♀, environs of Tehuacan, Puebla, Mexico, 1903, (L. Diguet). The holotype and allotype will be deposited in the entomological collections of the California Academy of Sciences.

The male of this subspecies can be separated from other forms, except *X. tabaniformis orpifex,* by the absence of white bands of hair on the metasomal terga. It differs from *X. t. orpifex* in the much darker vestiture of the anterior mesonotum. The females of *X. t. melanosoma* apparently can be separated only geographically from other similarly colored females.

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*New names in bold face, synonyms and homonyms in italics

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