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NATURAL ENEMIES AND INSECT SPECIATION[1]

Richard L. Doutt

University of California, Berkeley

In this last month of 1959, one hundred years after the publication of *The Origin of Species*, it is fitting that this Society give some acknowledgment to the Darwin Centennial. Biologists all over the world have paused to recognize this important anniversary, to consider the impact of the theory of evolution on the thinking and culture of mankind, and to pay tribute to the man whose name has become almost synonymous with the theory which he proposed. However, it should be mentioned parenthetically that while we think of Darwin when evolution is mentioned, Darwin apparently never used the term evolution, which in its modern sense is due to Herbert Spencer (Ford, 1956).

During the past eleven months of the Darwin Centennial many scientific groups, far more elegant and famous than ours, have scheduled commemorative lectures, symposia, and appropriate exhibits. These have all been properly dignified, impressive, and praiseworthy. While few of us have been actual participants in these events, we do, nevertheless, identify ourselves with the spirit of the occasion and from it tend to derive some vicarious satisfaction. However, I think there is a much better way to commemorate Darwin's contribution. I think that each biologist, each one of us who is a student of living organisms, should take time to view from our own particular vantage point the theory of evolution and the factors that influence speciation.

It is true that our own vantage point may not offer a very superior view; there may not be much to be seen from it, or, if it does command a spectacular view, we may suffer from some intellectual myopia so that we are unable to take advantage of it. But, however handicapped we may be, I think the honesty of the effort makes it worthwhile and that it would please Charles Darwin. He was not always sure of his own position, but was frequently puzzled and confused by what he observed. It is this fact which has given me the courage to speak to you on a subject

[1] Presidential address before the annual meeting of the Pacific Coast Entomological Society at the California Academy of Sciences, San Francisco, December 12, 1959.

in which I have few qualifications. It is this fact which makes me willing to risk the charge of being presumptous in talking to you about insect speciation when I really am not conversant with the subject. I merely wish to tell you what I see from my vantage point as a worker in biological control and accordingly one who is interested in population dynamics and the role of parasites and predators.

We must start from firmly established principles, and I do not intend to depart very far from them. The great truths in biology are always immediately before us; they are not cryptic and obscure phenomena that only a few are privileged to see. For example, Darwin's Galapagos finches were seen by people before Darwin went ashore from the Beagle, and the influence of these birds even on Darwin was apparently delayed and retrospective, for it was ten years before he made any significant comment on them (Lack, 1947). I am certain that Darwin's finches have their counterparts in many phenomena that we entomologists probably see but do not recognize yet as being significant. Now I am not suggesting that I have found some new significance in rearranging some frequently observed phenomena in insect populations. Instead, I am inviting you to join me in viewing these phenomena from a novel and perhaps slightly unconventional aspect, and I further ask you to consider them in the light of the twentieth century notions about insect speciation.

The equilibrium position of a species and the balance of nature

One good starting point is the basic fact that there is a balance of nature, which means simply that barring any major changes in any given environment the resident insect species over a period of time maintain a fairly constant quantitative relationship to one another. (Smith, 1935). In this situation no single species continually increases or decreases in relation to the others. For example, consider for a moment the insect species that exist outside this hall in Golden Gate Park. If we had taken annual surveys of these insects for the past 25 years we would have found that year after year some species were always fairly abundant, others less so, and finally some species were so rare that we would have considered them to be collectors' items. We would have found this to be true because each of the species has an equilibrium

position which it maintains in relation to the other species in its environment. Of course at the same time each species fluctuates both positively and negatively from this equilibrium position because of the changing seasons, or its reproductive cycle, or to any one of many other causes, but these are short term departures only. The species population always tends to return to its normal level of abundance. This reflects the general truth which was known to Darwin and his predecessors, that, on the average, only one progeny per parent can survive, otherwise the species would increase to infinity or decrease to extinction. This, then, is the static aspect of populations; it is the seeming paradox of stability in the midst of constant change. It can be compared to sea level which furnishes us a zero basis for altitude and one of the standard conditions in the most precise of physical sciences, and yet the sea is never level but is always in motion by waves or tides.

There are entomologists who see only the dynamic aspects of populations and not these static characteristics. They are so impressed by the fluctuations of insect populations that they are inclined to deny the existence of any equilibrium position in a species. To them its existence is contrary to facts and a denial of organic evolution. My contention, on the contrary, is that this equilibrium position does indeed exist; that it is just as universal a phenomenon among insect species as sea level is among the oceans of the world. Furthermore, I believe that the tendency of a species to keep this balance is absolutely essential to the maintenance of the species because it prevents the disastrous over-exploitation of the limited requisities in the environment. I endorse the view of my colleague, Dr. C. B. Huffaker, who believes that the measure of success of a species is the relative stability of its ecological position and that any adaptation which gives increased security of ecological position will tend to be perpetuated. In other words, natural selection is involved in the maintenance of balance in populations, and this has survival value. This is, of course, difficult to prove, for as Dr. Huffaker points out, these balanced relations, as such, do not fossilize (Huffaker, in press).

By adhering to our biologists' store of well established and basic facts perhaps we can find among them persuasive evidence to support this hypothesis. For one thing, it is evident that the equilibrium position of each species is determined by the regu-

latory factors in the environment. What do we mean by regulatory factors? These are mortality agents, usually biotic, which operate in a density dependent manner. That is, as the population grows above its equilibrium position the probability of survival of any individual member of that population becomes increasingly less. In our empirical work in biological control we have demonstrated repeatedly that these regulatory factors acting on insect populations may commonly be entomophagous organisms such as predators, parasitoids, and pathogens. These natural enemies frequently regulate the abundance of the host species in any given habitat, and their action prevents wildly fluctuating host densities that could lead to the exhaustion of all the requisites of food and space in the environment and through this, absolute depletion to the ultimate extinction of the species. Instead we find that through their regulatory action the natural enemies maintain the host populations in a stable sort of existence in the environment. They are very often responsible for the balance of nature as we see it among the species of insects.

It might appear at first glance that this tendency to evolve toward a stable system would cause variability to be at a minimum and to lead to fewer and fewer species. Actually the reverse is true. For example, the results achieved over the years in biological control projects sometimes appear to be a product of latitude, for the chances of quick and effective control by importing natural enemies seem to improve the closer we approach the tropics. This merely reflects the fact that the biotic mortality factors of the environment are comparatively much more effective in tropical than in temperate latitudes. At the same time, the numbers of species are far greater in the tropics. Coupled with this great complexity in the tropical biota is the fact that the populations tend to be very stable. It is only as we go toward the higher latitudes that we find the wildly fluctuating populations. It seems evident that where there is intense inter-specific competition the course of evolution is toward greater diversity of species and greater stability of this increasingly diverse and complex system. It is my suggestion that natural enemies are very often protagonists in this evolutionary drama.

What I am suggesting is that in many insect species it is an advantage to them to have effective natural enemies. By effective

natural enemies I mean those which are quickly responsive to changes in host density and increase the intensity of their action as the population increases. Probably most of us are not accustomed to thinking that mortality factors which are increasingly severe on a growing population can actually be beneficial to the survival of that species. The notion nevertheless appears to be true that an efficient entomophagous organism or high degree of pathogenicity in a parasite or pathogen may indeed work to aid the survival of the insect host or prey species.

The predators and parasitoids that we use in biological control are fatal to their hosts, and yet there is a widely published hypothesis, which indicates an equally wide acceptance, that an organism which kills its host is, comparatively speaking, a newcomer to the ranks of parasitism. The hypothesis is that a parasite which does not tend to kill its host is a more completely adapted type which reflects a host-parasite relationship of long standing. I am not competent to judge the validity of this theory when applied to the conventional types of parasites, but it is completely erroneous when one applies it to insect parasitoids, the parasitic Hymenoptera and Diptera. With these groups I am convinced that there is a preponderance of evidence to the contrary. The morphological and physiological adaptations exhibited by endo-parasites for their life within the host individual are far from being primitive. The psychological selection of hosts by female parasitic wasps and their general searching behavior and ovipositional responses do not fit the ordinary criteria that define primitive characteristics. These facts, I think, give very strong support to the belief that insect species tend to evolve toward stable balanced relationships and are aided in this by very effective natural enemies, which are themselves well adapted species, although fatal in their action on their respective hosts or prey.

THE FRAGMENTATION OF HOST POPULATIONS BY NATURAL ENEMIES

Although still largely based on theoretical grounds, there is a belief that a very efficient parasite or predator, particularly one that tends to be host-specific, tends to break a host population up into small isolated units. These small and separated colonies are often exterminated by the natural enemy, but in the meantime there have been a few escapees or emigrants that have started

new colonies of the host. We see evidence of such a colonial distribution in many of the sessile hosts such as diaspine scales. These small and somewhat isolated populations have been termed "demes" by some geneticists and it is rather generally agreed that the division of a species into a number of partly or temporarily isolated populations of various sizes gives the conditions most likely to result in rapid evolution (Sheppard, 1956). Of course, the demes are not completely isolated, but selection, with the deme as its unit, takes the form of more rapid growth of populations of the better adapted ones and their more extensive dispersion into territories of the less adapted with consequent grading up, or even replacement of the latter (Wright, 1956).

Quite probably there are a number of factors which lead to this colonial type of distribution in insects, but I am suggesting that natural enemies can play a very important role. Whenever extrinsic factors cause an interruption or retardation in gene flow between portions of a species, then these subdivisions of the species tend to drift apart genetically (Mayr, 1948). If then a very efficient parasite can fragment the populations of its host, it is precluding absolute randomness of mating and is creating a condition in which greater variability of the host species will be possible.

Natural enemies and the phenotypic expression of insect species

While the most important role of natural enemies of insect species is in maintaining balance by regulating the equilibrium position of the given species, it has long been evident to biologists that natural enemies may play a very important part in determining which phenotypes in a species survive. In other words, without natural enemies many of our insect species might look very different. This view is, of course, based on the phenomenon of mimicry and protective coloration that we so often observe in insects.

For example let us consider a butterfly which may in the adult stage mimic a species that is distasteful to birds. We generally consider the outstanding function of such mimetic resemblance to be protection, and yet in the population dynamics of Lepidoptera we believe that the predation on the adult stage is of minor importance, whereas by contrast the attack by natural enemies on the lepidopteran eggs, larvae, and pupae is very intense.

Certainly there are abundant data to show the important part played by parasites in destroying eggs, larvae, and pupae. Furthermore, general field observations show that caterpillars are heavily attacked by predators such as birds and wasps. Yet at the same time, adult butterflies are seldom seen to be attacked by birds. So it follows that protection from attack in the adult stage can be of little, if any, importance to a species of butterfly. Therefore, if a perfect mimetic pattern appeared suddenly in a non-mimetic species, giving complete immunity from attack, it would not increase the success of the species, which would be just as successful without the mimetic pattern. At first glance this would appear to render natural selection of the mimetic pattern impossible, but actually this is not so (Nicholson, 1927).

Imagine a hypothetical situation where a perfect mimetic pattern offering complete immunity from attack appears suddenly in adults of a non-mimetic species which is subject to attack by birds capable of discriminating between the two color patterns. All the possessors of the mimetic pattern would survive to lay eggs, while a proportion of the non-mimetic adults would be destroyed by birds. Therefore the proportion of the mimetic to the non-mimetic individuals would be greater when the insects laid their eggs than it was when the adults emerged. The parasites of the developmental stages of this generation would operate to regulate the equilibrium position at the same level it was previously, but in their attack they would not operate selectively and would therefore destroy, on the average, an equal proportion of the mimetic and non-mimetic stocks. Consequently, the proportion of the mimetic to non-mimetic individuals surviving to the adult stage would theoretically be the same as that proportion which existed in the egg stage. Again the birds would act selectively against the non-mimetic adults, but the parasites would in turn act without selective action on the succeeding generation of eggs, larvae and pupae. The selective action on the adults, although perhaps very slight, would nevertheless be cumulative generation after generation until finally the mimetic form would completely replace the non-mimetics. The result would be not an increase in the numbers of the species but a species composed of phenotypes of very different appearance from the original stock.

This theory would apply to cryptic coloration equally well,

and it is in these species which have built up complicated patterns suitable for concealment on lichened tree trunks, rocks, and posts that we see the phenomenon of industrial melanism. It has been reported that of the 780 species of Macrolepidoptera which occur in the British Isles, about 70 are in the process of replacing their populations with dark or black individuals in the vicinity of soot-laden industrial areas (Kettlewell, 1956).

It is of extreme interest that such a change in gene frequency in one species will alter the amount of predation on other species in the same habitat. Accordingly industrial melanism is suggested as being an auto-catalytic process by Sheppard (1956) who also points out that the evolution of mimicry will lead to mimicry in other species with the same mode of life and living in the same area. Thus parallel evolution in mimicry tends to be produced in insects living in the same area and with similar ecologies. Consequently, it is a noteworthy but not surprising fact that where mimicry is found usually a large number of species are involved, while in other places mimicry is rare or absent.

For a long time the idea has been prevalent in biological control circles that in general vertebrate predators do not regulate the population density of any given insect species. It has been thought that birds are not quickly responsive to changes in numbers of any one insect species and are therefore not density dependent in their action. However, there are data on a few bird species, at least, which show that birds can be very important. Brower (1958) has generalized that the behavior of birds which eat phytophagous insects is such that the probability of discovery of a food item of a particular shape, color-pattern, and size is increased if the one previously found is of similar appearance and is palatable. The birds thus form a "searching image" or a "visual image" of the prey. This kind of behavior could easily lead to density-dependent predation in nature.

Experiments were conducted by de Ruiter (1952) in which twig-like geometrid caterpillars and the twigs they specifically resembled were scattered on the floor of an aviary. Individual jays were then admitted and characteristically began to hop about looking for food but in each case ignored both the twigs and the motionless caterpillars. However, after birds finally found and ate a larva then both twigs and larvae were pecked at, which

resulted in nearly all the larvae being eaten. Tinbergen (1957) discussed these experiments and said that when caterpillars outnumbered twigs, the birds went on hunting for caterpillars, but if they picked up more twigs than caterpillars, they gave up searching. From this it can be seen that the time interval between successes can not be too long if the bird is to continue searching, and in nature this interval would bear a direct relationship to how well the prey was spread out.

Brower (1958) believes that this phenomenon of persistent and successful searching after the bird has found the first prey plays a role in the food plant specialization of phytophagous insects. Brower suggests that in a situation where two closely related, pro-cryptic species are feeding together on the same plants slight genetic differences in the two species would result in them being cryptic to a slightly different extent on any one food plant species. Therefore the selection pressure by birds concentrating on the common prey image would favor those individuals of each species which were on mutually exclusive plants, and in this way the common food plant diet originally shared by all would come to be divided among them. Brower suggests that the reason that food plant specialization is so prevalent is probably because the selective advantage of being on separate plants is greater than that conferred by the initial stages of a divergence in appearance which would ultimately be different enough to be overlooked by the birds.

So far I have stressed the positive role of natural enemies in being responsible for the phenotypic expression of a species population, but there are cases where just the opposite is true and the phenotypic expression is due to the absence of biotic pressure. In this connection one can consider some of the flightless endemic species in Hawaii. As Zimmerman (1948) points out "The flightless insects of Hawaii are the descendents of cripples which survived only because in these insular environments biotic and environmental pressures are reduced to a minimum, and conditions have been favorable for their survival. They are 'hopeful monsters' arisen under circumstances in which there is hope."

"Some of these flightless species which were successful under primitive Hawaiian conditions have recently succumbed to new

biotic pressure brought about by the introduction of predators which are foreign to the Hawaiian biotal balance. Some of us have searched intensively under the very trees where Dr. Perkins procured a series of the flightless fly *Emperoptera mirabilis* Grimshaw but have never been able to find a single example of the species. It appears that this remarkable fly is now extinct—at least in the type locality—because it was unable to withstand the new pressure created by the invasion of its environment by immigrant predaceous ants." (Zimmerman, 1948.) Therefore it appears from these observations that non-adaptive radiation can take place relatively easily where there is an absence of predators or where the predator pressure is low.

Natural enemies and insect behavior

Not only may the phenotypic expression of morphological characters in a species be influenced by natural enemies, but certainly the behaviouristic characters of the species may also be the end result of the pressure of natural enemies. All entomologists are aware of the behavior of certain insects when startled, such as beetles immediately dropping from plants, insects taking flight, or perhaps feigning death.

The power of flight in insects may originally have evolved because it gave a great advantage to the insects in escaping predators, and it has been suggested that this in turn led to the development in other animals of the ability to fly. It is apparently a system of measures and counter-measures, for, while bats through echosounding locate flying insects, there are moths which have the ability to detect the ultrasonic emanations from the bats and characteristically respond by immediately ceasing flight.

Many insects, particularly in the Orthoptera, locate mates by the sound made by one of the sexes. It would seem that this might also notify vertebrates of the insect's location, but actually the sound is of such frequency that vertebrates have difficulty in locating the source. This is due to a basic difference in the manner of hearing. Each sound wave has two basic properties, one the displacement of the particles or molecules of the medium and the other the change of pressure with which this is associated. Vertebrate ears perceive pressure changes while the hearing organs of insects register particle displacement. It was pointed out by Pumphrey (1940) that since any sound involves particle displace-

ment, and particle displacement involves direction, grasshoppers can locate sounds of all types equally efficiently as long as they are within the audible range. The situation is quite different in vertebrates.

Marler (1959) reminds us of the common experience that many Orthopterans are difficult to track down by their songs. "As has already been pointed out, the 'displacement' hearing organs of insects locate sound sources in a different way from vertebrate ears, and the efficiency is unaffected by the frequency of the sound, as long as it is audible. Insects therefore are freer than vertebrates in their choice of frequency. It is interesting to note that most of them, nevertheless, lie between about 6 and 14 kilocycles per second (Busnel, 1953). In the absence of breaks to serve as time clues, this is probably a quite difficult frequency range for those birds which prey on grasshoppers to locate. One may speculate on the possibility that some insect songs are adapted so that they are both easy for insects to track down, but difficult for vertebrates. It is noteworthy, too, that crickets, with songs which are often broken and lower-pitched, around 2 to 4 kilocycles per second and therefore easier to locate, are largely crepuscular and nocturnal. Because of this, and their cryptic and often subterranean habits, they may be less exposed to predators than some other species."

INSECTS AS PLANT PARASITES

Although the title of this address indicates that emphasis is being placed on the role of natural enemies in insect speciation, I think it is profitable to digress for a moment and consider the role of insects as parasites of plants. As natural enemies of plants, the insects may well have played a very important part in determining at least the quantitative balance that we find among our plant species. As you are aware some of the most spectacular results in biological control have been in the control of weed pests by imported phytophagous insects. In California, for example, Klamath weed has been cleared from hundreds of thousands of acres of range land by the imported chrysomelid beetles, and the plant now exists as a roadside inhabitant or a plant that grows on the marginal areas of clearings. Couple with this demonstration the result of the destructive scale insects on the junipers in

Bermuda, and it is evident that insects can play a very important role in determining the quantitative composition of the flora.

Speciation in entomophagous forms

The whole subject of speciation in the entomophagous forms themselves is far too large to take up in detail in an address such as this. It is, however, one of great interest, and it is possible that a few isolating mechanisms exist among the parasitic groups that are not encountered in other insect species. I like to think of an internal parasite as living in a host that is sort of a physiological island. Thorpe (1945) reports that there is considerable presumptive evidence of the isolating effect of host conditioning in parasitic insects. He believes that the conditioned response will give momentum to and set the direction for the selective processes tending to bring about genotypic isolation. Thorpe concludes that it would seem best to regard geographical and topographical and ecological isolation as three different scales of spatial isolation. In fact it has been said by Allee, *et al.* (1949) that living organisms, as hosts to parasites, form one of the three major habitats on earth, comparable to the aquatic and terrestrial habitats in which the hosts themselves dwell. Therefore, with each host as a kind of physiological island, it is not surprising that speciation has apparently occurred frequently among the parasitoids. It is not difficult to see how extrinsic factors associated with the host might set up isolating mechanisms in parasite populations attacking it. If these were sufficient to interrupt gene flow between portions of the parasitoid species and lasted for any substantial period of time, then perhaps a new species would evolve.

There is one contribution which a study of parasitoids can make to the general subject of insect speciation and that is the disclosure of races or biological species among host insects through the differential behavior of the parasite complex. There have been a number of examples where a single morphological host species has been proved to consist actually of several distinct forms because the parasites of one form were unable to develop in the other. On the other side of the coin one finds cases where a single host may actually have several morphologically indistinguishable but biologically very different parasites attacking it. These facts arise because of the necessity in biological control of studying in detail the biological and behaviouristic characters of the host and

parasite respectively. To me the discovery of these biological entities within a well established morphological species is no criticism at all of conventional taxonomic procedures. Instead I view it as the next logical step, another dimension to insect taxonomy. This is a refinement that can be accomplished only after the basic morphological taxonomic foundation has been laid. This is, then, the expected progress and evolution in insect taxonomy toward a degree of sophistication in systematics that we now only dimly see, and it is my suggestion that insect parasites can assist us in reaching this goal.

SUMMARY

The relative stability of an insect species in its ecological position is due to regulatory factors which are often predators, parasites, or pathogens. Through the action of such density dependent agents, the evolutionary tendency is to develop increasingly complex but stable biota. The phenotypic expression of morphological characters as well as the development of certain behavior patterns in insects is often due to the selective pressure of natural enemies. The speciation of insect parasitoids is discussed in relation to modern systematics.

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TENTH PACIFIC SCIENCE CONGRESS

The Tenth Pacific Science Congress of the Pacific Science Association will be held at the University of Hawaii, Honolulu, from 21 August to 6 September, 1961, sponsored by the National Academy of Sciences, Washington, D.C., and Bernice P. Bishop Museum, with the cooperation of the University of Hawaii. Scientific sessions will be held from 21 August to 2 September, with a post-sessional field trip through 6 September.—H. J. COOLIDGE, *Secretary-General,* 10th Pacific Science Congress, Bishop Museum, Honolulu 17, Hawaii.

PRESENT STATUS OF THE TRIBE MAYETINI IN THE UNITED STATES—PART II CALIFORNIA

(Coleoptera: Pselaphidae)

ROBERT O. SCHUSTER[1], GORDON A. MARSH[2], AND ORLANDO PARK[3]

The species of *Mayetia* occurring in California are distinct from other species in the United States in that the fourth segment of the maxillary palpus is devoid of sensory developments with the exception of the cone and specialized setae (fig. 2).

Seven species are now known to occur in California. Most of these were collected during 1957 and 1958. Considering the number of species found in a relatively short period of time in a small area of California, an estimate of 25 species of *Mayetia* inhabiting the State would be conservative.

Mayetia mendocinoensis Schuster, Marsh and Park, new species

(Figs. 1–5, 9, 10)

Male.—Head 0.11 mm. long × 0.12 mm. wide; pronotum 0.13 mm. × 0.11 mm.; elytra 0.12 mm. × 0.13 mm.; total length 1.11 mm. Elongate depressed; pale testaceous; impunctate; body pubescence monaxial, primarily straight, suberect. *Head* lacking eyes; about 54 setae on dorsal surface; tempora sharply rounded to neck; two small vertexal foveae behind middle, not perforate, being about twice as deep as the depth of the integument and separated by slightly less than the distance between fovea and lateral margin; feeble sulci extend forward from each vertexal fovea; two small tubercles near the antennal acetabulae and two near the base of the head; frontal margin sinuate between moderate antennal acetabulae; clypeus short, transverse; labrum tridentate on each side of excavate middle (fig. 3); mandibles arcuate, left crossing dorsal to right; inner ramus of right mandible with symmetrical "M"-shaped tooth; basal part of "M" of tooth on left ramus reduced (fig. 5); ventral surface of head flat with small centrally located gular fovea; tentorial connection to vertexal foveae complete; two macrosetae occur posterior to gular fovea; mentum with two large integumental projections anterior to a pair of setae (fig. 4); a circular mark and two setae occur on head capsule posterior to mentum (fig. 4); maxillary palpus of four segments with one macroseta on segment III; segment I minute; II pyriform, distal anterior edge flattened; III globose; IV ovoid with a minute, straight palpal cone and two thin hyaline setae midway on outer margin (fig. 2); antenna of 11 segments, slightly verticillate; segment I twice as long as II, narrower basally; III and IV half as long and nearly three-quarters as wide as II; V noticeably wider than IV; VI scarcely narrower than V; VII longer than VI and wide as II; VIII similar to V; IX through XI form strong club with X and XI connate; IX transverse; X

[1]Department of Entomology, University of California, Davis.
[2]Department of Entomology, University of California, Berkeley.
[3]Department of Biology, Northwestern University.

cup-shaped with four macrosetae; XI shorter than X, somewhat spongeous with seven long, lamellate setae spaced equidistally around base (fig. 1). *Thorax* with pronotum subelliptical, longer than wide; about 80 setae dorsally; definite longitudinal glabrous area weakly reticulate; lacking foveae or sulci; apterous; elytra lacking basal and subhumeral foveae; disc simple; definite foveae lacking although faint sulci parallel the suture; humeral angles rounded; lateral margins weakly expanded posterior to rounded apical angles; apices truncate; about 60 setae dorsally. Prosternum rather long, integument smooth before coxae, reticulate laterally; mesosternum simple; metacoxae contiguous, mesocoxae contiguous, the coxal cavities slightly separated; meso- and metathoracic internal structures as illustrated (fig. 9); pro- and mesotrochanters simple, metatrochanter spined; each tibia with one macroseta midway on anterior surface; a short comb of setae dorsally and a long comb ventrally near apex; apex of each tibia bearing two more or less distinct spines; tarsi of two segments ending in a single strong claw. *Abdomen* with six visible tergites, I through V similar in shape; V and VI not separated by the hexagonally marked membrane occurring between I through IV, reticulations of this membrane become more rectangular proximal to segments; segments II through V with foveae at each basolateral angle, foveae transversely connected by weak, pubescent sulci; sixth rounded distally; six visible sternites; I with wide coxal lines; II through V similar, each with foveae and sulci as in the tergites; VI with a large eccentric notch; the apices of a paired segment are external, sclerotized and terminal; a "doughnut"-shaped spiracle occurs on the first, fifth and sixth tergites. Sixth sternite is 0.067 mm. from the front of the segment medially to a line across the distal margins of the notch; notch 0.017 mm. deep. Aedeagus with a flattened, arcuate apex, of 0.135 mm. long × 0.076 mm. wide (fig. 10).

Female.—As described for the male with the following exceptions: Sixth sternite terminal, symmetrically sinuate apically; a sinuate line due either to a thickening or an inward development of the exoskeleton of the sixth sternite is visible within the terminal segment; metatrochanters not spined.

The *holotype male,* MENDOCINO, MENDOCINO COUNTY, CALIFORNIA, April 17, 1954, is deposited in the California Academy of Sciences, paratypes in the California Academy of Sciences, California Insect Survey, University of California at Davis, U.S. National Museum, and in the collections of the authors.

The specimens representing this species have all been collected in Mendocino County, California, by J. R. Helfer unless otherwise specified. Caspar, 2♀ March 7, 1954; 1♂, 12♀ July 14, 1957; 6♂, 5♀ August 4, 1957 (J. R. Helfer, G. A. Marsh). Little River, 2♀ May 3, 1955. Mendocino, 3♂, 4♀ April 17, 1954; 3♂, 1♀ March 16, 1955; 5♂, 8♀ June 18, 1957; 5♂, 10♀ July 1, 1957; 67♂, 57♀ July 6, 1957 (J. R. Helfer, R. O. Schuster); 2♂, 2♀

July 16, 1957; 2♂ July 21, 1957; 6♂, 5♀ July 24, 1957; 15♂, 5♀ August 4, 1957 (J. R. Helfer, G. A. Marsh); 2♂, 3♀ September 9, 1957; 7♂, 13♀ December 2, 1957; 19♂, 13♀ December 14, 1957.

The males of this species may be recognized by the shape of the aedeagus which is usually distinct in cleared specimens. The majority of the females examined showed a definite sinuate marking within the last abdominal segment. Since the abdomen is capable of considerable movement and measurement of the segments is difficult, no emphasis has been placed on their ratios.

The numbers of setae were counted by focusing on the dorsum at high-dry magnification and counting the setae moderately in focus. The numbers of setae are approximately the same for the other species examined from California and across the United States. The thin, hyaline setae of the antennal club are proportionately wider than those of the next species but this can be appreciated only by comparison.

The means and standard deviations of the measurements for 30 males and 30 females are given below. The head length was measured across the front of the antennal tubercles to a line across the back of the tempora. The elytral length was taken from the posterior point of the scutellum to a line across the apices. Other measurements are the maximum possible in a longitudinal or transverse direction. Total length was the distance from the front of the antennal tubercles to the end of the abdomen without considering expansion or contraction inherent in the mount. Males. Head 0.119 ± 0.004 mm. long $\times$ 0.130 ± 0.005 mm. wide; pronotum $0.133 \pm 0.003 \times 0.123 \pm 0.006$; elytra $0.119 \pm 0.005 \times 0.140 \pm 0.009$; total length 1.05 ± 0.08. Females. Head 0.120 ± 0.003 mm. long $\times$ 0.129 ± 0.004 mm. wide; pronotum $0.135 \pm 0.004 \times 0.122 \pm 0.005$; elytra $0.120 \pm 0.005 \times 0.135 \pm 0.008$; sixth tergite $0.118 \pm 0.005 \times 0.113 \pm 0.004$; sixth sternite $0.091 \pm 0.004 \times 0.130 \pm 0.005$; total length 1.12 ± 0.07.

Specimens of *M. mendocinoensis* have been taken in numbers from the top few inches of soil of undisturbed podzol profiles, probably of the Caspar series. They are commonly found in the first few inches of mineral soil of the A2 horizon and are infrequently recovered from the overlying mat of organic debris. Within the distribution of the soil series, there seems

to be no correlation between the occurrence of a particular plant species and the occurrence of *Mayetia*. *Mayetia mendocinoensis* has been taken from soil with pH readings as low at 4.1, but the largest numbers have been recovered from soils of about pH 5.5.

Mayetia walkeri Schuster, Marsh and Park, new species

(Figs. 6–8, 11)

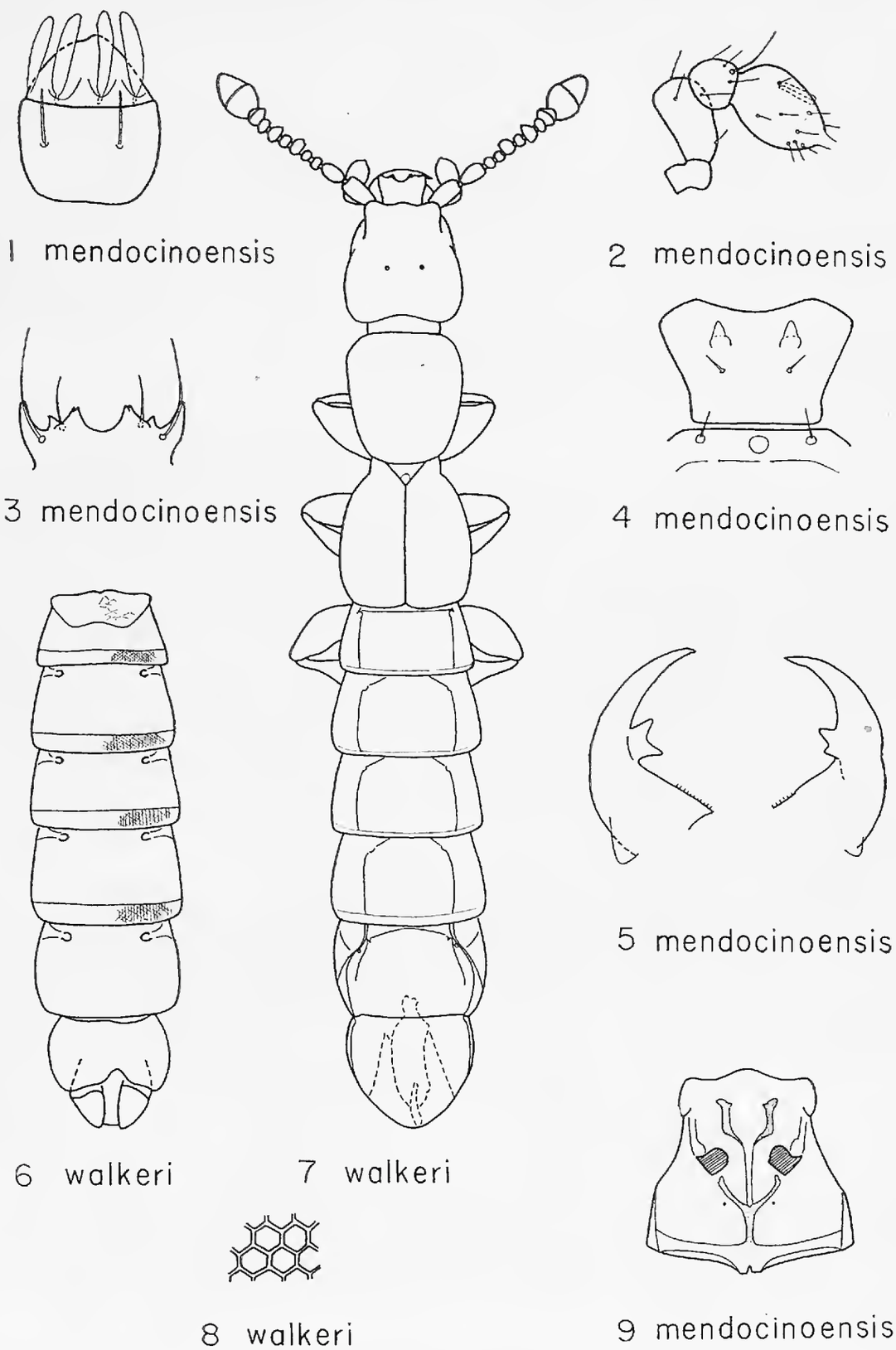
Male.—Head 0.16 mm. long × 0.16 mm. wide; pronotum 0.17 mm. × 0.14 mm.; elytra 0.17 mm. × 0.17 mm.; total length 1.21 mm. Substantially as described for *M. mendocinoensis*. The vertexal foveae are mutually closer than the distance from fovea to lateral margin; sixth sternite is 0.079 mm. long, the notch 0.022 mm.; aedeagus has a sclerotized "median lobe," visible even within the abdomen, 0.141 mm. long × 0.077 mm. wide (fig. 11).

Female.—As described for the male with the following exceptions: Sixth sternite evenly sinuate apically and much wider than long; a straight, transverse line visible within the last abdominal segment; metatrochanter not spined.

Holotype male collected 6.4 MILES SOUTH OF KLAMATH, DEL NORTE COUNTY, CALIFORNIA from redwood litter and soil by N. A. Walker on September 20, 1955, is deposited in the California Academy of Sciences, a paratype male, same data, in the collection of Orlando Park, and one female, same data, in the collection of R. O. Schuster.

The males are easily separated from those of the preceding species by the genital structure. This difference is apparent in cleared specimens and dissection is unnecessary. The transverse line within the last abdominal segment of the female seems to divide an internal structure into basal and apical parts and easily distinguishes this species from any of the others examined. When more specimens become available for study, ratios of the length to width of the sixth tergite and sternite may be found to differ sufficiently to assist in the discrimination of this species.

Specimens of this species have been recovered from Mendocino, Mendocino County, California. While considered conspecific they are not included in the type series. The main departure from the Del Norte County specimens is size, the specimens from Mendocino County being approximately the same as *M. mendocinoensis*. Additional series from intervening localities should be obtained to substantiate the conspecific relationship of specimens from Mendocino and Del Norte Counties.



EXPLANATION OF FIGURES

Fig. 1, Antennal club. Fig. 2, Maxillary palpus. Fig. 3, Labrum. Fig. 4, Mentum and front margin of head capsule. Fig. 5, Mandibles. Fig. 6, Ventral aspect of male abdomen. Fig. 7, Dorsal aspect of entire male. Fig. 8, Detail of areolate membrane. Fig. 9, Meso- and metathoracic structures, internal aspect.

Mayetia raneyi Schuster, Marsh and Park, new species
(Fig. 12)

Male.—Head 0.12 mm. long × 0.14 mm. wide; pronotum 0.13 mm. × 0.13 mm.; elytra 0.13 mm. long; total length 1.24 mm. As described for *M. mendocinoensis.* Sixth sternite is 0.059 mm. long, the notch 0.017 mm.; aedeagus cuniform, terminated apically by a membrane in which a sclerotized piece lies at right angles to the basal portion, 0.101 mm. long × 0.042 mm. wide (fig. 12).

Female.—Also very similar to that of *M. mendocinoensis.* The terminal abdominal segment is of similar shape but a subrectangular marking is usually visible in the basal half.

The *holotype male,* 10 male and 10 female paratypes were collected NINE MILES SOUTH OF MONTICELLO, NAPA COUNTY, CALIFORNIA on January 22, 1958 from 0 to 20 cm. in sand from under oak by Frank Raney and R. O. Schuster. Additional paratypes were collected as follows: Two males, eight females from the same locality on December 13, 1957 by Leslie M. Smith and R. O. Schuster; one male 10 miles south of Monticello from soil on a grassy slope on December 13, 1957 by Leslie M. Smith and R. O. Schuster; one male and one female taken from sand beneath *Umbellularia californica* nine miles south of Monticello on January 19, 1958 by R. O. Schuster; 20 males and 37 females, Napa Valley Ranch, Napa County, California on April 12, 1958 by Leslie M. Smith from soil under oaks. The holotype male and paratypes of both sexes are deposited in the California Academy of Sciences, paratypes in the California Insect Survey, U.S. National Museum and in the collections of the authors.

Both sexes of this species can be separated from the others by the described secondary sexual characters.

Mr. Frank Raney has been of assistance not only in the collection of this species but also in determining soil types and plant species for many of the collection sites.

Mayetia scobina Schuster, Marsh and Park, new species
(Fig. 13)

Male.—Head 0.11 mm. long × 0.11 mm. wide; pronotum 0.13 mm. × 0.11 mm.; elytra 0.12 mm. long; total length 1.07 mm. As described for *M. mendocinoensis* except for the secondary sexual characters. Sixth sternite is 0.059 mm. long, the notch 0.014 mm.; aedeagus with a scaly area at median one-third, 0.135 mm. long (fig. 13); metatrochanteral spine is relatively broader, being of triangular shape.

Female.—Ultimate segment of abdomen with interior opposed "comma"-shaped markings.

The *holotype male* and four female paratypes were collected FOUR MILES WEST OF NEWCASTLE, PLACER COUNTY, CALIFORNIA on March 12, 1958 from soil under *Quercus wislizenii* by Leslie M. Smith and R. O. Schuster. Additional paratypes include five males and 14 females taken from the same locality on March 21, 1958 from soil under *Q. wislizenii* and soil under grass by W. H. Lange, Leslie M. Smith and R. O. Schuster, and nine males and 18 females also from the same locality taken on April 15, 1958 by Leslie M. Smith and R. O. Schuster.

The holotype male is deposited in the California Academy of Sciences, paratypes in the California Academy of Sciences, California Insect Survey, U.S. National Museum, and the collections of the authors.

The males of this species are easily recognized by the peculiar shape of the aedeagus. The females were associated with the males by their occurrence in loci quite separate from the microhabitats occupied by a second species found in the same general area. They are distinguished by the two "comma"-shaped markings in the terminal segment of the abdomen. A series of short, transverse lines may or may not be evident anterior to these markings.

Mayetia langei Schuster, Marsh and Park, new species
(Fig. 14)

Male.—Head 0.12 mm. long × 0.13 mm. wide; pronotum 0.14 mm. × 0.12 mm.; elytra 0.13 mm. long; total length 1.03 mm. Essentially as described for *M. mendocinoensis*. Sixth tergite is 0.063 mm. long, the notch 0.014 mm.; aedeagus 0.135 mm. long (fig. 14).

Female.—Lacking identifying markings within the distal abdominal segment.

The *holotype male*, nine male and eight female paratypes were collected FOUR MILES WEST OF NEWCASTLE, PLACER COUNTY, CALIFORNIA on March 21, 1958 by W. H. Lange, Leslie M. Smith, and R. O. Schuster. Additional paratypes include one male collected five miles west, and four females four miles west of Newcastle on March 12, 1958 by Leslie M. Smith and R. O. Schuster. Most of these specimens were recovered from Aiken sandy loam of a pH range from 5.8 to 7.2. All but three of the specimens were taken under the crowns of *Quercus wislizenii*. The holotype male and paratypes are deposited in the California Academy of Sciences, additional paratypes in the California Insect Survey, and in the collections of the authors.

The males of this species are distinctive on the basis of the genitalia. The females, associated with the males because of their co-existence in small sized soil samples, seem to be inseparable from the females of the following species.

Mayetia fistula Schuster, Marsh and Park, new species

(Figs. 15, 16)

Male.—Head 0.11 mm. long × 0.12 mm. wide; pronotum 0.13 mm. × 0.12 mm.; elytra 0.12 mm. long; total length 1.03 mm. Essentially as *M. mendocinoensis*. Sixth tergite 0.067 mm. long, the notch 0.010 mm.; aedeagus 0.142 mm. long (fig. 15).

Female.—Not associated.

This species is represented by the *holotype male* and two male paratypes collected NEAR NASHVILLE, EL DORADO COUNTY, CALIFORNIA on April 25, 1958 by Leslie M. Smith and R. O. Schuster. These specimens were recovered from a clay loam, pH 6.8. The type is deposited in the California Academy of Sciences, the paratypes in the collection of R. O. Schuster.

What appears to be a single, highly variable species has been recovered from localities in El Dorado and Amador Counties. The aedeagi vary from a simple tube-like structure (fig. 16) to the form selected for the type in which the distal portion is gradually expanded forming a distinct barb on one side (fig. 15). Regardless of the degree of development of this barb, the apex remains comparatively blunt, and the width, on either side of the basal constriction, is subequal. These two features have been considered in separating *M. fistula* from the following species, the aedeagi of which might otherwise be considered within the range of variation of *M. fistula*. The variation observed in the aedeagi of the series presently considered as *M. fistula* occurs in three steps and may eventually be interpreted as representing closely related species.

Mayetia pravitas Schuster, Marsh and Park, new species

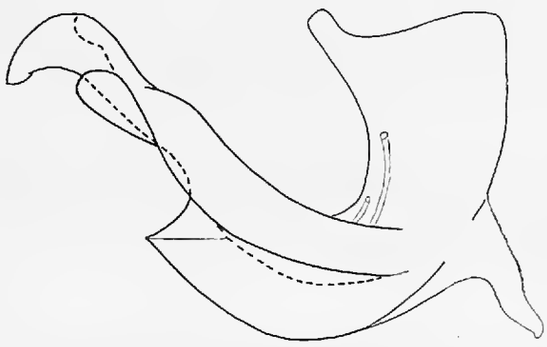
(Fig. 17)

Male.—Head 0.12 mm. long × 0.13 mm. wide; pronotum 0.13 mm. × 0.12 mm.; elytra 0.13 mm. long; total length 1.18 mm. Except for the following differences as in *M. mendocinoensis:* Sixth tergite is 0.063 mm. long, the notch 0.016 mm.; aedeagus 0.110 mm. long × 0.034 mm. wide (fig. 17).

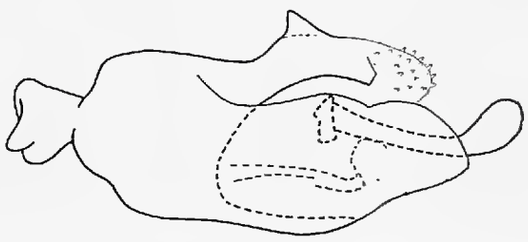
Female.—Lacking definite marking within the ultimate abdominal segment.

The *holotype male,* five male and seven female paratypes were collected NEAR NASHVILLE, EL DORADO COUNTY, CALIFORNIA in the Consumnes River drainage on March 5, 1958 by Leslie

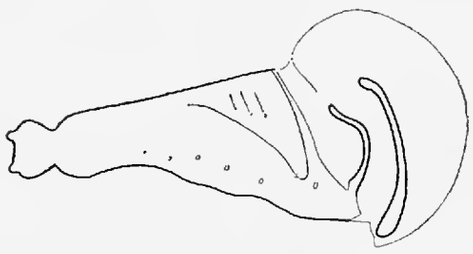
M. Smith and R. O. Schuster. The soil was taken from a slope on which a mixture of buckeye, bay and oak was growing. Five additional males and seven females were collected at the



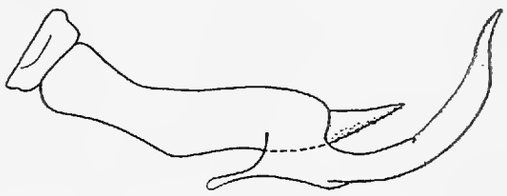
10 mendocinoensis



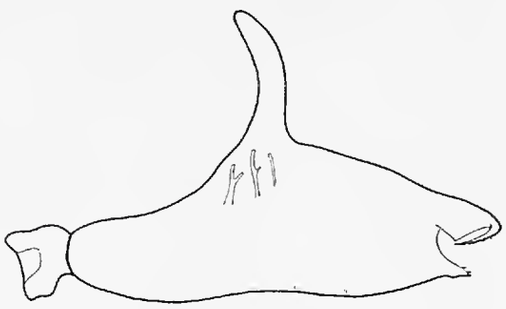
11 walkeri



12 raneyi



13 scobina



14 langei

15 fistula

16 fistula ?

17 pravitas

EXPLANATION OF FIGURES

Figs. 10–17, Aedeagi, figs. 15, 16, represent suspected range of variation exhibited in the aedeagi of *M. fistula.*

same locality on April 25, 1958 from a clay loam with a pH of 6.8 by Leslie M. Smith and R. O. Schuster.

The holotype male and paratypes are deposited in the California Academy of Sciences, paratypes in the California Insect Survey, U.S. National Museum, and in the collections of the authors.

Although very close of the preceding species, the male aedeagus differs in being more arcuate, the distal end is acute, and the structure is considerably expanded after the basal constriction.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE: NOTICE OF PROPOSED USE OF PLENARY POWERS IN CERTAIN CASES (A.[N.S.]43)

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. 17, parts 3/5, published on 15 December, 1959:

(1) Designation of a type-species for the nominal genus *Bolitochara* Mannerheim, 1831 (Class Insecta, Order Coleoptera). Z.N.(S.)243;

(2) Designation of type-species for the nominal genera *Ischnopoda* Stephens, 1835, and *Tachyusa* Erichson, 1837 (Class Insecta, Order Coleoptera). Z.N.(S.)244;

(3) Suppression of the generic name *Southernia* Filipjev, 1927 (Class Nematoda). Z.N.(S.)940.

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 15 May, 1960. 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 15 May, 1960, 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 Assistant Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London, S.W. 7, England.—W. E. CHINA, *Assistant Secretary, International Commission on Zoological Nomenclature.*

OBSERVATIONS ON THE NESTING BEHAVIOR OF ASTATA OCCIDENTALIS CRESSON IN CENTRAL CALIFORNIA

(Hymenoptera: Sphecidae)

JERRY A. POWELL AND DONALD J. BURDICK
University of California, Berkeley

Recently Howard E. Evans (1957) has published biological observations on several species of the genus *Astata* together with a comparison of the behavioral patterns of the group. Subsequently we have had the opportunity of observing a relatively large colony of *A. occidentalis* Cresson in Alameda County, California. Since Evans' work included a rather thorough report on a colony of this same species at Versailles, Indiana, a comparison of the nesting habits of the populations from the two areas and some remarks on variation is of value. Evans' paper gives additional data on the nesting habits of the genus and a review of the literature.

The active colony of *A. occidentalis* Cresson was first descovered September 17, 1958, near the southern end of San Francisco Bay about two miles southwest of Warm Springs, Alameda County. Observations were made on September 20 and during the afternoons of September 23 and October 1, 1958. Weather conditions were generally clear and warm, although September 23 was somewhat windy and cooler. The nesting site was located along the bank of a slough in the mud-flat region marginal to the bay where the soil generally is a dense, moist alkaline clay with a high organic content. Vegetation in the area consists mostly of low-growing plants, primarily pickleweed (*Salicornia ambigua* Michx.), and fat-hen (*Atriplex hastata* L.). Interspersed throughout the habitat are areas of bare soil which are utilized extensively for nesting by other aculeate Hymenoptera (*Anoplius, Ageniella, Motes, Sphex, Chlorion, Nomadopsis,* etc.). The *Astata* burrows were located in an area about twelve by three meters and contained an estimated forty active female wasps. However, the twenty-nine burrows under observation were concentrated in a small portion of the site in a zone about one by three meters. In this particular area the soil consists of a 2–3 cm. layer of loose loam at the surface, and a relatively uniform understory of moist clay and is in part covered by boards, other debris and sparse growths of *Salicornia.* Most of the wasps had selected spots for burrow construction on flat ground, just above the crest of the slough bank, however, some burrow entrances were in evidence on higher areas of the south-

facing slope and entered the ground nearly horizontally. The burrows were found in the open, near, or under the pickleweed and seemed to be randomly located with respect to the plant cover and micro-topography of the site. The Warm Springs population often had burrow entrances within a few centimeters of each other. In contrast, Evans found the Indiana population in the hardpacked clay of a baseball diamond which was completely devoid of vegetation, and, perhaps due to the nature of the site, the burrows there were located no closer to one another than half a meter.

At Warm Springs, males were observed in numbers in and around the nesting site. During the warmer part of the day individuals were commonly perched on terminals of the *Salicornia* or on other protruding objects from which they occasionally darted out in short flights over the nesting area, usually returning to the same perch in a few seconds. Although Evans did not observe males of *A. occidentalis,* possibly due to the late stage of the nesting season, he reported similar flights by the males of *A. unicolor* Say, but in the latter species the perches were located some distance from the burrows. It is presumed that these flights are associated with the mating behavior, but copulation has not been observed in either species. On the basis of his observations of *A. unicolor,* Evans concluded that the females must fly into the area occupied by the males for mating. However at the *A. occidentalis* site the males were in close proximity to the females engaged in nesting. As was reported for *A. unicolor,* these flights occurred without any apparent stimulus, and active females in the area were never approached by the males during the course of our observations. It seems likely that females copulate only once, shortly after they first emerge.

The only digging activity observed was that being carried out by females with established burrows, and probably this was associated with cell construction. The process of removal and dispersal of soil was similar to that reported by Evans. In the Warm Springs colony the burrows were in general shorter and had fewer cells than in the Indiana population. In our excavations we found the burrows ranging in length from 11.0 cm. to 14.5 cm. and terminating about 9–10 cm. below the surface, whereas Evans reported that the burrows may be as much as 18 cm. long and 12 cm. deep. He also stated that a completed burrow may have up to 14 provi-

sioned cells, but our excavations showed only three to six cells associated with any one burrow, which presumably indicates that the provisioning was in an early stage.

The prey of *A. occidentalis* Cress. consists almost entirely of adult Pentatomidae (Hemiptera), and they are stored at the bottom of the tunnel before the preparation of each cell. Cell construction apparently is not initiated by the female wasp until enough bugs are accumulated to fully provision it. The elliptical cells are smooth-walled and vary somewhat in size, averaging about 7 by 16 mm. (8 by 15 mm. in Evans' study). They are constructed singly or often in linear series up to four cells in length as short side burrows to the open tunnel. When the cells were in series, we found them to be separated by filled portions 6–11 mm. thick as compared to thin portions (1–3 mm. thick) in the Indiana study on the species. In addition, we found a slightly greater range in depth of the location of the cells (6–15 cm. as opposed to 6–12 cm. reported by Evans).

The provisioning behavior of the females in the Alameda County population was essentially similar to that observed in the previous study on the species. During the course of our observations the females did not carry out as pronounced a pattern of circling around the burrow entrance on leaving as that described by Evans. This pattern, presumably one of area recognition, was quite irregular and ranged from direct departure to running up nearby vegetation or circling a small area once or twice. It seems possible that the vegetation in the Warm Springs site was of some significance in reducing the area recognition patterns in that it supplied nearby landmarks. Provisioning at the Warm Springs site was carried out slowly. The earliest that females were seen with prey was about 11:00 a.m. (Pacific Daylight Time). In the three hour period from 11:00 a.m. to 2:00 p.m., three bugs was the maximum number to have been brought in by any one female. Most of the active females had stored only two stinkbugs during this time. The stortest interval between two successful provisioning flights by a female was 13 minutes, but the average time required for a hunting trip was a little over an hour. Our limited data did not indicate any correlation between the previous experience in provisioning and the time length of trips as has been shown for other Sphecidae (e.g. *Cerceris;* Linsley & MacSwain, 1956).

The prey taken from cells and female wasps consisted of 255 adult and two nymphal pentatomids representing six species in the following numbers:

Adults:

Holcostethus limbolarius (Stål)	164
Thyanta brevis Van Duzee	77
Thyanta pallidovirens pallidovirens Stål	7
Perillus bioculatus (Fabricius)	4
Thyanta punctiventris Van Duzee	3

Nymphs:

Trichopepla ?aurora Van Duzee	1
Thyanta pallidovirens pallidovirens Stål	1

All the previous prey records for *A. occidentalis* have been adult Pentatomidae, and this use of adults has been employed as a biological criterion for the species since other species of *Astata* prey on immature Hemiptera. The finding of the two nymphs indicates that this criterion is not an exclusive characteristic, and possibly it may depend in part upon the availability of prey. The two nymphs were found in cells of separate burrows which in each case had many adult bugs stored. The stage of wasp larvae in other cells indicated that the two cells containing the nymphs were relatively recently provisioned.

As found in the Indiana population, individual wasps usually preyed on only one or a very few species of stinkbugs. One female had collected 24 pentatomids, all individuals of *Thyanta brevis,* a second had stored 24 *Holcostethus limbolarius* and 22 *T. brevis.* However, one cell was unearthed which contained four different prey species (one *P. limbolarius,* three *T. brevis,* one *T. punctiventris,* one *T. p. pallidovirens*). The source of the prey is unknown. It has been assumed in many solitary wasp studies that the female repeatedly returns to the same habitat where prey is available, and this might account for the relative uniformity in bug species selected by *A. occidentalis* females.

Fully provisioned cells were found to contain from four to nine bugs, averaging 6.3, a significantly higher number than that reported for the species in Indiana. It is possible that the average of 3.8 bugs per cell in the latter population is at least in part due to a larger average size of the pentatomids since the predominant species of prey at Warm Springs have smaller individuals than those recovered by Evans. The prey was usually placed in the cells

in the head-in, venter-down position reported by Evans for both *A. occidentalis* and *A. unicolor*, but a certain amount of variation was observed. This was especially noted in the final few bugs of a cell, and possibly it was due to the smaller size of the prey in the Alameda County colony causing them to not fit uniformly in the oval cells. The placement of the egg is also identical with that recorded for *A. occidentalis* and *A. unicolor*.

The transport of prey is much the same as observed in the Indiana population. Some variation was noted in the manner in which the wasp supported the prey while walking near the burrow. The smaller bugs were grasped in the wasp's mandibles by the base of the beak, while in transport of larger prey she provided additional support with the fore and mid legs, although these were used for walking at the same time. On arriving at the site with prey, the female alighted on the ground or on the *Salicornia*, usually about 10–20 cm. from the burrow, and as Evans reported for the species, the approach to the burrow entrance which followed was usually quite circuitous.

None of the bugs in our study recovered from the effects of the sting. A great deal of variation in these effects was nonetheless noted. Some in freshly provisioned cells had already died, while others were kept alive in the laboratory and responded to touch for many days. One individual showed reaction for 39 days.

In contrast to the colony studied by Evans which was heavily parasitized by miltogrammine flies, only a small percentage of the cells exposed by our excavations had been destroyed by natural enemies. Although adult specimens of three species of miltogrammine sarcophagids (*Senotainia litoralis* Allen, *Metopia leucocephala* Rossi, *Metopia* sp. near *inermis* Allen) were collected in the nesting site, none were seen to follow prey-laden females, nor were maggots of these flies encountered in any cells. Of over 50 cells seen, two had been parasitized by a larger fly, one had been destroyed by ants and onther by mold. Neither of the adult flies emerged from the puparia. Two hymenopterous parasites were collected in the nesting area, but no definite association could be shown for these. Several females of the tiphiid wasp, *Myrmosa bradleyi* Roberts were taken crawling about the nesting site, and one male was netted nearby. One individual was seen to enter an *Astata* burrow, and in another instance a female *Myrmosa* was recovered during the excavation of a nest tunnel. Three specimens

of a chrysidid wasp, *Hedychrum* sp. were collected flying about the burrow sites. In addition, remains of sphecid wasps of several genera were found in the webs of Black Widow Spiders, *Latrodectus mactans* (Fabr.) amongst the *Salicornia* in the nesting site, and this spider is assumed to be an occasional predator of *A. occidentalis* in this locality. Finally, remains of excess stored pentamoids were found in several instances to be utilized by an undetermined dipterous scavenger.

Acknowledgement for determinations is gratefully made to Dr. R. M. Bohart, University of California, Davis (the *Astata* and *Hedychrum*), Professor H. J. Reinhard, Texas A & M College (Sarcophagidae), Dr. Herbert Ruckes, American Museum of Natural History, New York (Pentatomidae), Marius S. Wasbauer, University of California, Berkeley (the *Myrmosa*), and to Dr. J. W. MacSwain, University of California, Berkeley, for reading the manuscript and offering helpful suggestions.

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1956. Some observations on the nesting habits and prey of Cerceris californica Cresson (Hymenoptera, Sphecidae). Ann. Ent. Soc. Amer. 49(1) :71–84.

A NEW ENTOMOLOGICAL JOURNAL

Volume 1, number 1 of "Pacific Insects," dated July 15, 1959, has been distributed. It is a large, excellently printed journal, and should be a welcome and distinguished addition to the list of entomological periodicals. Four issues annually, totaling about 400 pages, are planned.

An explanatory paragraph states, "This journal is the organ of the program 'Zoogeography and evalution of Pacific insects' sponsored by the Entomology Department, Bishop Museum, Honolulu. It is devoted primarily to monographs or zoogeographical papers on insects and other terrestrial arthropods from the Pacific area, including eastern Asia, Australia, and Antarctica." Dr. J. Linsley Gressitt of the Bishop Museum is editor.

The subscription rate is $5.00 per volume, payable to the business manager of the Journal, Dr. C. M. Yoshimoto, Bishop Museum, Honolulu. Remittances in Yen or Stirling may be made to the business agent in Japan, Dr. K. Yasumatsu, Kyushu University, Fukuoka, Japan.

SEVERAL NEW SPECIES OF NORTH AMERICAN ORTHOPTERA

H. F. STROHECKER
University of Miami

The specimens on which the following descriptions are based have come to me in the collections of the California Insect Survey or from Mr. Jacques Helfer of Mendocino, California. Included is the description of a grasshopper which I collected many years ago in northwestern Florida.

Mr. J. A. G. Rehn of the Academy of Natural Sciences in Philadelphia, Dr. W. L. Brown of the Museum of Comparative Zoology, and Dr. Ashley Gurney of the U.S. National Museum have lent specimens of several little known species of Acrididae useful in the study. Dr. Gurney has also supplied drawings of the aedeagus of the unique type of *Melanoplus sonomaensis* Caudell.

GRYLLACRIDIDAE

Daihiniodes valgum Strohecker, new species

(Fig. 1)

This insect is referred to *Daihiniodes* largely on the basis of its tarsomeres, three in the front tarsus, four in the middle and hind tarsi, but it seems to combine the features of several rhaphidophorine genera as defined by Hubbell in 1936. The second and third articles of the hind tarsus are heart-shaped and carinate beneath as in *Rhachocnemis*, rather than distinctly spinose, while the spurs of the hind tibiae are elongate and crowded distad as in *Ammobaenetes*. The membranous area on the lower surface of the last joint of the maxillary palp extends two-thirds the length of the joint.

Head as in *D. hastiferum* (Rehn), fastigium flat and perpendicular. *Legs:* front tibia with four stout spurs on ventro-caudal margin and four slender spurs on ventro-cephalic margin (excluding terminal calcars). Front femur with a slender genicular spur on cephalic face. Middle femur with genicular spur on both faces. Middle tibia with four spines on each dorsal edge and two spurs on each ventral edge. Hind femur with many denticles on dorsal surface, its ventro-cephalic carina with 21 small spines distributed along its entire length. Hind tibia strongly bowed, each dorsal edge with eight spurs (including the dorsally directed calcar) and a number of denticles. The distal six spurs elongate, inner series longer and crowded distad forming a "sand-basket." *Subgenital plate* membranous, prolonged into two tapering lobes. The color of the insect is a rather uniform pale brown. Length of body 20 mm.: of pronotum 5.1 mm.; of front femur 6.9 mm.; of hind femur 16 mm.

Holotype male, PALM SPRINGS, RIVERSIDE COUNTY, CALIFORNIA,

June 1, 1949 (L. M. Smith), deposited at the California Academy of Sciences, San Francisco.

ACRIDIDAE

Trimerotropis helferi Strohecker, new species

(Fig. 2)

Male.—Form short and robust for the genus, in general proportions resembling *Microtes*. Femora, tibiae, coxae and adjacent areas of sterna and pleura clothed with long, white hairs, much as in *T. (olim Circotettix) maculata* (Scudder) but less dense. *Color* light gray and tan, thickly maculate and punctate with black, maculae of tegmina hardly aggregated into cross-bands. Wing disc hyaline or very feebly tinged with yellow, the black band narrow and interrupted in axillary region, reaching hind margin but little extended along it. Costal spur short, reaching less than halfway to base of wing. *Legs:* Front and middle femora and tibiae annulate with black. Hind femur with fuscous mottling in basal half of external face, and a fairly definite dark band at apical third, upper and lower edges of the external face and upper and lower flanges minutely, seriately maculate with black. Lower sulcus pale with a narrow, dark band before apex. Hind tibiae brownish yellow, darker apically, knees dusky. *Head* large, in frontal view wider across cheeks than across eyes (8:7), frontal costa deeply sulcate, its carinae continued with only a slight undulation at foveolae as the margins of the fastigium, which is rather deeply impressed and as wide as dorsal diameter of eye. Median carina of pronotum subcristate on prozona, weakly notched by first sulcus, principal sulcus deep. Lateral carinae feebly indicated on anterior lobe of prozona, definite but rounded on metazona. Hind margin of pronotum forming an angle slightly greater than 90°. Lateral lobes with lower hind angle broadly rounded. Length of body 19 mm.; of pronotum 3.7 mm.; of tegmen 18 mm.; of hind femur 10.3 mm.

Female.—Larger and stouter than the male. Coloration similar but tegminal maculae aggregated into a diffuse basal area and a cross-band at mid-length. Fastigium shallower and broader than in male. Length of body 28 mm.; of pronotum 5.3 mm.; of tegmen 24 mm.; of hind femur 14 mm.

Holotype male and allotype female, CLEONE, MENDOCINO COUNTY, CALIFORNIA, August 6, 1958 (J. R. Helfer), deposited in the U.S. National Museum (No. 64567). Paratypes: 47 males and 48 females with the same data as the holotype, and five males and two females collected by Helfer at Cleone on August 8, 1958.

Additional specimens at hand were taken by Helfer near Petrolia, Humboldt County on July 17, 1958, at Arcata and Mad R. Mts., July 1919 by E. C. Van Dyke, at Eureka, June 24, 1924 by J. M. Aldrich, June 11, 1935 by E. O. Essig. All these localities are in Humboldt County. A series of four males

and one female taken by E. G. Linsley, July 4, 1956, at Grover City, San Luis Obispo County, are remarkably short and stout with the tegmina extending only to the tips of the femora. The body length of these males is 14–14.5 mm. and the tegmina measure only 12.5–13.5 mm. Corresponding measurements for the female are 21 and 18 mm.

I have considered the possibility that the name *Trimerotropis pilosa* McNeill might be applicable to this species, but that name was probably based on small specimens of *T. pallidipennis* (Burmeister). In general appearance *helferi* resembles a small specimen of *maculata* but its closest relationship is probably with *T. arenacea* Rehn, from which it differs in stouter form, broader head, color of hind tibia, and hairiness.

Dr. Gurney, on learning of my study of this species, generously sent to me the entire series submitted to the National Museum by Mr. Helfer as well as the biological notes of the collector. Apparently *T. helferi* occupies a habitat niche similar to that of *T. maritima* (Harris) and *T. acta* Rehn and Hebard on the Atlantic coast, *i.e.*, it is an occupant of the first line of dunes. Plants with which the insect was associated are *Convolvulus soldanella* L., *Franseria chamissonis* Less., and *Artemisia pycnocephala* DC. Determinations of these were made by Dr. S. F. Blake of the Plant Industry Station at Beltsville, and communicated to me by Dr. Gurney.

Melanoplus fricki Strohecker, new species

(Fig. 3)

Resembles *M. hesperus* Hebard in size and coloration. Tegmina apically rounded. Cercus similar to that of *hesperus* but wider at base. Suranale with a transverse ridge on each side at mid-length. The most distinctive features are found in the structure of the phallus. Length of body 15.2 mm.; of pronotum 3.5 mm.; of hind femur 9 mm.

Holotype male, KING'S MOUNTAIN, SAN MATEO COUNTY, CALIFORNIA, September 28, 1941 (Kenneth Frick), deposited in the California Academy of Sciences. Allotype female with data as for holotype. It is doubtful that features adequate for differentiation can be found in the females of this group of *Melanoplus.* Paratypes: two males and two females with the same data as the holo- and allotype.

Melanoplus muricolor Strohecker, new species

(Fig. 4)

So similar to *M. nanus* Scudder that a general description is not necessary.

Tegmina three-quarters as long as pronotum, narrowly separated, apex evenly rounded. Arms of furcula attenuate, divergent. Lateral margins of suranale reflexed, forming a rather deep trough, median ridges laterally tuberculate at about mid-length of plate. Cercus similar to that of *nanus* but slenderer. Length of body 14 mm.; of pronotum 3.2 mm.; of hind femur 8.5 mm.

Holotype male, SANTA CLARA COUNTY, CALIFORNIA, September 11, 1941 (Kenneth Frick), deposited in the California Academy of Sciences. Allotype female with data as for holotype. This specimen, associated with the male, is designated the allotype, but I am unable to say in what ways it differs from the female of some other species of the *nanus* group .

In the figure of the phallus, the right side is represented as it appears in the dried state.

Melanoplus gurneyi Strohecker, new species
(Fig. 5)

A small grasshopper of the *puer* (Scudder) (s.s.) group. In Hubbell's key (1932, Miscell. Pub. 23, Univ. Mich. Museum Zoology, p. 17) it runs out to *apalachicolae* Hubbell, which it closely resembles, although smaller than the average size of that species, and with the cerci symmetrically styliform rather than dorsally excised. The edges of the suranale are not undulate over the cercal bases and the arms of the furcula are brief, rounded lobes, shorter than the tenth tergite. The phallic structure is distinctive. Length of body 12.8 mm.; of pronotum 2.6 mm.; of hind femur 8 mm.

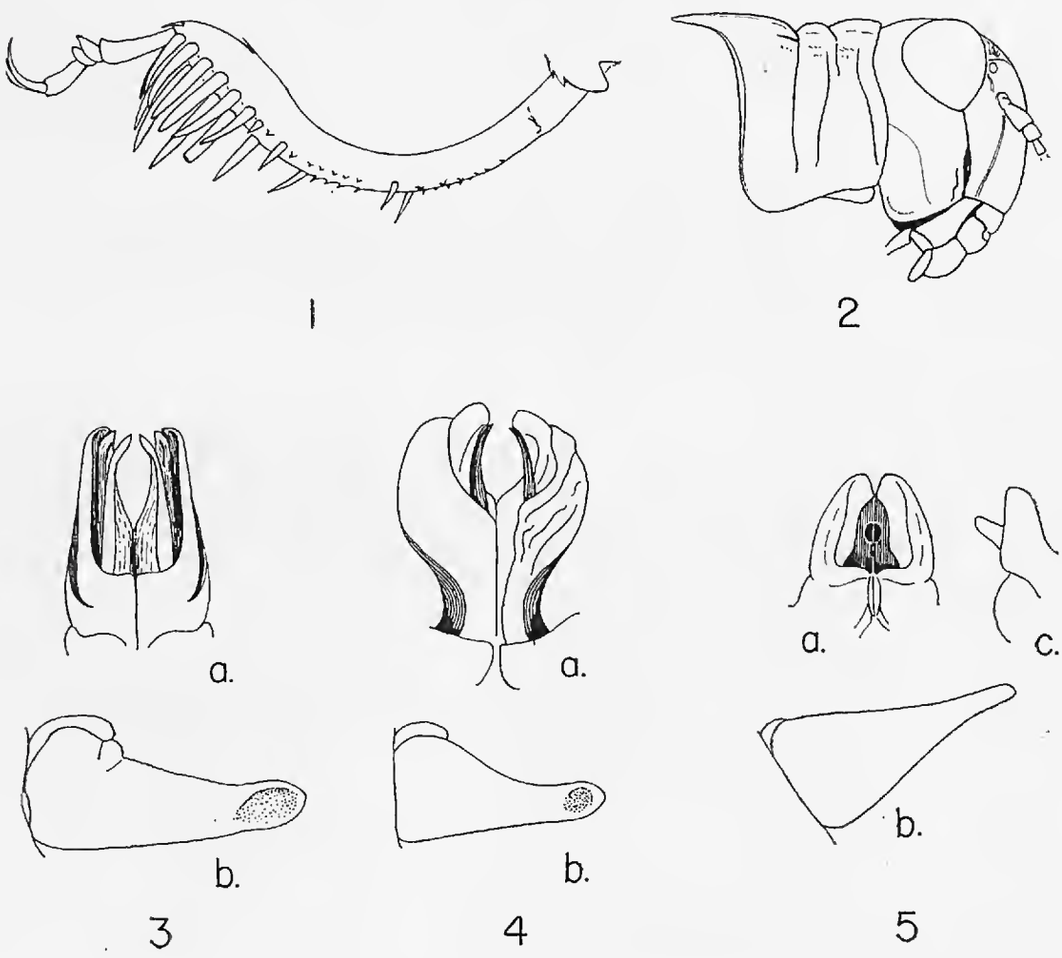
Holotype male, BEACON BEACH (now Tyndall Field), BAY COUNTY, FLORIDA, August 6, 1940 (author's collection).

Allotype female with same data as the holotype and resembling the female of *apalachicolae* to the point of identity. Paratypes: 20 males and 16 females taken with the types. The habitat of the species is a xeric sand area with *Ceratiola* the most abundant plant, this associated with dwarf oak and basil-weed. The clumps of basil-weed were occupied by *Hesperotettix gemmicula* Hebard.

Seven males collected at Inlet Beach differ from the topotypes in the greater development of the aedeagal valves, which are strongly protuberant when viewed from the side. The cerci are also proportionately shorter in the Inlet Beach specimens, but these structures show variation in length in both series.

The drawings of the phallic structure were made from potash-

glyceral preparations except the right side of figure 4a, which is drawn from the dried state.



EXPLANATION OF FIGURES

Fig. 1, *Daihiniodes valgum* Strohecker, left hind tibia of male. Fig. 2, *Trimerotropis helferi* Strohecker, head and pronotum of male. Fig. 3, *Melanoplus fricki* Strohecker, male; a. caudal view of phallus; b. left cercus. Fig. 4, *Melanoplus muricolor* Strohecker, male; a. caudal view of phallus; b. left cercus. Fig. 5, *Melanoplus gurneyi* Strohecker, male; a caudal view of phallus; b. left cercus; c. lateral view of phallus of Inlet Beach male.

ERRATA

Abbott, C. H., 1959. Pan-Pac. Ent. 35:84; line 32, read Calipatria instead of Carpinteria. The butterflies were moving out of Sonora in a west-northwest direction in the Imperial Valley.

Schuster, R. O., G. A. Marsh and O. Park, 1959. Pan-Pac. Ent. 35:117; line 11 read Dr. John R. Bowman instead of Dr. Robert Bowman.

A FRAGMENTARY OBSERVATION ON THE MATING BEHAVIOR OF TIMULLA

(Hymenoptera: Mutillidae)

Apparently relatively little is known of the mating behavior of the mutillid wasps of the genus *Timulla*. The only published data known to me relate to an observation by Fattig (1936).[1] Near Atlanta, Georgia, late in July, 1935, he observed large numbers of males of *T. briaxus* Blake flying under a tree above a tumbling mass of males about one and one-half inches in diameter, which surrounded a pair in copulation. Fattig picked up the mass and when the loose males quickly flew away he preserved the mating pair and was unable to note further activity.

On July 27, 1959, near an artificial water hole (dirt-banked tank for the use of livestock) nine miles north of Apache, Cochise County, Arizona, a wasp was seen in flight carrying an object and was mistaken for a predator with its prey. When captured, they proved to be a copulating pair of *Timulla (Timulla) oajaca* (Blake).[2] The male, being more than twice the size of the female, held the latter beneath the body by means of the legs and the curved abdomen and affixed genitalia. The two remained in copulation when placed in cyanide and the genital clasp was not released even after death.

The mating pair was flying under a broken sky with scattered clouds at 12:15 p.m. When first observed they were about 30 inches above the ground, flying in a straight line toward the southwest. They were captured when they alighted on a plant of Russian Thistle about 18 inches above ground level. Mickel (1937)[3] records the capture of a mating pair of this species at Cotulla, Texas, May 11, 1906 (J. C. Crawford) and another at College Station, Texas, July 10, 1931 (H. J. Reinhard), but no details are given of the particular circumstances.

A similar observation involving a tiphiid wasp, *Myrmosa bradleyi* Roberts, at Tracy, San Joaquin County, California, was made by J. W. MacSwain on June 7, 1949. In this instance the male was carrying the female in flight, but the two did not remain in copulation after capture.—E. G. LINSLEY, *University of California, Berkeley.*

[1] Fattig, P. W., 1936. An unusual mating of velvet ants (Hymen.: Mutillidae). Ent. News, 47:51-52.
[2] Identified by W. E. Ferguson, University of California, Berkeley.
[3] Mickel, C. H., 1937. The mutillid wasps of the genus *Timulla* which occur in North America North of Mexico. Ent. Amer., 17:1-119.

A REMARKABLE INSTANCE OF SEXUAL DIMORPHISM IN A NEW SPECIES, RHOPALANDROTHRIPS NILGIRIENSIS

(Thysanoptera: Terebrantia)

T. N. ANANTHAKRISHNAN

Loyola College, Madras-31, S. India

Notable records of sexual dimorphism among terebrantian Thysanoptera from India are rare, except for such of the more common characteristics of the male, as their apterous nature, lack of ocelli, and so forth. In this connection, mention may be made of *Exothrips madrasensis* Ananthakrishnan, where joint V of the male antenna is unique in being small, distinctly concave at inner margin, convex along the outer and with a tooth-like protuberance carrying a well developed spine, at the apex of the inner margin. Further, the fore-tibia in the male is armed with a sharp tooth at apex within, a character also met with in *Perissothrips parviceps* Bagnall and *P. aureus* Ananthakrishnan. *Rhopalandrothrips* Priesner, has elongated, bacilliform antennae in the male, more especially the VI joint which is so modified, a character much as in *Sorghothrips* Priesner. The sixth antennal joint is as long as joints III and IV in *Rhopalandrothrips ricini* Shumsher, the only hitherto known species from India; in *Rhopalandrothrips consociatus* (Targioni-Tozzetti), joint VI is as long as the combined lengths of all the other joints while in *R. obscurus* Uzel, it is longer. *Rhopalandrothrips nilgiriensis* new species, is remarkable, since the VI antennal joint of the male is nearly five times as long as that of the female and much longer than the combined lengths of the other joints. It must also be stated in this context, that in *R. nilgiriensis*, apart from the differential nature of joint VI in the male, there is considerable difference in the sizes and shapes of antennal joints III-V. There is a progressive decrease in the sizes of joints III-V, the fifth being short, cup-shaped and broadly united with the sixth.

Rhopalandrothrips nilgiriensis Ananthakrishnan, new species

Macropterous female: Total body length, 1.16 mm. Body colour: Head and thorax orange yellow; abdominal segments I-VIII pale greyish yellow; apex of IX and X dark grey brown. Antennal joints uniform brown. Forewings greyish, setae brown; hindwings pale, with a longitudinal brownish streak; fringes brown. Legs, yellowish grey. Eyes black, ocelli with dark red pigment. *Head* 1.2 times broader than long, being 120μ long and 140μ wide across eyes. Vertex slightly depressed between eyes. with a distinct notch between antennal bases. Eyes prominently

pilose, about as long as cheeks. Postocular setae short, 28μ long and interoculars 32μ long. Head at base with clear transverse striae. Mouth cone 122μ long, reaching near the hind margin of prosternum. Maxillary palp 51μ long, individual joints measuring 22, 13 and 16μ long respectively. Labial palps 16μ long. Antenna nearly 2.5 times as long as head; segments 3 and 4 vase-like with slender, pointed, horseshoe-like sense cones. *Antennal joints*, length (width) in μ:—29(26); 38(26); 51(19); 54(19); 34(16); 45(19); 8(8); 16(6). *Prothorax*, 140μ long at middle, hind margin distinctly arched, surface densely setose. Anterior angles with a small spine 19μ long; hind angles with a pair of well developed spines, outer 58μ long and inner 61μ long; hind margin with two pairs of spines, the outer small and half as long as the inner, which is 35μ long. *Pterothorax*, 238μ long. Wings well developed, 910μ long, 98μ wide at base, 56μ at middle and 35μ at tip. Wing chaetotaxy: costa 26; upper vein 4 + 3 (at base) + 2 (at tip); lower vein 16 in a row. *Abdomen* broad at middle, narrowing towards apex; VIII abdominal segment with a well developed comb. The outer, middle and inner bristles of IX abdominal segment, 93, 125 and 166μ long respectively; tenth segment with outer and inner bristles 109 and 115μ long; ovipositor 238μ long.

Macropterous male: Total body length 1.008 mm. Coloration as in the female, but darker; head and thorax of a darker hue; abdomen darker grey brown; wings grey brown with an orange tinge; antenna darker brown. *Head* 112μ long, 126μ wide across cheeks; cheeks slightly serrate, with transverse striae at base. Eyes 70μ long and almost as wide. Antenna more than three times as long as head. Antennal joints III–VI totally differing in size and shape from those of the female, especially joint VI which is nearly five times as long as that in the female, profusely setose, the setae arising from distinct warts. Antennal joints, length (width) in μ: — 29(26); 38(28); 43(21); 26(19); 16(19); 211(29 at base); 5(3); 10(5). *Prothorax* 112μ long, 168μ wide at base; pterothorax 252μ long, 224μ wide across mesothorax and 196μ wide across metathorax. Wings well developed, 742μ long, 70μ wide at base, 49μ at middle and 42μ at tip. Wing chaetotaxy: costa 26; upper vein, 6 (at base) + 2 (at tip); lower vein, with 15 in a row. The outer, middle and inner bristles of IX abdominal segment and the outer and inner bristles of the X abdominal segment, 77, 64 and 102μ and 86 and 77μ long respectively. *Genitalia*, Length of hypophallic arms and the median phallus, subequal, 99μ long.

Holotype male and a female on pear leaves, May 3, 1957, POMOLOGICAL STATION, COONOOR (5500′), INDIA. Types with the author (T.N.A. 274).

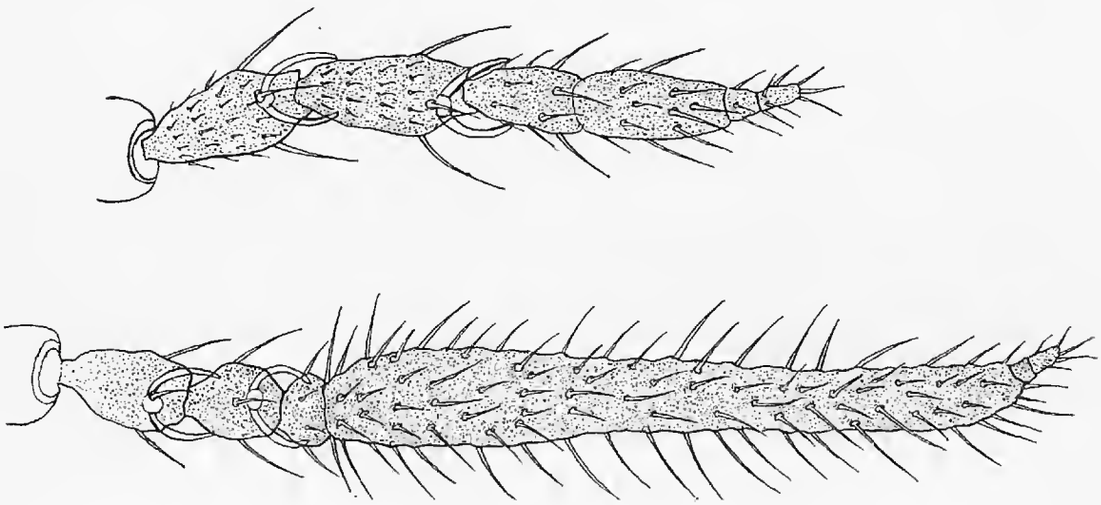
A comparison of *R. nilgiriensis* with the other species of the world, namely, *R. annulicornis* Uzel, *obscurus* Uzel, *consociatus* (Targ. Tozz.), *corni* Moulton and *ricini* Shumsher reveals that it is now possible to classify the existing species into two groups, namely, the *consociatus* group, with antennal joint VI of the

male as long as or much longer than joints I-V together, and the *annulicornis* group with joint VI shorter than joints I-V respectively. Accordingly, *R. nilgiriensis* Ananthakrishnan belongs to the *consociatus* group while *annulicornis, obscurus, corni* and *ricini* belong to the *annulicornis* group.

KEY TO SPECIES OF RHOPALANDROTHRIPS (MALES)

1. Antennal joint VI longer than combined length of joints I-V.....2
– Antennal joint VI shorter.....4
2. Joint VI as long as or slightly longer than combined length of I-V ..... *consociatus* (Targioni-Tozzetti)
– Joint VI very much longer.....3
3. Lower vein of forewing with 14 or less setae.....*obscurus* Uzel[1]
– Lower vein with more than 14 setae.....*nilgiriensis* Ananthakrishnan
4. Antenna 6-jointed, apterous.....*annulicornis* (Uzel)
– Antenna 8-jointed, macropterous.....5
5. Joints III and IV much shorter than VI.....*corni* Moulton
– Joints III and IV as long as VI.....*ricini* Shumsher

The author is particularly indebted to the Ministry of Education, Government of India, for the award of a grant for the survey of Thysanoptera of Ootacamund and Kodaikanal Hills.



EXPLANATION OF FIGURES

Rhopalandrothrips nilgiriensis Ananthakrishnan; upper, antenna of female; lower, antenna of male.

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[1] The female of *obscurus* shows definite differences from *nilgiriensis*.

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AN ADDITIONAL NOTE ON THE LIFE HISTORY OF MITOURA SPINETORUM (HEWITSON)

(Lepidoptera: Lycaenidae)

A lycaenid larva taken on May 16, 1959, at Russelman Park, Mt. Diablo, Contra Costa County, California, by W. S. Ross, was subsequently turned over to Tilden, who reared from it a normal male of *Mitoura spinetorum* (Hew.).

The larva was found on Pine Dwarfmistletoe *(Arceuthobium campylopodum* Engelm.), a previously recorded foodplant. The larva pupated on May 17, and the imago emerged June 14, 1959, after the long pupal period of twenty-eight days. The color of the larva matched the foodplant perfectly. The pupa however was very dark brown and was hidden in the branches of the foodplant and held in place by an incomplete silken girdle.

This insect is uncommon in the Mt. Diablo area. This is the first recorded rearing of the species from Contra Costa County or from the San Francisco Bay Region of California.

There appear to be but three previous references[1] to the life history habits of *Mitoura spinetorum*.—J. W. TILDEN, *San Jose State College, San Jose, California.*

[1] Comstock, J. A., & C. M. Dammers, 1938. Bull. So. Calif. Acad. Sci. 37:30-32.
Garth, J. S.,, 1950. Grand Canyon Nat. Hist. Assoc. Bull. 11:31.
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PACIFIC COAST ENTOMOLOGICAL SOCIETY

PROCEEDINGS

Two Hundred and Sixty-third Meeting

The two hundred and sixty-third meeting of the Pacific Coast Entomological Society was held February 28, 1959, in the Morrison Auditorium of the California Academy of Sciences, San Francisco, California. President R. L. Doutt called the meeting to order at 2.00 p.m.

The following members were present: H. Ruckes Jr., E. S. Ross, D. D. Jensen, E. O. Essig, R. M. Bohart, A. E. Michelbacher, W. H. Nutting, L. Caltagirone, E. L. Kessel, W. W. Middlekauff, P. H. Arnaud, Jr., L. M. Henry, T. S. Acker, E. P. Catts, J. A. Powell, J. R. Powers. D. Burdick, J. W. Tilden, R. Langston, D. Giuliani, K. W. Brown, C. J. Rogers, J. E. Henry, T. Seeno, R. S. Dahl, D. H. Huntzinger, A. Samuelson, C. D. MacNeill, F. J. Santana, J. G. Edwards, H. B. Leech, D. P. Furman, F. E. Skinner, R. C. Miller. Visitors registering were: Arden E. Palmer, Sheila Palmer, Aldeau Clemens, John Sanjean, Margaret E. Bohart, P. S. Messenger, Mrs. P. S. Messenger, Mrs. Richard Doutt, Walter Thomsen, Samad Vojdani, J. A. Chemsak, Mary Ann McHenry, Mrs. Jerry Powell, Jerry I. Stage, Byron N. Chaniotis, Frank Parker, Lionel A. Stange, Jeanette Rogers, William A. Freeman, Soenoto Atmosoadjono, Mrs. R. Dahl, Lynda Dahl, Mrs. Rita Huntzinger, Mr. and Mrs. S. S. Rivas, Max Barret.

The minutes of the meeting held December 13, 1958 were read and approved.

The President announced the following appointments to the committee to judge the entomological exhibits at the forthcoming state science fair: Kenneth Hagen (Chairman), Laura Henry, H. B. Leech.

Dr. Ruckes proposed the following nominees for full membership in the Society: Sheila Palmer, Paul Marsh, O. S. Bindra, K. R. Thakare. He also nominated E. Paul Catts for student membership. Hugh Leech nominated Ted Spilman for full membership. J. G. Edwards nominated for full membership: Calvin J. Rogers, John E. Henry, Fred J. Santana, and Kirby W. Brown. The nominees were elected to membership by unanimous vote.

In response to the President's call for notes and exhibits, Dr. Ruckes projected color slides of the sugar pine cone beetle, *Conophthorus lambertianae* Hopkins. He noted that the beetle spends the winter as an adult in the mined tip of a sugar pine twig. This winter there appears to be a very large population of surviving cone beetles as evidenced by the great number of mined twig tips visible on the sugar pines in the Sierras. This is the first time in the past four years that such a high population has been recorded.

Dr. J. W. Tilden exhibited a preserved pair of ixodid ticks in mating posture. The male is much smaller than the female, and is fastened with the chelicerae apparently attached to the genital opening of the female.

Mr. H. B. Leech projected slide transparencies of an adult female of *Cuterebra latifrons* Coquillett which he collected from the basement of his home.

Mr. E. P. Catts, to whose attention the living cuterebrid had been brought, stated that approximately 275 eggs were laid by the fly. In efforts to rear adults from these eggs, a total of 40 host individuals of six rodent species were infested with from one to six first instar larvae per host. Infestation was accomplished by allowing the larvae to penetrate the nares of the hosts. No apparent annoyance to the host was caused by the initial penetration. Mature larvae were obtained from the house mouse, laboratory rat and a wood rat, *Neotoma fuscipes*. Three larvae from *Neotoma* and *Rattus* pupated and emerged after 36-41 days. Two were males and one a female. Identification of the specimens was made by Dr. Curtis Sabrosky of the U. S. National Museum.

Miss Alice Gray, of the American Museum of Natural History, gave an interesting account of the decorative uses of insects. Miss Gray commented on the varied uses of insects in costume jewelry, in designs for clothing material, as models for toys and in a variety of other adaptations. Her comments were highlighted by a fascinating collection of exhibits.

Mr. H. B. Leech of the California Academy of Sciences, described his recent winter collecting trip to the Cape region of Baja California, Mexico. The following account is given verbatim.

"Mr. Alan Leviton, herpetologist of the California Academy of Sciences, and I left San Francisco on December 3, 1958, in an almost new ¾-ton International 'Travelall', equipped with 4-wheel drive, a power winch, and 8-ply tires. Stopping at the San Diego Museum of Natural History we got advice on road conditions from Dr. George Lindsey and Mr. Huey—and as a result had overload springs installed the next day. At nearby La Mesa we enjoyed the hospitality of Dr. and Mrs. F. X. Williams.

"By road from Tijuana, the peninsula of Baja California is almost a thousand miles long. The first 140 miles or so, to Arroyo Seco, are paved; the next 40 have been graded but are now severely washboarded. Beyond El Rosario one enters the region of interesting endemic plants, and travels over some of the roughest roads in North America. The country is rugged, with jagged and barren-appearing mountains in view most of the time as one travels, till the Magdalena Plains are reached just before the Cape region. The road is nearly all single track, through sand, gravel, rock (where it is sometimes too narrow to allow dual tires), and dirt; it often follows arroyos and flood plains, where both the surface and placement change with every heavy rainstorm. In the Cape region travel is much easier, except after floods and between Todos Santos and Cabo San Lucas.

"Because of a time schedule, no collecting stops were made between Tijuana and La Paz, although a few things were taken at night on camp stops. At Canipole we turned southeast to Loreto, then up a wonderfully scenic canyon (mostly one-way road, with grades to 23%) where water beetles could be seen from the car as we forded streams.

"At La Paz we were joined on December 17 by Dr. Ira L. Wiggins of Stanford, leader of the expedition. Arrangements were made to rent a house for headquarters and storage of equipment. Much help and advice were received from residents, especially Mrs. Margaret Waters, Mr. Walter Heyne-

man, and Dr. and Mrs. Eduardo Ajuria. Contact was also made with Mr. and Mrs. K. Bechtel, the expedition's sponsors, and three one-day collecting trips made in their plane. On December 21 Mr. Duncan Porter, botany student of Stanford University, arrived and collected with us until the end of the year. Mr. Allyn Smith, conchologist of the California Academy of Sciences, and Dr. Reed Moran, Curator of Botany at the San Diego Natural History Museum, came by plane on January third and finally returned with us; Dr. Wiggins had to leave on January 10.

"We collected in the Cape region, around La Paz and down to and around the cape, from December 18 to January 27, when we shipped on the boat Korrigan IV, Captain Elizondo, for Guaymas, and drove home via Tucson, Arizona. Entomological collecting was generally poor, though there were many shrubs in flower. The Gulf side east of the Sierra de la Victoria, from Cabo San Lucas to east of La Paz, had a terrific rain storm with hurricane winds last September. Though it wrought extensive damage, especially at San Jose de Cabo, it also resulted in extensive plant growth, and the cattle were in better condition than for many years. Dr. Wiggins decided that we should take advantage of the unusually lush winter conditions in the low country, so we did not go into the mountains at all.

"Despite the many flowers, there were vitrually no Hymenoptera, Diptera or Heteroptera on them, and only a single beetle, a cerambycid, was taken on a flower. One common mallow-like shrub, *Melochia tomentosa* (Sterculiaceae), did attract large long-tailed skippers in numbers, and a rarer vine, *Cardiospermum halicacabum*, had butterflies, wasps and flies at the flowers; pretty green hairstreaks were so intent on *Cardiospermum* nectar that they could be picked off with tweezers, one after another. Along the road about 6.5 miles north of Todos Santos many noctuid moths could be seen at night on the nectar-producing flowers of *Agave* sp., but most were out of reach; flowers of other species of *Agave* seen were not nectiferous.

"With one exception, collecting with a beating sheet was totally unproductive, because there were virtually no insects on the trees and shrubs (many of which were too thorny to beat, anyhow). The exception was *Yucca valida*; by beating the pads of dead leaves hanging around the trunks of the living trees, I got many insects sheltering there: carabids, monommids, bruchids, chrysomelids, in the Coleoptera; silver fish, cockroaches, katydids, spiders and scorpions tumbled out, and sometimes numbers of ants and termites. *Polistes* sp. were an occupational hazard of this type of collecting, and produced a good deal of activity when their nests were unknowingly banged.

"Sweeping with a heavy net was impractical because of the rigid and/or spiny nature of nearly all the shrubbery. Butterfly collecting was good so far as numbers of species and specimens, especially skippers, was concerned; but it was nearly impossible to chase any active butterfly, except along paths or roads, because if I took my eyes off the ground to watch the insect, I was in cactus or sprawled over a rock in no time.

"Some luck was had by turning over the many cardón trunks felled by the September storm, and rock rolling was fairly good if you liked scorpions. Large coastal sand dunes at Rodriguez, some 20 miles west of La Paz, and

those of San Lucas, gave some interesting Tenebrionidae, and at the latter place cockroaches. Smaller coastal dunes southeast of La Paz promised much, for they were obviously covered with the tracks of large nocturnal tenebrionids; upon patrolling them at night with a light, I was terribly disappointed to find that these track-makers were soldier crabs.

"During January, night temperatures in the lowlands of the Cape region averaged between 50° and 60° F., yet light collecting with a Coleman lantern was very poor. A few moths usually came in, and sometimes swarms of small corixids, but often not a single beetle. Much better luck was had during the colder evenings in the northern half of the peninsula, during our trip down in early December.

"In individuals, the most common insect species was *Polistes* sp. or spp. These wasps were ubiquitous and a nuisance; they often swarmed around the car, wherever we happened to stop it, and even forced us to eat our lunch away from the desirable shade of the vehicle. They were a real hazard to butterfly collecting, because the swinging net disturbed and annoyed them. Other than for butterflies, the only really productive collecting was on the few occasions that we found suitable water.

"Irrigation streams and flood pools gave few species, though often in large numbers. But natural streams and seepages, not necessarily permanent, yielded a fine lot of aquatics, including half a dozen new species and a number of new records for the region. For instance, a good stream in Arroyo Aqua de los Pasos, about 12.5 miles east of La Paz on the road to Las Cruces, produced at least 15 species of Dytiscidae and Hydrophilidae on January 4, but on January 23 it was bone dry. A pool three feet long and a foot deep, at the end of a drying up trickle at Arroyo Saltito, near Las Cruces, contained over 30 species of Dytiscidae and Hydrophilidae, including *Hydrochus* sp., a genus not previously reported south of Hamilton Ranch, some 700 miles north."

Dr. P. S. Messenger of the University of California Experiment Station described the large, controlled environmental test chambers currently in use at the Albany station for research on insect biology. These chambers were formerly used in Hawaii and in Texas for fruit fly investigations. Their use enables the investigator to duplicate the seasonal fluctuations of a region in question at any time of the year, including diurnal variations. Dr. Messenger demonstrated use of the chambers with a series of projection slides.

The meeting was adjourned to the "Coffee Social" at 4:00 p.m.—DEANE P. FURMAN, *Secretary*.

Two Hundred and Sixty-fourth Meeting

The two hundred and sixty-fourth meeting of the Pacific Coast Entomological Society was held April 11, 1959, in the Morrison Auditorium of the California Academy of Sciences, San Francisco, California. President R. L. Doutt called the meeting to order at 2:05 p.m.

The following members were present: D. P. Furman, T. Palmer, E. S. Ross, K. S. Hagen, R. H. Van Zwaluwenburg, D. D. Linsdale, J. A. Powell, W. E. Ferguson, L. E. Caltagirone, F. E. Skinner, J. Milstead, P. D. Hurd, Jr., D. G. Denning, D. Burdick, E. P. Catts, K. W. Brown, T. S. Acker, H. B. Leech, T. C. Lawrence, J. G. Edwards, P. H. Arnaud, Jr., C. D. MacNeill,

C. Cushner, R. L. Doutt, R. L. Langston, E. L. Kessel. Visitors registering were: A. E. Palmer, Clark Ross, W. E. Simonds, P. S. Messenger, Padre Francisco S. Pereira, A. Earl Pritchard, Ron Stecker, Wm. M. Thwaites, John P. Herron, Ronald E. Wheeler, Don R. Totten, Catherine Toschi, Robbie, Rick and Stephanie Ferguson.

The minutes of the meeting held February 28, 1959 were read and approved.

The President announced that the judging of the exhibits at the state science fair would be held on the following week-end. He also stated that the date for the annual field day of the Society had been set for May 16th at Russelman Park.

In response to the call for nominations for members to the Society, Dr. P. D. Hurd, Jr., nominated Charles W. O'Brien, a graduate student in systematics at the University of California. Dr. Hurd also proposed that William E. Simonds of the Bureau of Entomology, California Department of Agriculture, be reinstated as a regular member. Dr. Ken Hagen nominated Mr. Jim Milstead, a graduate student in the Department of Entomology at the University of California, and Dr. Allan D. Telford at the Department of Biological Control, University of California, Albany. The three candidates and the one applicant for reinstatement were unanimously elected to full membership in the Society.

In response to the President's call for notes and exhibits Don Burdick noted that at the December meeting of the Society Mr. Wasbauer and he had stated that adults of *Methocha californica* Westwood probably would not emerge until next spring. The prediction was proved erroneous with the emergence of a male on January 16, 1959. Details of cocoon spinning were discussed.

Dr. E. S. Ross exhibited a book, "Aphidoidea of the Middle East" by Bodenheimer and Swirski. The book is particularly noteworthy in view of the stress placed on the ecology and physiology of aphids.

Jerry A. Powell exhibited examples of a hepialid moth, *Hepialus sequoiolus* Behrens. Pupae and larvae were collected from galleries in stems of *Lupinus arboreus* at Pt. Reyes, Marin Co., Calif. on February 27, 1959, and one male was taken at the same time. *H. sequoiolus* has long been known to be a borer in the lower stems of this plant, the habits of the species having been first described by Williams (Ent. News, 16:285. 1905) in San Francisco. In this connection, a point of interest to note is that there are three additional species of Micro-lepidoptera which were described from the San Francisco sand dune area that have been taken from the bush lupine at Pt. Reyes during the last two years. These are the tortricids, *Argyrotaenia franciscana* (Walsingham), a leaf feeder, *Epinotia infuscana* (Walsingham) which bores in the stem tips, and lastly *Grapholitha imitativa* Heinrich, a very common moth flying amongst the lupine in April and May, the larvae of which have not as yet been discovered.

Ronald Stecker exhibited a cerambycid beetle, *Xystrocera globosa* (Olivier) collected at San Jose State College about April 1st. It apparently emerged from ash or mahogany imported from Japan or the Philippines. The

beetle is widely distributed throughout Madagascar, Egypt and the Oriental region.

Mr. Stecker also described a technique for collecting fleas from rodents without harm to the host. The animal is paced in a jar which has just been rinsed with 70 per cent ethyl alcohol. The fleas quickly jump from the host, sticking to the damp surface of the jar. The rodent is then removed, the jar rinsed with alcohol again, pouring the rinse into a collecting vial along with the fleas.

Mr. H. B. Leech showed some color slides illustrative of problems encountered in this type of photography. One slide of a living *Metriona bicolor* (Fabricius) showed no trace of the beautiful golden color of the insect, the electronic flash having done away with it, and depicting instead, the anatomical details under the iridescence.

Leopoldo Caltagirone, Entomologist of the National Entomological Station, La Cruz, Chile discussed the recent changes in the scope of entomological studies in Chile. He cited the earliest publication, to his knowledge, on the natural history of the country written by a Chilean as the "Saggio sulla storia naturale del Chili", by the Jesuit Abbe Juan Ignacio Molina, published in Italy in 1782. In the 19th century foreigners like Gay, Germain, Philippi and Reed contributed greatly to knowledge of Chilean insects. Carlos Porter, in the late 1800's and first three decades of the 20th century, influenced studies of Chilean natural history. During the same period, working in pure and applied entomology, were Manuel Jesus Rivera, Carlos Silva Figueroa, Carlos Camacho, Claude Joseph, Flaminio Ruiz, Carlos Stuardo, and others. These men and their works form the Chilean entomological tradition. At present however, entomology in Chile is not taught as an independent professional field, but merely a subject in the curricula of agronomy, veterinary and human medicine, and biology. Entomologists in Chile in the recent past have specialized either in taxonomy or economic entomology, with little stress on ecology or distribution of insects. Encouraging support has been given recently to advancement of the ecological and biogeographical aspects of the field.

Padre F. S. Pereira, C.M.F., Departamento de Zoologica, Secrataria de Agricultura, Sao Paulo, Brazil, discussed Brazilian entomological collections. The principal collections are at Rio de Janeiro and Sao Paulo. In Rio de Janeiro are the Museo Nacional, Escola Nacional de Agronomia and the Instituto Oswaldo Cruz. In Sao Paulo are the Departamento de Zoologica and the Instituto Biologico. Padre Pereira listed a number of active workers together with their fields of interest.

Mr. Frank Skinner next exhibited a series of color slides of coccinellids feeding on aphids. He also placed on demonstration an exhibit of color slides, so arranged as to be viewed simultaneously by transmitted light.

Mr. R. H. Van Zwaluwenburg, Entomologist, Hawaiian Sugar Planters' Association (retired) discussed his recent tour of European museums in connection with his work on elaterid beetles of the Pacific area. He noted that most of the types are located in European museums. He gave his impressions of the major museums of Europe with interesting sidelights on personnel and facilities encountered.

Following a brief discussion the meeting was adjourned to the "Coffee Social" at 3:15 p.m.—DEANE P. FURMAN, *Secretary.*

Two Hundred and Sixty-fifth Meeting

The two hundred and sixty-fifth meeting of the Pacific Coast Entomological Society was held as a field day, May 16, 1959, at Russelman Park, Contra Costa County, California.

The following members registered: E. G. Linsley, J. W. MacSwain, W. W. Middlekauff, O. W. Graf, D. P. Furman, P. H. Arnaud, Jr., H. Ruckes, Jr., W. E. Ferguson, Sheila Palmer, E. S. Ross, J. W. Tilden, R. L. Langston, J. Milstead, D. M. Maddox, F. E. Skinner, J. E. Swift, K. Brown. Visitors registering were: R. W. Stark, Phyllis Middlekauff, Marguerite E. Arnaud, Mr. and Mrs. Arden Palmer, Patricia Palmer, J. W. Tilden family, R. L. Langston family, Samad Vojdani, Ray F. Smith, Stephanie Ferguson, Wilda Ross, Mustafa Ozer, Jim Milstead family, Frank Skinner family, Deane Furman family, John Swift family.

An informal field day meeting of the society was held on the slopes of Mount Diablo. Hiking, collecting, swimming and baseball were among the more strenuous activities, but the shaded park benches and tables drew their share of attention, as a place to visit with old friends and new acquaintances. —DEANE P. FURMAN, *Secretary.*

Two Hundred and Sixty-sixth Meeting

The two hundred and sixty-sixth meeting of the Pacific Coast Entomological Society was held October 17, 1959, in room 113 Agriculture Hall, University of California, Berkeley, California. President R. L. Doutt called the meeting to order at 2:10 p.m.

The following members were present: R. L. Doutt, R. C. Miller, R. M. Bohart, R. L. Usinger, T. S. Acker, R. L. Langston, Y. Tanada, H. B. Leech, P. H. Arnaud, Jr., F. R. Cole, J. W. Tilden, R. F. Smith, J. R. Powers, E. E. Lindquist, D. H. Huntzinger, E. G. Linsley, K. S. Hagen, F. E. Skinner, J. E. Milstead, W. E. Ferguson, R. W. Thorp, E. P. Catts, D. P. Furman, O. S. Bindra. Visitors registering were: Margaret E. Bohart, Rodger Mitchell, Herbert C. Brodahl, David C. Brodahl, A. Earl Pritchard, Paul R. Ehrlich, Libby Smith, Soemarlan, Stamford D. Smith, Fred Watari, Bill Freeman, Barry E. Pullen, Philip S. Barker, Theodoros Buchelos, Panayotis Doxopoulos, Frank J. Radovsky, H. T. Gordon.

Dr. Ray Smith welcomed the members and guests of the Society to the meeting at the University of California.

The minutes of the meetings held April 11th and May 16, 1959 were read, corrected and approved.

The President announced the following awards made by the Society at the 1959 State Science Fair: Honorable Mention to Art Horning of the Sunset School, Carmel, California. First Place to David Brodahl of Winton School, Hayward, California. David was presented with the book, Living Insects of the World, by A. B. Klots and E. B. Klots.

The President announced that the committee to select a slate of nominees for Society officers for 1959 is composed of Kenneth Hagen, Hugh B. Leech, J. G. Edwards, Chairman.

The Auditing committee selected by the Executive Board consists of J. W. Tilden, Chairman, C. Don MacNeill, Ray Smith.

In response to the request for nominees for membership the following candidates were proposed for full membership: K. L. Mahler, John F. Lawrence, Dan Brinkman, Junji Hamai, Cornelius V. O'Connell, Jr., Michael J. Cowell and T. R. Haig. Ray F. Smith was nominated for reinstatement as a full member. The candidates were elected to full membership by unanimous vote.

Dr. Ray Smith discussed the organization of entomology as a discipline at the University of California, noting that teaching of entomology started 68 years ago on the Berkeley campus. A basic feature of the training at this campus is the development of a scholarly attitude by the student, who not only must fulfill requirements in basic courses in entomology but also in a wide variety of other fields such as botany, genetics, chemistry and zoology. While both undergraduate and graduate majors in entomology are trained, the majority of students are graduates. At present there are 77 graduate students in entomology at Berkeley.

Dr. Smith outlined briefly typical examples of current research projects under investigation by staff of the Department of Entomology and Parasitology. The California Insect Survey was inaugurated formally in 1947. The objective is a survey of the insect fauna of the state. The official publication is the Bulletin of the California Insect Survey, which was started in 1950. Other projects mentioned were "Insects in amber". Literally thousands of specimens are now on hand, many dating back to the Oligocene period. In forest entomology active research is progressing on determination of factors involved in tree selection by beetles. Four staff members are working on insect vectors of plant diseases. Two staff members are investigating the biology and ecology of wild bees, significant agents in the pollination of wild and cultivated plants.

Dr. Usinger discussed problems in biosystematics of bedbugs, pointing out that he is in a unique position, in that he has representatives of all the 50 known species and 20 genera of the world, and has most of them alive in cultures at present. Much remains to be done, however, before the systematics of the Cimicidae is clarified. On his recent collecting trip in Africa he collected a new species of *Leptocimex* in which the organ of Ribaga, previously considered a reliable generic guidepost, is very different from that of other members of the genus. At the species level in various genera he has found numerous characters which seemed valid, but upon analysis these have been found to vary indiscriminately. A detailed study of the Cimicidae of the world is the continuing object of his attention.

William W. Allen discussed control of the cyclamen mite as a research project which involved more or less routine screening of insecticides. Even so, in the final development of an effective control it was shown to be necessary to determine the persistence of residues on the fruit, as well as to determine the detrimental effects which insecticides might have on natural enemies of the mite. *Hoplia* beetles were described as pests which attack the roots of strawberries. Although strawberries are attacked in the same areas where *Hoplia* adults damage grapes, biological studies show that the

two are separate species. The *Nemocestes* weevils were discussed as another native insect which became a pest when strawberries were planted in close proximity to their native hosts.

Dr. Harold Gordon presented a talk on current developments in insecticide resistance, which is summarized below.

Since house flies became DDT-resistant about 1947, there has been an unbroken series of victories by the insects over chemical control by synthetic organic insecticides, and it now seems likely that any insect species can in time acquire resistance to any one insecticide. The insecticide industry has not been seriously worried until recently, because the development of DDT-resistant strains at first seemed to be a welcome opportunity for the introduction of competitive insecticides. However, the increasing occurrence of "positive cross-resistance" is now causing universal concern.

With DDT-resistant house flies, lindane or aldrin gave excellent control for a time, but then strains of flies arose that were resistant to lindane and aldrin and still resistant to DDT. Later use of organic phosphates gave rise to strains that were resistant to phosphates and still resistant to chlorinated insecticides. These strains are in fact "pre-adaptively" resistant to some of the new carbamate insecticides (such as Sevin or H-57) which have never been used on flies. Such extreme "posititive cross-resistance" would seem to spell the death of chemical control. This is especially depressing because even if the use of all insecticides is discontinued for several years, resistance declines but does not disappear completely, so that re-use of insecticides re-selects highly resistant strains in one or two generations.

Since it is hopeless to look for an insecticide which is "resistance-proof", toxicologists are studying ways of using two or more insecticides. One approach being examined by Dr. Hoskins at Berkeley is the detection of incipient resistance, from small changes in dosage-mortality curves that occur while effective control is still possible. The hypothesis is that shifting to another insecticide will reduce or eliminate the "positive cross-resistance" which occurs when the shift is made too late, i.e., when high resistance to the first has already appeared.

Another idea is the finding of insecticides which can be used in alternation. The theory is that resistance to one insecticide will decline as resistance to the other increases, and that the decline will be fast enough to allow successful continuous alternation of the two.

My own preference has developed in the last year, and favors the simultaneous use of two insecticides capable of giving "mutual synergism". The possible mechanism of this effect rests on the fact that high resistance to an insecticide seems to involve the development of a high concentration of a fairly specific enzyme that can destroy it. "Mutual synergism" can occur between two insecticides which are dissimilar enough so that two distinct detoxicating enzymes are required to destroy them, but similar enough so that each can protect the other from the action of its specific enzyme. Such synergism will not occur between any two insecticides. However, neither will it be an extremely rare effect, difficult to find.

Dr. Richard Bohart discussed the entomology summer field course of the University of California. This is a required course for all undergraduate

majors in entomology. It is given over a four to six week period of the summer at various localities. Most of the sessions have been held in California, but a very rewarding period was spent recently in the Chiricahua Mountains of Arizona where the American Museum of Natural History operates its Southwestern Research Station. The course provides assurance that entomology students experience a variety of field collecting, observing the activity of insects in their normal environments.

In response to the President's call for notes and exhibits, J. W. Tilden exhibited a glow worm, evidently a larviform female of some species of Lampyridae, which was taken by Bruce Tilden on the evening of August 2, 1959, at the lower end of Madera Canyon, Santa Rita Mountains, Arizona. It glowed very brightly but intermittently and would stop glowing if disturbed. It fed on slugs and angleworms, surviving until October 12, 1959.

E. P. Catts displayed an exhibit of two living Cuterebrids collected in Marin County, California. These were collected as part of a study on these myiasis producing Diptera of rodents. The specimens are unusual in that they possess pronounced red eye spots. The species is unknown.

Numerous other exhibits were placed on display by members of the staff and graduate students of the Department of Entomology and Parasitology.

The President noted that a "coffee social" and display of exhibits would follow the formal meeting. The meeting was adjourned at 4:20 p.m.—DEANE P. FURMAN, *Secretary.*

Two Hundred and Sixty-seventh Meeting

The two hundred and sixty-seventh meeting of the Pacific Coast Entomological Society was held December 12, 1959, in the Morrison Auditorium at the California Academy of Sciences, San Francisco, California, President R. L. Doutt called the meeting to order at 2:10 p.m.

The following members were present: R. L. Doutt, W. A. Doolin, J. W. Tilden, D. Giuliani, C. J. Rogers, Judy Ross, K. W. Brown, D. H. Huntzinger, J. G. Edwards, R. L. Usinger, L. A. Stange, B. N. Chaniotis, A. Menke, P. Marsh, F. E. Skinner, E. P. Catts, Laura M. Henry, J. W. MacSwain, W. D. Murray, W. A. Russell, D. D. Linsdale, T. Lawrence, P. H. Arnaud, Jr., T. Acker, D. Rentz, J. A. Powell, W. E. Ferguson, K. S. Hagen, D. P. Furman. Visitors registering were: Mrs. R. M. Bohart, Mrs. Blanca Labrador, Mr. and Mrs. Walter D. Riley, José Ramón Labrador, J. T. Doutt, Mrs. Richard Doutt, Richard J. Doutt, Mrs. Calvin J. Rogers, Ronald E. Wheeler, Stamford D. Smith, Ronald E. Hall, Jalil Abul-Hab, Fred Iltis, Soemarlan, Fred Watari, Monroe H. Pastermack, Jr., Michel M. J. Lavoipierre, Nancy C. MacSwain, John MacSwain, Gerald I. Stage, Roy R. Snelling, Paul Ehrlich, Mrs. Jerry Powell, Mrs. William E. Ferguson, P. S. Messenger.

The minutes of the meeting held October 17, 1959 were read and approved.

The following nominees were proposed for regular membership: David C. Rentz, Ronald E. Hall, Stamford D. Smith, Miss Judy Ross, Frank Parker. The candidates were elected to regular membership by unanimous vote.

Dr. R. C. Miller presented the Annual Report of the Treasurer.

Dr. J. W. Tilden, reporting for the Auditing Committee, stated that the Society books had been examined and found to be in order. The above two reports were accepted by unanimous vote and a copy of the Treasurer's Report placed on file.

J. A. Powell, reporting for the Editorial Committee, stated that the Pan-Pacific Entomologist had printed 220 pages this year in addition to indices, and some 25 manuscripts have been submitted for future issues.

H. B. Leech, Chairman of the Historical Committee, reported that our file of letters by the Coalburg, Virginia lepidopterist, W. H. Edwards, all to W. G. Wright of San Bernardino, California and apparently complete for the period 1882-1905, have been loaned to Mr. F. Martin Brown for study.

He also noted that Mr. E. R. Leach of Piedmont has presented the first section of his entomological correspondence and hopes to be able to get the late F. W. Nunenmacher's letters for the Society's historical file. Another recent acquisition is the Owen Bryant correspondence, much of it relating to specimens now in the California Academy of Sciences' collections.

President Doutt announced that Professor E. O. Essig and Mr. R. H. Van Zwaluwenburg have been reappointed to three year terms on the Publication Committee.

Reporting on the state of the Society, President Doutt noted that there are approximately 350 members, about 150 of whom receive notices of meetings. During the past year the average attendance of members at meetings has been 47.

In response to the call for notes and exhibits Paul Arnaud noted that a caterpillar of the monarch butterfly collected in the fall of 1957 at Redwood City, San Mateo Co., California produced a tachinid fly maggot which emerged during the chrysalis stage of the host. However the chrysalis later produced an apparently normal butterfly. Only two species of tachinids are known from the monarch in this area, and although the maggot died in the process of pupating, it may possibly be identified later from the preserved larva.

Paul Ehrlich reported briefly on the annual meeting of the Society for the Study of Evolution and the Darwinian Centennial Celebration held at Chicago in November. He stated that the entomological contributions were among the most outstanding presented.

Mr. Leech mentioned having visited one of our members, The Rev. Edward Guedet, at Notre Dame Hospital, San Francisco, where he has been for the past year. He is in good spirits and would enjoy visits from entomologists. His fine collection of Lepidoptera was presented to the Academy during the period 1944-1950.

In view of the present interest in collecting by means of mercury vapor lights, Mr. Leech drew attention to a prediction by the late Owen Bryant that this should be the best attractant light (1908. Science, N.S. 28 (727): 797–798).

Jerry A. Powell read a note concerning a collection of Noctuidae visiting flowers. On the evening of September 23, 1959, a number of moths were seen hovering about the flowers of glossy abelia, *Abelia grandiflora*, a common ornamental bush of the honeysuckle family, on the University of Cali-

fornia, Berkeley campus. Collections were made from a number of bushes at that time and at dusk the following day (about 7:30-8:00 p.m. P.D.T.) during typically cool, breezy evenings for the area. Seven species of noctuids were taken in the following numbers, *Pseudaletia unipuncta* (Haworth) (3), *Heliothis zea* (Boddie) (2), *H. virescens* (Fabricius) (5), *Autographa egena* (Guenee) (1), *A. biloba* (Stephens) (2), *Trichoplusia ni* (Hübner) (3), and *Mouralia tinctoides* Guenee (3). Although most of these are abundant and widespread species and are commonly encountered in other parts of California, Powell had encountered only *unipuncta* and *biloba* in Berkeley in four years' collecting at lights. In addition, *Mouralia tinctoides* is a relatively little known species in this area, apparently not having been previously recorded north of Santa Barbara, California.

William Ferguson, who attended the recent Centennial meeting of the American Entomological Society at Philadelphia, noted that this was the first society devoted to Entomology in the United States. In many respects the Society is not unlike the Pacific Coast Entomological Society today.

J. G. Edwards announced that Dr. Otto Swezey died on December 7, 1959.

Dr. Usinger moved that the Society express its condolences to Mrs. Swezey over the death of Dr. Swezey. The motion was seconded and passed by unanimous vote. The Secretary was directed to send the letter.

Dr. Edwards, reporting for the nominating committee, nominated the following members to serve as Society officers during 1960: President, J. W. Tilden; Vice President, Paul H. Arnaud, Jr.; Secretary, Frank E. Skinner; Treasurer, Robert C. Miller.

The nominees were elected to office by unanimous vote.

The Chair was turned over to incoming President J. W. Tilden, who called upon retiring President R. L. Doutt to deliver the Annual Address, titled "Natural Enemies and Insect Speciation".

The address, which will be published separately in the Pan-Pacific Entomologist, was followed by a spirited discussion, with particular interest centering around the concept that factors affecting populations are all density dependent versus the concept that certain factors are independent of density.

As a final item on the agenda J. G. Edwards projected a colorful series of slides depicting his activities in collecting alpine insects in Montana and Canada.

The meeting was adjourned to the "Coffee Social".—DEANE P. FURMAN, *Secretary*.

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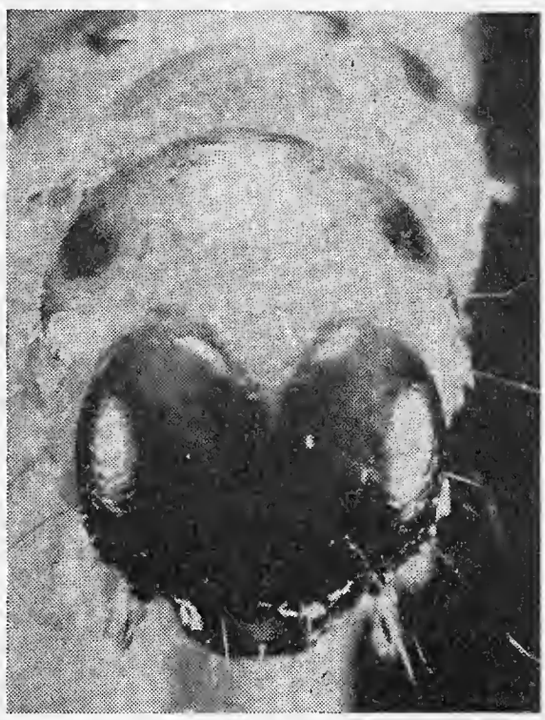

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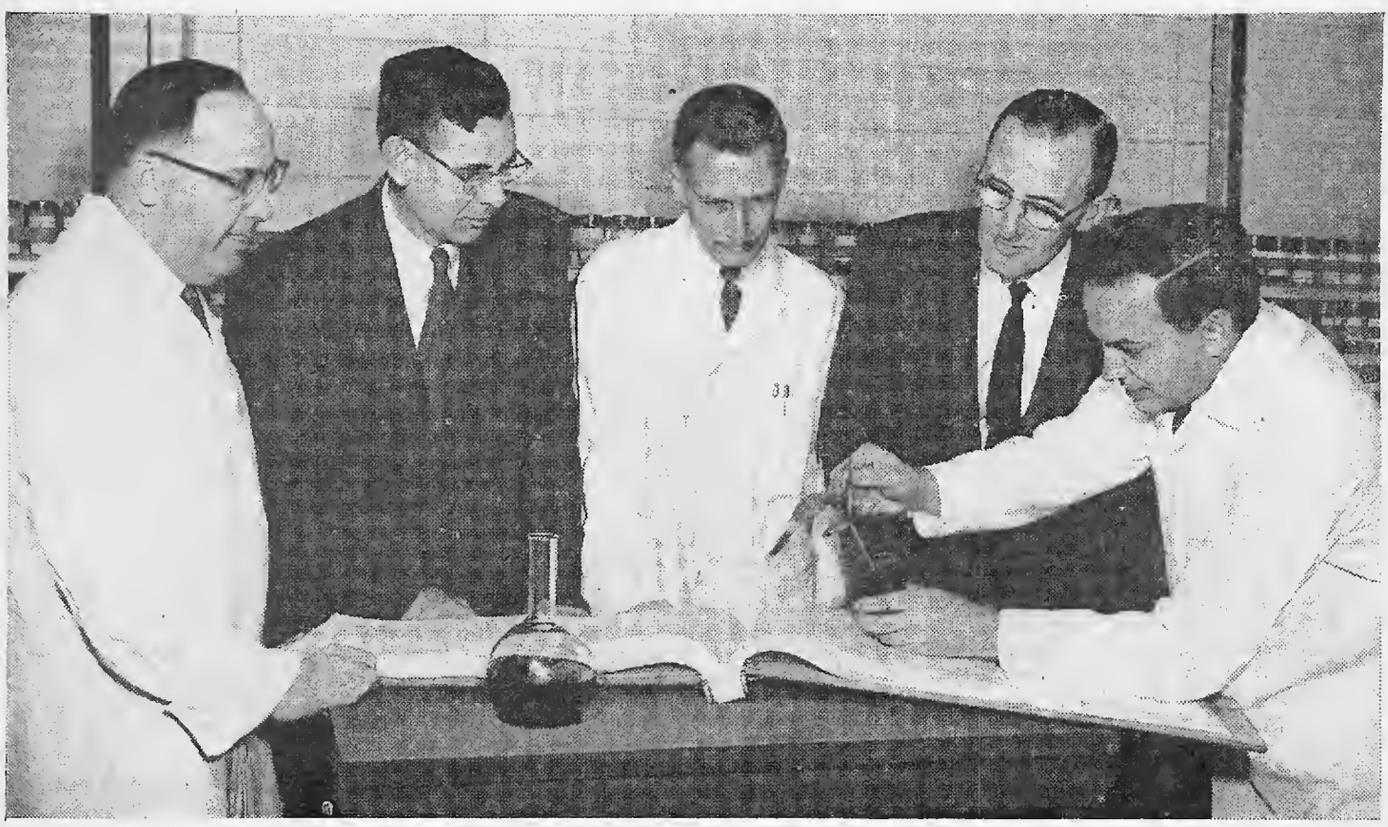

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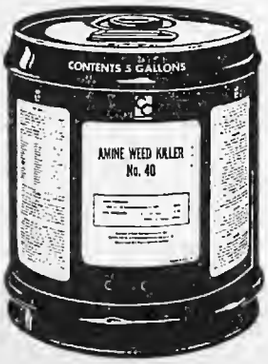

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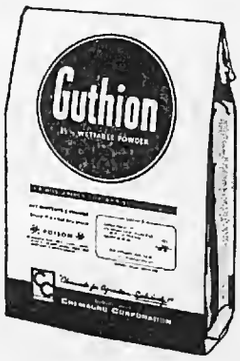

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THE PAN-PACIFIC ENTOMOLOGIST

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A REVIEW OF TWO UNCOMMON CALIFORNIA GENERA OF THYSANOPTERA (TEREBRANTIA)

Stanley F. Bailey
University of California, Davis

Having previously reviewed the Aeolothripoid genera, as well as *Heterothrips*, a summary of the two California genera, *Merothrips* and *Oligothrips*, may now be presented. The latter is known only from this state. A discussion of these two genera follows their technical descriptions.

Merothrips Hood

Hood, J. D., 1912. Proc. Ent. Soc. Wash. 14:132–134

Head usually elongate, with a long seta on dorsum between base of antenna and eye. Eyes normal in macropterous forms, reduced in apterous forms. Ocelli present in macropterous forms. Antennae long, moniliform, eight-segmented; segments III and IV with sensory areas at distal end. Mouthcone bluntly rounded. Maxillary palpi two or three-segmented; labial palpi two-segmented. Prothorax wider than long, nearly always longer than head; anterior angles without prominent setae, posterior angles with one or two long setae at each angle. Legs short and stout, fore and hind femora swollen, armature present on fore legs; heterogonic forms known. Wings, when present, without microsetae on surface; forewing with two longitudinal veins. Abdomen very blunt at posterior; ovipositor very greatly reduced. No comb on posterior margin of segments. Abdomen of male without ventral sensory areas and without externally projecting claspers.

Type of the genus: *Merothrips morgani* Hood, 1912. Apterous female holotype in Hood collection.

The family Merothripidae is represented presently by this single, non-fossil genus.

As has been pointed out so sagely by J. D. Hood (1937), the eminent thysanopterist, "individuals of this aberrant genus are so extremely rare that a critical study of the taxonomy of the group cannot be made until various unknown forms, some macropterous and some apterous, have been discovered." At present no macropterous males have been collected, and in only two species have the oedymerous males been seen. As years pass the accumulated knowledge should be periodically summarized for the record and to aid future workers in taking the next step forward. No previous summary of this genus, now with twelve valid species, has been published. The bits of knowledge of this rare group which were

obtained by the now deceased J. R. Watson, Dudley Moulton, and J. C. Crawford unfortunately were never summarized. I have compiled the scattered information on the group and specifically record as new (1) the male of *laevis* Hood, (2) the nymphal stage of *morgani* Hood only, (3) present new synonymy of *morgani*, (4) offer a provisional key to the world species, (5) thanks to Priesner, extend the known distribution of the genus to continental Europe[1], and (6) through correspondence with K. Sakimura, make note that Kurosawa in 1941 observed cocoon-spinning. I have been pared with many genera, but forming sufficient base upon which to broaden our concept of the genus.

Ideally a published description should be sufficiently complete and accurate that a worker familiar with the group could visualize and reconstruct the species. When unique specimens are unavailable for study such a device is most helpful, even though it has obvious vulnerable aspects. The writer first used this method in *Erythrothrips* (Bailey, 1947, Pan-Pac. Ent. 23:105). In *Merothrips* the more recent descriptions have been so well detailed and the measurements so inclusive that on graph paper it is possible to reconstruct the salient features of *genuinus* Hood, *nigricornis* Hood, and *productus* Hood. With the exception of *morgani*, I have been able to examine neither the Hood species nor *williamsi* of Priesner. In discerning and evaluating small differences between thrips species it appears to me that physical measurements should be weighted about 40 per cent and judgment, acquired over the years, weighted 60 per cent.

From the nature of the micro-habitat in which *Merothrips* species live, it has been supposed they are fungus feeders or scavengers of some sort. To our knowledge none have been reared through their life cycle. The majority of specimens have been collected under dead bark, in plant debris and in fungi. H. E. Cott and the writer have collected a few specimens of *morgani* from the frass in beetle burrows in dead willow. Large numbers of collections of leaf mold, dead bark of various trees, moss, duff from beaches and pine woods have not yielded *Merothrips* in California. Eggs observed in the body cavity of *morgani* and *laevis* indicated that normal reproduction by oviposition occurs. The

[1] In correspondence dated September 19, 1957, Priesner stated, "I had a visit this year from Dr. Bournier (France) who collected a lot of most interesting thrips in Southern Europe, among them two specimens of a *Merothrips* of which we only knew some fossil forms from the Baltic amber." (*M. fritchi* Pr., 1924.)

greatly reduced ovipositor and the habitat in which the adults are found lead one to believe the eggs are merely dropped in or on the substrate as is the case with many Tubulifera. The only nymphs of *Merothrips* known to the writer are those of *morgani* collected by K. Sakimura in pineapple trash and one by F. Andre from dead pine bark.

Lastly I might note that the very well-developed fore legs with spurs are usually indicative of a predaceous habit, or at least indicative that such a need for these structures once existed.

Key to the Species of Merothrips Hood

1—Posterior two-thirds of lateral margins of head (cheeks) expanded to form a narrow shelf (Plate II, fig. 4) ..... *genuinus* Hood
—Head not so expanded 2
2—Head produced anteriorly beyond eyes (Plate II, fig. 5) ..... *productus* Hood
—Head not produced anteriorly 3
3—Sensory areas on antennal segments III and IV transverse 4
—Sensory areas on antennal segments III and IV oval (Plate I, fig. 3), not linear or not as a broad band 5
4—Maxillary palpi 2-segmented. Sensory areas linear and very narrow ..... *laevis* Hood
—Maxillary palpi 3-segmented. (This character is not given in descriptions of *cognatus, genuinus, nigricornis, productus* and *williamsi*) Sensory areas in the form of a broad band extending not over half way around antennal segments III and IV 7
5—Color dark brown to blackish brown. Head length 99 microns, width 85 microns ..... *nigricornis* Hood
—Color yellow to pale yellowish brown or grey brown. Head much smaller 6
6—Very small species; total length of antennal segments III-V, 81 microns ..... *capensis* Faure
—Total length of antennal segments III-V, 99 microns; segments more slender (see Plate I, fig. 8) ..... *morgani* Hood (apterous male)
7—Pronotum with two long setae at each posterior outer angle (Plate II, fig. 3). Antennae very long, segments III-V, 152 microns (Plate I, fig. 10) ..... *mirus* J. C. Crawford
—Pronotum with one long seta at each posterior outer angle. Antenna much shorter 8
8—Major setae very short; postoculars, 13 microns; posterior pronotals, 39 microns ..... *brevisetis* Hood (macropterous female)
—Major setae longer 9
9—Head with two small setae between postocular and smaller postocellar seta ..... *tympanis* Hood
—Head with only one seta (the occipital) between each postocular and postocellar seta 10
10—Macropterous female with large tibial tooth. Without postocular

setae.....*fusciceps* Hood and Williams
—Macropterous female (of those described) with small tibial tooth. Postocular setae present.....11
11—Head very broad (135 microns); ratio of length to width 0.94. Antennal segment IV, 43 microns.....*williamsi* Priesner
—Head much narrower and antennal segments IV much shorter.....12
12—Eyes "prolonged on ventral surface to a point directly beneath posterior dorsal margin of head".....*cognatus* Hood
—Eyes not prolonged ventrally to the same length as the posterior dorsal margin of head.....*morgani* Hood

Merothrips brevisetis Hood

Merothrips brevisetis Hood, 1954. Proc. Biol. Soc. Wash. 67:20–21.

The terminally located sensory areas on antennal segments III and IV and the short setae separate this species from *morgani* Hood and *tympanis* Hood. Hood specifically noted that the eyes are "margined posteriorly and medially by one pair of setae (the occipitals) between postoculars and postocellars." This species, like *morgani,* is known to have oedymerous (or maximum heterogonic) males. Collection data: South America. Brazil: Belem, Para. Both sexes taken from dead branches of *Heavea* and *Bixa,* July-August.

Merothrips capensis Faure

Merothrips capensis Faure, 1938. Pub. Univ. Pretoria. Ser. II, Nat. Sc. No. 4: 6-7, Pl. I, figs. 3–4.

Faure informs me that considerable additional material in this genus has been collected in Cape Province and Zululand. Apparently a complete range of heterogonous forms of *capensis* is now known. The small oval sensory areas on the antennae (Plate I, fig. 9) and small size enables this species to be distinguished from the gynecoid apterous males of *morgani.* Collection data (incomplete): Africa. Cape Province, Hermanus. Both sexes taken from fallen leaves and moss, January. Recent correspondence with R. zur Strassen indicates additional species now are known in Africa.

Merothrips cognatus Hood

Merothrips cognatus Hood, 1925. Psyche 32(1):53–54.

Information on this species is scanty. It was originally compared with *fusciceps* Hood and Williams, and *williamsi* Priesner, both known from unique, macropterous females. The describer separated it from the holotype of his *fusciceps* by the ventrally prolonged eyes. Collection data: West Indies. Trinidad. Female

"on dead branch of *Lagerstroemia* infested with bromeliads." Other data lacking.

MEROTHRIPS FUSCICEPS Hood and Williams

Merothrips fusciceps Hood and Williams, 1915. Jour. N.Y. Ent. Soc. 23(2):123–125, Pl. VII, figs. 1–4.

This species appears to be very distinctive in that postocular setae are absent (see original illustration of Hood) and that the macropterous female has large tibial spurs typical of the oedymerous male of *morgani*. The antenna is very similar to that of the macropterous *morgani* (Plate I, fig. 6). If a colony of this species is collected, undoubtedly apterous forms would be among the individuals. Such a finding should clarify its relationships. Collection data: NORTH AMERICA. Louisiana, New Orleans. One female from an ornamental clump of bamboo, December.

MEROTHRIPS GENUINUS Hood

Merothrips genuinus Hood, 1938. Rev. de Ent. 8(3–4):354–357.

The very distinctive shelf-like expansion of the cheeks and the very large oval sensoria (Plate II, fig. 4, Plate I, fig. 2) further exhibit the greater diversity in the genus on the Atlantic coast than is presently known elsewhere. There is no other known member of the genus which has these unique characters. Collection data: NORTH AMERICA. Florida: Homestead. Both sexes collected from dead branches, December.

MEROTHRIPS LAEVIS Hood

Merothrips laevis Hood, 1938. Rev. de Ent. 8(3–4):350–352.

What I believe to be the male of this species has been seen from Jamaica (Ill. Nat. Hist. Sur. Collection, No. 49642). One specimen only was examined. It is apterous and of normal form. The pronotum (male) and critical antennal segments (female) are illustrated in Plate II, fig. 1 and Plate I, fig. 4. The original description stated that the pronotum was without sculpture. Apterous females (det. Watson) from Key West and Stock Is., Florida, which I have seen, have faint anastomosing lines on the surface. Such variations throw some doubt on the determination even though the sensory areas on the antennae definitely place them with *laevis*, as do the two-segmented maxillary palpi. These specimens have a minute tooth on the terminal tarsal segment on all legs (Plate III, fig. 4). I have not seen the unique type. Collection data: WEST INDIES. Jamaica. NORTH AMERICA. Florida: Pine Key, Key West, Stock Is.

Both sexes in shells, debris, moulding leaves, etc., January and May.

MEROTHRIPS MIRUS Crawford

Merothrips mirus J. C. Crawford, 1942. Proc. Ent. Soc. Wash. 44(7):152–154.

This species is very distinctive and can be readily distinguished by its large size, the two long setae at each posterior outer angle of the pronotum, and the large sensory areas on antennal segments III and IV (Plate II, fig. 3 and Plate I, fig. 10). Collection data: SOUTH AMERICA, Brazil: Nova Teutonia, Santa Catharine. Females taken on dead branches, May–July.

MEROTHRIPS MORGANI Hood

Merothrips morgani Hood, 1912. Proc. Ent. Soc. Wash. 14:132–134, Pl. V, figs. 1–3.

Merothrips floridensis Watson, 1927. Fla. Ent. 10(4):60–61. (New synonymy.)

Merothrips hawaiiensis Moulton, 1937. Proc. Haw. Ent. Soc. 9(3):411–412. (New synonymy.)

Merothrips plaumanni J. C. Crawford. 1942. Proc. Ent. Soc. Wash. 44(7): 150–152. (New synonymy.)

The genotype, *morgani,* was described from apterous forms of both sexes. Collections recorded up to 1937 apparently included only apterous forms. Moulton (1937) described *hawaiiensis* from winged specimens. I now have available a sufficiently large series of this species to see the range in forms, although I feel the complete range to maximum heterogonic forms, possibly in both sexes, has not yet been brought together. A careful study of the macropterous *fusciceps* Hood & Williams and *cognatus* Hood should be made with illustrations of the chaetotaxy of the head to enable one to more accurately separate them from *morgani*. To date

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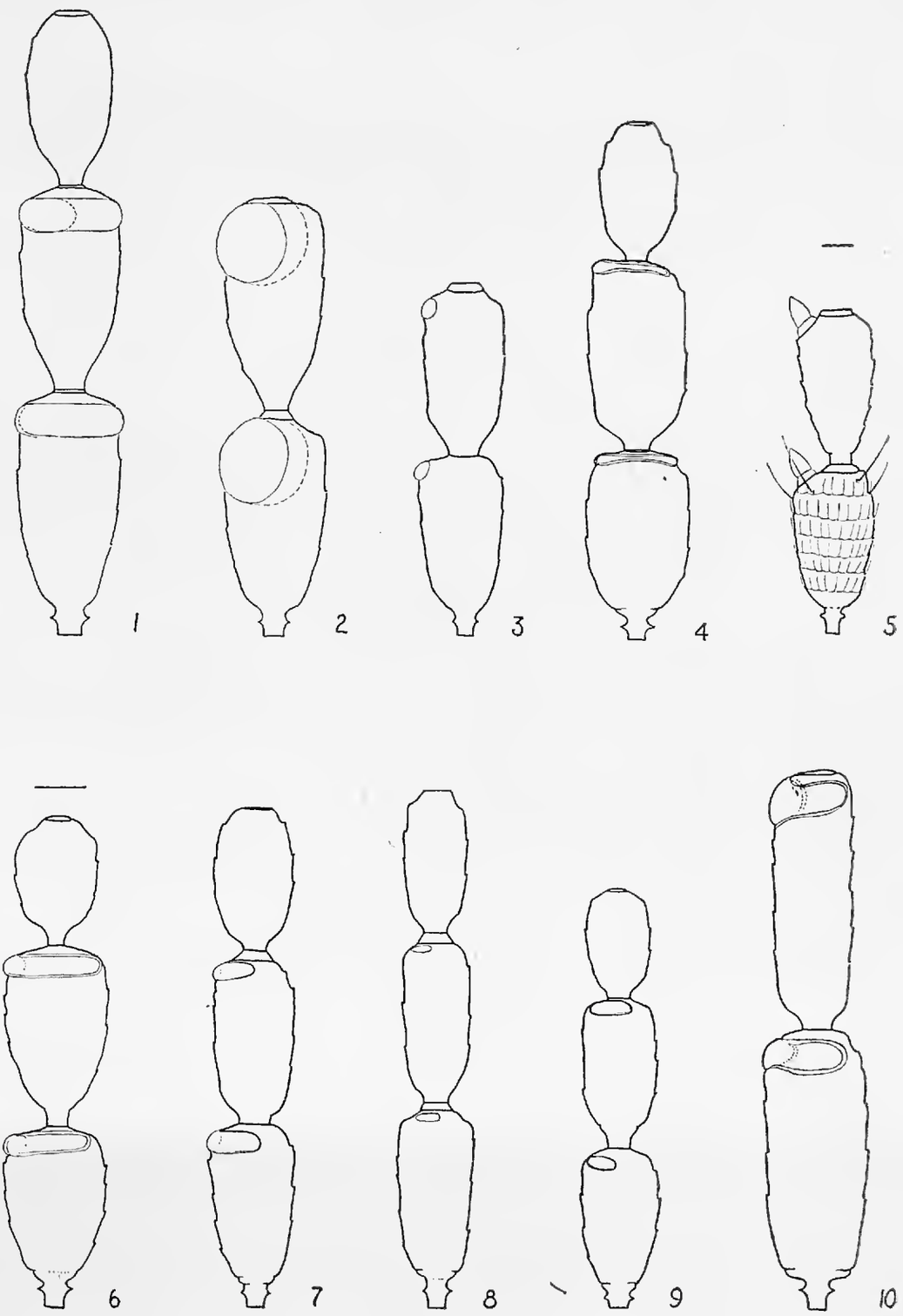
EXPLANATION OF FIGURES

Fig. 1. Antennal segments III, IV, V of *Merothrips productus* Hood, macropterous female (reconstructed from original description); 2. Antennal segments III and IV of *Merothrips genuinus* Hood, macropterous female (reconstructed); 3. *Merothrips nigricornis* Hood, apterous female (reconstructed); 4. Antennal segments III, IV, V of *Merothrips laevis* Hood, apterous female; 5. Antennal segments III and IV of *Oligothrips oreios* Moulton, topotype female; 6. Antennal segments III, IV, V of *Merothrips morgani* Hood, macropterous female; 7. *Merothrips morgani,* apterous female; 8. *Merothrips morgani,* apterous male, maximum form; 9. *Merothrips capensis* Faure, apterous female (reconstructed); 10. Antennal segments III and IV of *Merothrips mirus* J. C. Crawford, macropterous paratype female. Scale: Figs. 1–4, 6–10, line equals 0.01 mm.; fig. 5, 0.032 mm.

I am unaware of a hetergonic form in the female, although some specimens verge on "monstrous" forms. Some specimens studied appear to be de-alated. Note also should be made of the record of *morgani* (Hood, 1917) from Pine Key, Fla., Jan., 1914. This specimen apparently was described many years later, in 1938, as *laevis* Hood as the collection data are identical.

K. Sakimura has been fortunate in obtaining a series of



morgani (= *hawaiiensis* Moulton) which shows the range in size of apterous males and both the macropterous and apterous females, as well as the nymph. This excellent series was collected from pineapple trash, via a Berlese funnel, at Poamohu, 1600 ft., Oahu, T.H. Moulton's specimens of *hawaiiensis* (California Academy of Sciences, San Francisco, type slide No. 5397) were compared with this material as well as with Watson's types of *floridensis (floridanus* Watson, 1927, *lap. cal.)* and Crawford's paratype of *plaumanni* (Crawford specimen No. 835) from Brazil. I believe all three to be synonymous with *morgani.* Variations exist in the degree of sculpture on the pronotum. The California and Hawaiian specimens have a much smoother pronotum than specimens collected in Virginia by Andre (USNM collection). No differences are noted in the antennae, palpi, or chaetotaxy. The known forms are illustrated in accompanying plates. Collection data: BRAZIL. TERRITORY OF HAWAII. NORTH AMERICA. California, D.C., Florida (many localities), Illinois, Iowa, Kentucky, Maryland, New Jersey, New York, Ohio, Texas, Virginia. Both sexes collected all year from many "hosts" which are rotting bark of various trees, spanish moss, *Polyporus, Andropogon,* pineapple trash, date palm, bromeliads, ferns, etc. Some collections have been made via a Berlese funnel.

MEROTHRIPS NIGRICORNIS Hood

Merothrips nigricornis Hood, 1937. Rev. de Ent. 7(2–3):272–274, fig. 3c.

This species is known from a unique female. It is separated by "the unusually dark coloration, strongly protruding eyes, and the greatly reduced antennal sensoria." Collection data: SOUTH AMERICA. Peru: vic. Celendin, Depart. de Cajamarca. From flowers of *Helianthus Jelskii,* June.

MEROTHRIPS PRODUCTUS Hood

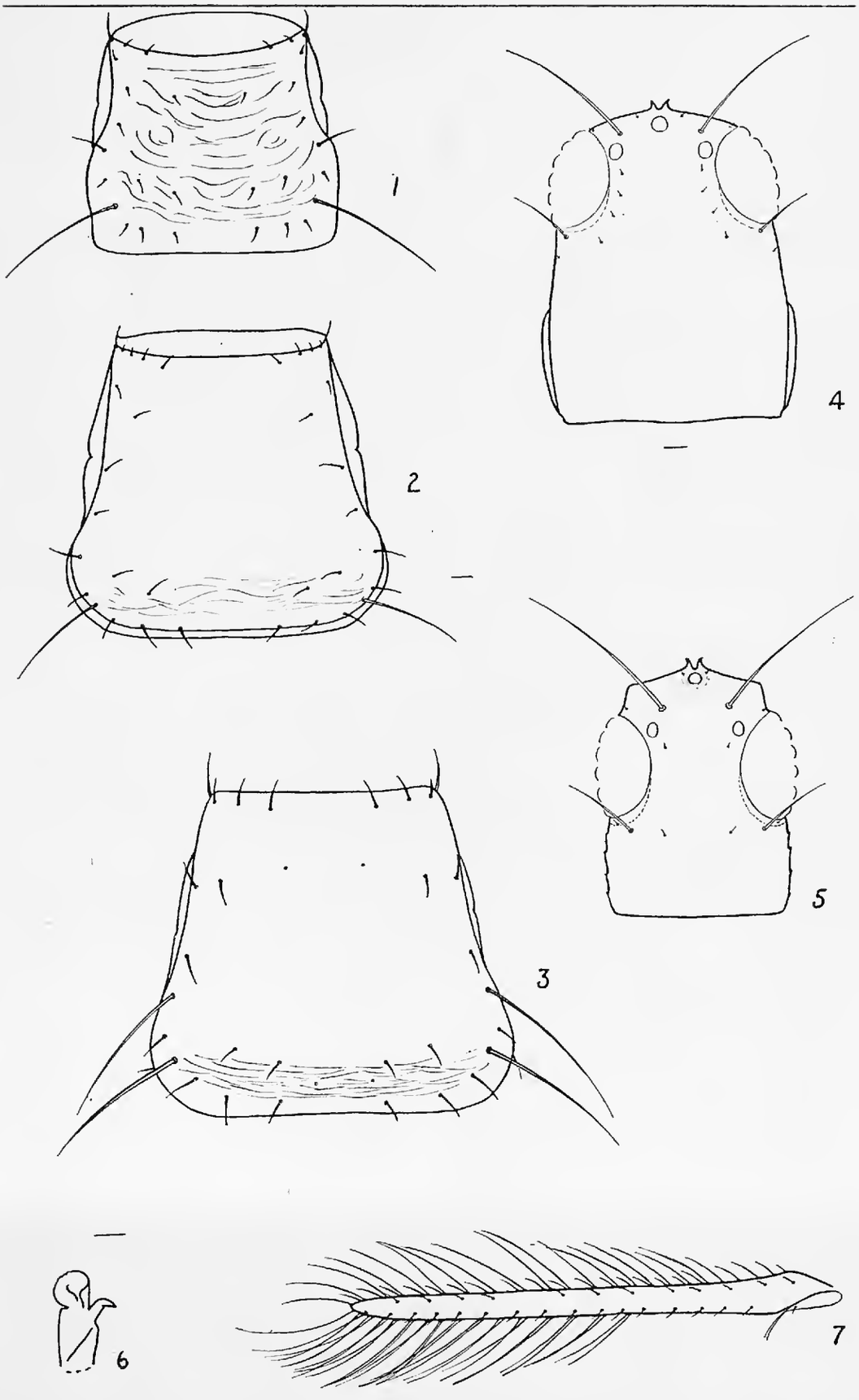
Merothrips productus Hood, 1938. Rev. de Ent. 8(3–4):352–354.

This North American species, while known from a unique

EXPLANATION OF FIGURES

Fig. 1. Pronotum of *Merothrips laevis* Hood, apterous male; 2. *Merothrips morgani* Hood, maximum apterous male; 3. *Merothrips mirus* J. C. Crawford, macropterous female; 4. Dorsum of head of *Merothrips genuinus* Hood, macropterous female (reconstructed); 5. *Merothrips productus* Hood, macropterous female (reconstructed); 6. Fore tarsus of *Oligothrips oreios* Moulton; 7. Fore wing of *Merothrips morgani* Hood, macropterous female. Scale: Figs. 1–3, line equals 0.01 mm.; figs. 4, 5, 7, 0.02 mm.; fig. 6, 0.016 mm.

female is readily separated by its produced head and the form of the sensoria (Plate II, fig. 5 and Plate I, fig. 1). Hood in describing it raised the question of the possibility of it being a de-alated specimen. Collection data: NORTH AMERICA. North Carolina:



Rocky Point, Pender County. One female from a dead branch. October.

MEROTHRIPS TYMPANIS Hood

Merothrips typmanis Hood, 1954. Proc. Biol. Soc. Wash. 67:20.

This South American representative, along with its close relative, *brevisetis* Hood, has not been illustrated. It has relatively broad sensory bands on the antennae and is separated by its describer by means of "two pairs of setae between postoculars and postocellars." Collection data: SOUTH AMERICA. Brazil: Nova Teutonia, S.C., Rondon, Parana. Many females from dead branches, September and December.

MEROTHRIPS WILLIAMSI Priesner

Merothrips williamsi Priesner, 1921. Deutsche Ent. Mus. 3:191–192.

To date it has not been possible to locate the unique type and, with the aid of the always-helpful describer, to redescribe and illustrate some of the salient characters. At present we separate it from *cognatus* and *morgani* by the very broad head and the long fourth antennal segment. Collection data: SOUTH AMERICA. Paraguay. One female under bark, June.

OLIGOTHRIPS Moulton

Moulton, D., 1933. Pan-Pac. Ent. 9(3):139–140.

Head slightly wider than long, widest at posterior margin. Setae on dorsum of head long; four postocular setae, one pair within ocellar triangle. Dorsum of head with horizontal striations. Eyes normal, not extended ventrally. Antennae nine-segmented, terminal joints not fused; segments III and IV each with one sub-apical spearhead-shaped sensory cone on outer margin, about 10 microns long. Mouth cone short, bluntly rounded maxillary palpi 3-segmented, labial palpi 2-segmented. Prothorax wider than long. Pronotum with irregular longitudinal thickening in center, with irregular horizontal striations, heaviest near posterior, setae long with a pattern similar to *Ankothrips* and *Melanthrips*. Fore legs slightly swollen, fore tarsi with large, curved, simple claw. Fore wings bluntly pointed, with two longitudinal veins both supporting regularly spaced setae, surface covered with micro-setae, costal fringe present. Abdomen normal, sharply pointed, posterior margins of segments without comb. Ovipositor well-

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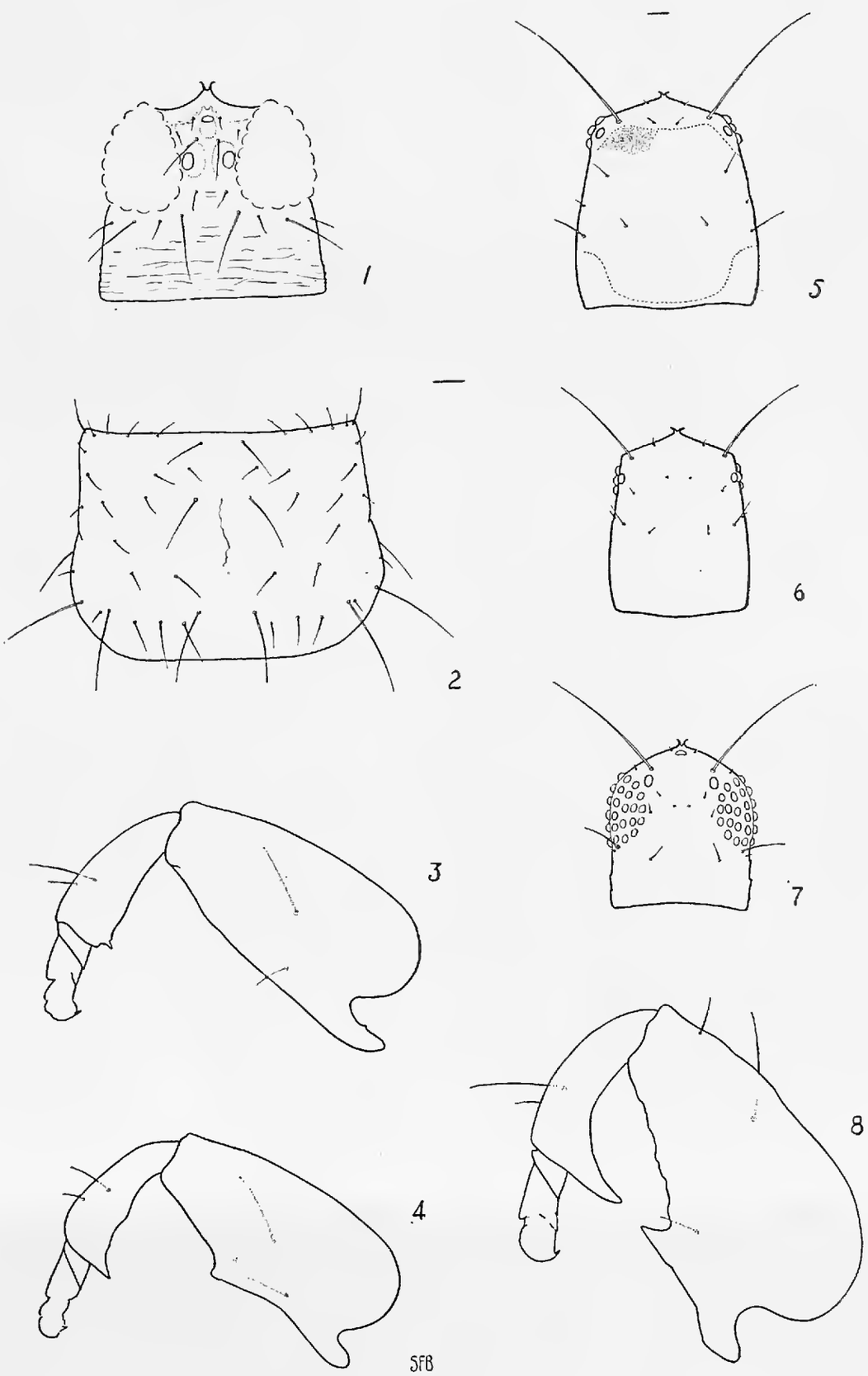
EXPLANATION OF FIGURES

Fig. 1. Dorsum of head of *Oligothrips oreios* Moulton, female; 2. Pronotum of *O. oreios*, female; 3. Femora, tibia and tarsus of *Merothrips morgani* Hood, macropterous female; 4. *M. laevis* Hood, apterous male; 5. Dorsum of head of *morgani*, maximum apterous male; 6. *morgani*, apterous female; 7. *morgani*, macropterous female; 8. Femora, tibia, and tarsus of *morgani*, maximum apterous male. Scale: Figs. 1, 2, line equals 0.016 mm.; figs. 3–8, 0.01 mm.

developed and down-curved. Male smaller than female, winged, with fore femora strongly swollen, claw on fore tarsus as in female. Abdominal segments III-VIII with narrow, elongate, clear, sensory areas on venter occupying central third of segment.



Type of the genus: *Oligothrips oreios* Moulton, 1933. Holotype female, No. 4753, in California Academy of Sciences, San Francisco.

This genus still remains monotypic. It appears to stand between the aelothripoid genera and the typical thripoids. The nine-segmented antennae, the lack of forked sensory trichomes, the pronotal setal pattern, and the claw on the fore tarsi associate *Oligothrips* with the more "primitive" thrips. On the other hand the down-curved ovipositor, the reduced number of palpal segments, the pointed wings, and the clear sensory areas on the male abdominal sternites exhibit an association with the generalized thripoids. The Moulton collection contains only the holotype and three paratype females. The various characters referred to are illustrated in Plate I, fig. 5; Plate II, fig. 6; Plate III, figs. 1, 2.

Presently it is known only in California, from various localities in mountainous portions of the northern part of the state (Bailey, 1957). The hosts of *O. oreios* are principally madrone and manzanita. There is one annual generation only. The abundance of the species varies greatly from year to year. All stages except non-feeding nymphs ("pupae") are found in the bell-shaped blossoms of these spring-blooming shrubs and trees. The yellowish-orange nymphs (similar to and found with *Orothrips*) drop to the ground beneath the host when mature and form loose cocoons in the soil at a depth of 3–12 inches depending on the soil structure. I have learned to associate the claw on the fore tarsi of thrips with this cocoon-spinning habit and infer this structure is employed by the adult in emergence. I expect that in the future, on semi-arid mountain slopes in April and May, this thrips also will be found in Oregon and Washington. In a similar environment in Chile and Peru this genus or related forms also could be expected to occur. For convenience in identifying such possible future collections the accompanying table of related genera has been prepared.

This summary of a small segment of the Terebrantia has been made possible by the favors generously granted by the following persons: J. F. Gates Clarke, H. E. Cott, J. C. Faure, K. O'Neill, H. Priesner, E. S. Ross, K. Sakimura, L. J. Stannard, and A. N. Tissot.

Morphological Characters of the Genera of Heterothripidae

Genus	*Joints in maxillary palp*	*Antennal segments*	*Comb on abdominal tergites*	*Type of sense cones on antennals III and IV*	*Setae on pronotum*	*Postocular setae*	*Ovipositor*
Heterothrips Hood, 1908	3		present	band of small circular areas	small	very small	down-curved
(Protemnothrips) Hood, 1937		9 (7–9 fused)					
(Herothrips, s. str.*)*		9 (free)					
Holarthrothrips Bagnall, 1927	3	9	present	lanceolate	prominent	very small	down-curved
Adiheterothrips Ramakrishna, 1928	5	9	present	lanceolate	small	absent	"long"
Fauriella Hood, 1937	3	9	absent	transverse ventral areas	small	very small	straight
Opisthothrips Hood, 1937	3	8	absent	transverse ventral areas	small	very small	straight
Oligothrips Moulton, 1933	3	9	absent	lanceolate	long; posterior angulars longest	long	down-curved

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THE RESPONSE OF MICROSANIA AND HORMOPEZA TO SMOKE

(Diptera: Platypezidae and Empididae)

EDWARD L. KESSEL

University of San Francisco and *California Academy of Sciences*

For the past several years it has been my privilege to observe and collect smoke flies in many parts of North America. There are two genera of these flies, *Hormopeza* of the family Empididae, and *Microsania* of the Platypezidae. It was at Mill Valley, California, that I first became acquainted with both of these forms where they were found to occur together in the smoke purposely produced to attract microsanias (Kessel, 1947, 1952). Subsequently, I collected microsanias in other parts of California and also in New York, New Mexico, Washington, Montana, British Columbia, Yukon Territory, and Alaska. Also in Alaska, western Canada, and Montana I found a second species of *Hormopeza* (Kessel, 1958) commonly associated with *Microsania*.

During my second trip to Alaska in August and September, 1959, going by way of Washington, British Columbia, and the Yukon, I again found both microsanias and hormopezas prevalent in the smoke smudges which we made at numerous officially designated campsites along the way. And this time I was able to make some observations which may prove to be significant in regard to our understanding of the response of these insects to smoke. Is the response a reaction to a visual or an olfactory stimulus?

I had always thought it likely that both the visual and the olfactory senses play a part in the positive tropism to smoke which is exhibited by these flies, but I am now convinced that

these insects are attracted to the smoke by the sense of smell alone. At least the visual stimulus need not enter into the matter.

On several occasions, after having saturated my clothes with smoke by collecting over a dense smudge at one campsite, I found it unnecessary to build a fire in order to collect a few smoke flies at subsequent locations. This was particularly true of *Microsania.* As long as I wore my smoked-up clothes, I found that again and again smoke flies would be found running about on my clothes even though no fires were burning in the vicinity. This effect lasted not just for hours, but for days. And it applied in the case of our automobile, not just clothing. At one camp the car was parked so that it was enveloped for some time in the dense smoke from our fire. The windows were open so that the smoke passed freely into the interior. Two days later at a location hundreds of miles beyond where the smudge had been, and again with no evidence of fire in our camping area, we found dozens of these little smoke flies running about on the hood of the parked car. Scores more entered it the following day after we reached our destination (Spenard, Alaska) and had left the windows open after completely unpacking. An estimated hundred microsanias were found running about on the interior of the windshield at that time. A few hormopezas were present, but they were not abundant.

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RECENT LITERATURE

THE GALÁPAGOS ISLANDS, A HISTORY OF THEIR EXPLORATION, by Joseph Richard Slevin. Occasional Papers of the California Academy of Sciences, No. 25, x + 150 pp., 31 text figs. The California Academy of Sciences, San Francisco: December 22, 1959. Price $3.50.

This study by the late Joseph Slevin contains much background information of value to persons interested in the insects of the islands.

NEW SPECIES OF SYRPHIDAE AND ASILIDAE
(Diptera)

FRANK M. HULL
University of Mississippi

I wish to thank Dr. P. D. Hurd, Jr. for the opportunity to study the interesting species of *Meromacrus* Rondani here described, together with several other new Diptera.

Meromacrus croceatus Hull, new species

A pale, brownish orange species with spots and fascia of deep yellow tomentum. Related to *Meromacrus gloriosus* Hull (1942), in which species the pile above wings, on postalar callosity, scutellum, pteropleuron and antenna is black. In *Meromacrus croceatus* it is entirely golden yellow with no black pile present anywhere. Length 15 mm.

Female.—Head: light brownish red throughout. Occiput golden pollinose; tomentum matted, yellow; a wide band of similar, bright golden, somewhat scale-like, or flattened tomentum on sides of front and face, extending as far as upper angle of cheeks, reaching from eye margin to lateral border of broad, medial, facial, stripe. Underlying, somewhat paler micropubescence extends downward to lower, anterior angle of face. Middle of face with a wide, shining, bare stripe. Face gently concave on upper half with a very low tubercle below middle. Antenna of usual type, third segment somewhat longer below than above; whole antenna light brownish red in color, with yellow pile. Arista thick, reddish yellow, with finely tapered apex, almost thread-like and whole surface microscopically pubescent. Eyes bare. *Thorax:* reddish brown, becoming blackish brown on hypopleuron, black on lower sternopleuron; middle of mesonotum black, dully shining, leaving entire humerus, notopleuron laterally and narrowly, and a lateral stripe above wing, which includes postalar callosity, reddish brown in color; prescutellar area reddish brown, scutellum wholly of same color. Pile subappressed, coarse, golden; conspicuous markings of dense, yellow tomentum which consist of: (1) a large, posteriorly pointed oval spot medial to humerus: (2) an oblique fascia from lateral margin of notopleuron ending at middle fourth of mesonotum; (3) the above continuous laterally with a stripe on posterior margin of mesopleuron; (4) the above is further continuous with a large, oval spot on upper sternopleuron. Remainder of pleuron without tomentum. Pteropleuron with numerous, golden hairs. Area just in front of scutellum and along posterior margin of mesonotum and continuous over whole lateral border of postalar callosity with a dense border of yellow tomentum. Halteres small, with reddish knob and stalk. *Legs:* entirely light brownish red with yellow pile, except on ventral aspect of hind femur; a dense patch of appressed, reddish sepia setae confined to distal two-fifths of hind femur; a few smaller, similar setae on ventral, distal half of middle femur. Medial surface of extreme base of anterior femur with a

dense setae patch, setae black. Claws pale, yellowish on basal two-thirds, black beyond. *Wings:* hyaline on posterior two-thirds, yellowish on basal half of anterior third, reddish sepia brown beyond. Stigmal crossvein well developed. Loop of third vein broadly rounded and deep. Anterior crossvein enters discal cell distinctly beyond middle. *Abdomen:* light brownish red with basal half of second tergite diffusely yellowish brown; medially the slightly sunken crease, which basally demarcates second segment, very dark brown; likewise, a dark brown semicircular area in middle of base of first segment. Posterolateral third of first segment on each side with a wide, oval, extensive spot of deep sulphur yellow tomentum; a similar crescentic, extensive spot on base of third segment on each side, from anterior corner nearly to middle of segment, occupying two-fifths the length of segment. Similar but smaller and more widely separated spots of yellow tomentum at base of fourth segment. All abdominal pile reddish golden in color, flat appressed, except tending to be erect on sides of segment. Sternites light reddish with pale yellow, posterior margins.

Holotype female, BLYTHE, RIVERSIDE COUNTY, CALIFORNIA, June 25, 1945. In collections of the California Academy of Sciences, San Francisco.

Baccha myrtella Hull, new species

Related to *Baccha nectarina* Hull (1949). Linear vittate marks of abdominal segments 3, 4 and 5 very slender and sublateral vittae quite short and completely separated from submedial ones. Color of thorax and scutellum mostly extremely dark sepia. Length 14 mm.

Male.—Head: face and cheeks, all front, except black spots, light brownish yellow; sides of face paler, narrowly dusted with white pollen, which extends forward below tubercle. All pile of head black, except a few hairs along epistoma. Lower part of front above preantennal callus set off by a shallow crease. Middle of front with a moderately large, distinct, black triangle but no distinct lines above or below. Upper portion of callus shining brown. Middle of callus with a large, shining black, nearly circular, anteriorly pointed spot. Antenna light brownish orange, third segment smoky to blackish on all except base and ventral third. Arista reddish at base, gradually becoming darker at apex. Occiput greyish yellow pollinose; pile long, reddish above, except for two or three black hairs immediately behind the vertex; lower occipital pile more yellowish. One or two black hairs anteriorly at middle of occiput opposite indentation of eye; occipital pile not scalous or flattened. Vertex opaque black between ocelli, yellow to golden brown behind; black pile in a single row. *Thorax:* mesonotum blackish sepia, except widely along lateral margins from humerus to postalar callosity. These margins dark, yellowish brown or clay color, scutellum of same color; disc sepia in oblique light. Middle of mesonotum with two wide, light golden brown vittae and a narrower, medial stripe of same; all three of these vittae fuse to make a slightly expanded, wide, pollinose area reaching base of scutellum. Dark

markings of mesonotum remaining constitute a pair of wide, sublateral, posteriorly attenuate, dark sepia vittae and a pair of central, submedial narrower distinctly divergent vittae, which end a short distance beyond suture; posterior ends rounded. Mesonotal and scutellar pile fine, black, except for a distinct, anterior, golden collar. Ventral fringe of scutellum of about twelve pairs of long, fine, black hairs. Pleuron obscurely yellowish brown on posterior mesopleuron, upper sternopleuron, pteropleuron and all of metapleuron, except a black, posterior, diagonal band across lower portion of metapleuron; upper part of metapleuron yellow. Squamae and halteres reddish brown. *Legs:* anterior and middle pairs of legs light brownish yellow, middle femur scarcely darker brown, with a still darker obscure, wide, preapical annulus. Middle of hind tibia either darker brown or with more brownish black pile in middle; base a little paler and apex narrowly brownish orange, with pale pile below and laterally. Hind tarsi yellowish white on first three segments, last two segments pale orange brown. *Wings:* uniformly sepia brown, except in oblique light second basal cell and basal part of costal cell barely paler. Third vein gently curved, subapical crossvein quite long and sigmoid, preanal spuria distinct; alulae wide and brown. *Abdomen:* petiolate, sepia brown with yellow pattern. First segment brownish yellow, posterior half sepia, except laterally. Second segment subcylindrical, barely narrower in middle than posteriorly with basal fourth a little more flared and widened. This segment five or six times longer than its smallest width, with a pair of quite obscure, brownish yellow spots behind middle. Third, fourth and fifth segments with widely separated, parallel, linear, distinct, yellow vittae. These vittae on third segment end a considerable distance from posterior margin, but reach margin on other segments. A small, distinct, yellow, roughly triangular spot on base of each segment sublaterally, distinctly separated from submedial vittae; these outlying spots on fifth segment linearly continued to end of segment. Segments 4 and 5 emarginate, middles of segments and all remainder, except narrowly along the lateral margin, obscurely opaque. All abdominal pile black.

Holotype male, CHANCHAMAYO, PERU, May 7, 1948, 1200 meters, collected by J. Schunke. Type in the collection of the author.

Cerotainiops pritchardi Hull, new species

Characterized by black head, thorax and light red abdomen. Related to *Cerotainiops abdominalis* Brown but distinguished by the long, prominent, yellowish white bristles of scutellum and by color of hind femur, which is pale red on almost the basal half and the color rather sharply demarcated. From *Cerotainiops wilcoxi* Pritchard (1942) it is distinguished by wholly and uniformly brownish black tibiae and tarsi and anterior four femora, besides reduced area of red color on hind femur. Length 11.5 mm.

Male.—Head: black, densely covered with pale pollen, almost whitish, with a slight, brownish yellow tinge. Middle of face below with eight pairs

of long, slender, black bristles, upper half of rather narrow, facial gibbosity with four or five additional pairs of nearly white bristles. Copious fringe of more slender, long, whitish bristles or bristly hairs, laterally, somewhat more recumbent or more sharply directed downward. Proboscis and palpus black, basal pile pale and hairs at end of proboscis brownish yellow. Upper half of face with some long, coarse, appressed pile, except in middle. First and second segments of antenna almost black; third segment black, except the greatly narrowed base, which is as dark as first segment, almost black. First segment with white pile and two or three stout, brownish white, ventral bristles. Second segment with some long, whitish setae, and above and below a single, rather long, stout, conspicuous, black bristle. Ocellar tubercle with one pair of anterior, stout, long, brownish white bristles, behind them two pairs of shorter similarly colored bristles. Upper part of occiput with a transverse row of six or seven stout, brownish yellow bristles on each side. *Thorax:* black; mesonotum largely covered with pale, brownish yellow pollen, an anterior pair of submedial vittae, rather widely separated, ending opposite posterior end of humerus, bare of pollen and dull black. An expanding diagonal stripe reaches nearly to transverse suture from posterior margin of humerus, which is partly included. Transverse suture bordered on each side by pale pollen of mesonotum, on posterior side with an additional, oblique, rather large, bare stripe, which is only narrowly separated from a similar stripe. Whole of scutellum, except margin, which is at most only faintly creased, pollinose. Margin with two pairs of long, rather stout, brownish white bristles, one or two weak, shorter bristles and disc with some scattered, more or less recumbent, coarse, pale hairs. Pile of mesonotum pale and recumbent, oblique posterior stripe behind suture without pile. Pleuron wholly pale yellowish white or brownish white pollinose. Halteres pale brownish yellow, base reddish sepia. Metapleural pile and a stout, mesopleural bristle pale, brownish yellow, almost white. *Legs:* black, feebly shining. Under surface of middle tibia near base dark reddish brown, basal two-fifths of hind femur light brownish red. Claws black with extreme base dark brown. Pulvilli light brown, well developed. *Wings:* not quite hyaline with a slight brown tinge, which disappears on posterior margin. Subcostal vein ends at least midway or beyond that section of third vein which begins at anterior crossvein and ends at furcation of third vein. Villi restricted to a border along second vein and along anterior branch of third vein and a narrow border along first vein, most of pubescence lying distal to anterior crossvein. *Abdomen:* pale brownish red. A narrow, basal band of blackish linearly along anterior margin of first segment, restricted to middle half of this segment. Sternites pale brownish orange with pale pollen and similarly colored pile. Pile of tergites mostly reddish orange, becoming paler along lateral margins. First tergite laterally with two stout, yellow bristles, second to fourth tergites with one or two such bristles. Terminalia brownish orange. Apices of processes black.

Holotype male, SAN FERNANDO, LOWER CALIFORNIA, MEXICO, July 31, 1938, collected by Michelbacher and Ross, deposited in the California Academy of Sciences collections.

Cophura hurdi Hull, new species

A pale brown, pollinose species, which traces to *Cophura dora* Pritchard in Pritchard's key (1943); differing in general coloration. Length 7 mm.

Female.—Head: pale brown, thinly covered with brownish or yellowish white pollen; a single oral row of ten slender, distinctly golden red bristles; on remainder of face only a few, fine, much shorter, white hairs restricted to lower two-thirds. Proboscis dark brown, palpus pale brown with similarly colored hairs. Antenna with first two segments pale brown, slightly reddish; third segment black, or blackish sepia; sharply pointed style or microsegment half as long as third segment. Ocellar tubercle with a pair of moderately stout, reddish brown bristles. Upper occiput with a transverse row of seven reddish bristles on either side. Pile on lower half exceptionally fine, whitish and crinkly. Whole occiput brownish white pollinose over a light, reddish brown background. *Thorax:* mesonotum light, reddish sepia brown, rendered paler by greyish white or in part brownish or yellowish white, rather dense pollen. A distinct, sharply demarcated, narrow, dark brown, linear, medial stripe, when viewed from rear, which seems to expand a little posteriorly and which bears a row of fine, short, pale yellow, sparse, acrostical hairs. Dorsocentral bristles weak anteriorly, only about four well differentiated in front of suture, these short; some additional, erect, bristly hairs along anterior margin. A single, prominent, moderately stout, long, reddish bristle behind suture not far from scutellum, two others much more slender and shorter. Lateral bristles moderately prominent, golden reddish or reddish brown; two notopleural, one postsupraalar, one postalar and one pair on scutellar margin. Whole scutellar disc and margin with brownish or yellowish white pollen or micropubescence, a few long, fine, white scattered, suberect hairs on disc. Humerus paler in color, rather light brownish yellow, densely pollinose. Lateral margins to transverse suture also more yellowish. Pleuron of a paler and somewhat more reddish brown color, everywhere densely, pale pollinose. *Legs:* almost entirely light brownish yellow, more or less subtranslucent. Dorsal half of anterior femur, dorsal apex of hind femur continued as a light, smoky brown, rather diffuse and not greatly contrasted dorsolateral streak to base; a similar, narrow streak anteriorly on anterior tibia. Apical half of each tarsal segment apparently slightly more brownish, basal half slightly more yellowish. Pile and bristles of legs chiefly pale yellow. Hind femur slightly and gradually swollen toward apex, apical fourth arched dorsally. Hind tibia distinctly swollen near apex, outer surface more brownish. Apex of anterior tibia with a distinct, curved, black, ventrolateral spine. Apex of middle tibia with a stout, straight, black apical spine, a slightly smaller reddish brown spine beside it. Posterior coxa with a blunt tubercle, without anterior spine. Ventral pile of first two segments of anterior tarsus very fine, dense and erect; similar pile on first two segments of middle tarsus. *Wings:* slender, with very limited, hyaline areas. Basal third to end of radial sector nearly hyaline, a large, irregular, hyaline spot in middle of marginal cell, a smaller spot just beyond base of second submarginal cell, spot on marginal

cell continued narrowly behind in first submarginal cell. Middle of first and second posterior cells more or less hyaline; pale brown clouded areas which remain on wing somewhat accentuated at all crossveins and at fork of third vein. Whole apex of wing moderately brown, with a faintly lighter spot along costa in middle of end of first submarginal cell. First vein parallel with costa for some distance before ending. Base of second submarginal cell simple and acute, third vein forking beyond discal crossvein. *Abdomen:* slender, shining, light brown, with parallel sides and sparse, minute, flat appressed, short, golden hairs which appear brown in some lights. A large, subtriangular spot of pale brownish, almost white pollen on each side of fifth and sixth segments; widely separated on fifth tergite, these spots more narrowly separated on sixth; much smaller, very widely separated, similar spots on seventh tergite; eighth tergite concealed. On curled edge narrowly of first four tergites are elongated, pollinose borders of same color (not visible from above). Sternites similarly colored with numerous, brown flecks where each minute hair emerges, with indications of three narrow, obscure, pale, longitudinal stripes on the otherwise brownish white, pollinose background. Spines of terminalia brownish black.

Holotype female, ANTIOCH, CONTRA COSTA COUNTY, CALIFORNIA, September, 1939, collected by B. Brookman, deposited in California Academy of Sciences collections. Named in honor of Dr. P. D. Hurd, Jr.

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RECENT LITERATURE

THE SCOLYTOIDEA OF THE NORTHWEST. OREGON, WASHINGTON, IDAHO AND BRITISH COLUMBIA, by W. J. Chamberlin, Oregon State Monographs, Studies in Entomology, No. 2 vii + 205 pp. [pp. 206–208 list other titles in the general Monographs series and are not by Chamberlin], 113 text figs., 4 pls. Oregon State College, Corvallis, 1958. Price $2.50.

This treats of the bionomics and taxonomy of the Northwest Platypodidae and Scolytidae. There are keys, descriptions, citations of type localities, distribution, and host plants. In addition to the cited 113 text figs. there is a fig. 13a, and 32 un-numbered text figs.

SYNONYMICAL NOTES ON THE GENUS CERCERIS—II[1]

(Hymenoptera: Sphecidae)

HERMAN A. SCULLEN
Oregon State College, Corvallis, Oregon

Studies of type material leading to the publication of a review of the genus *Cerceris* for North America north of Mexico has revealed synonymy in several species of the genus. As there will be some natural delay in the publication of such an extensive paper, it is considered advisable to place on record the present known synonymy. A synonymical note is also included on a species from the Philippine Islands and Formosa.

CERCERIS ACANTHOPHILA Cockerell

Cerceris acanthophila Cockerell, 1897. Entomologist 30:135. Male.

Cerceris minax Mickel, 1917. Univ. Nebr. Studies, 17:339. Female. male. (New synonymy.)

Cerceris huachuca Banks, 1947. Psyche 54:29. Male. (New synonymy.)

Type No. 10038 at Philadelphia Academy of Natural Sciences and Type No. 3409 at the U.S.N.M. are both labeled "Type, *Cerceris acanthophila* Cockerell." The holotype female and the allotype male of *C. minax* Mickel are at Nebraska University. The holotype male of *C. huachuca* Banks is at the Museum of Comparative Zoology, (No. 27636).

CERCERIS CALIFORNICA Cresson

Cerceris californica Cresson. 1865. Ent. Soc. Phil., Proc., 5:128. Male.

Cerceris ferruginior Viereck and Cockerell, 1904. N.Y. Ent. Soc., Jour. 12:134. Male. (New synonymy.)

Cerceris garciana Viereck and Cockerell, 1904. N.Y. Ent. Soc., Jour. 12:135. Male. (New synonymy.)

Cerceris populorum Viereck and Cockerell, 1904. N.Y. Ent. Soc., Jour. 12:135. Male. (New synonymy.)

Cerceris argyrotricha Rohwer, 1908. Canad. Ent. 40:324. Female. (New synonymy.)

Cerceris cognata Mickel, 1916. Amer. Ent. Soc., Trans. 42:408. Female. (New synonymy.)

Cerceris denticularis Banks, 1917. Harvard Univ., Mus. Comp. Zool., Bull. 61:113. Female, male. (New synonymy.)

Cerceris interjecta Banks, 1919. Canad. Ent. 51:84. Male. (New synonymy.)

Cerceris arno Banks, 1947. Psyche 54:19. Female. (New synonymy.)

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[1] A grant from the National Science Foundation made it possible to spend some time during the fall of 1958 studying types of Cercerini at several eastern institutions. The present notes being published are based, in part, on these studies. Grants for General Research administered by the Graduate School, Oregon State College, have also assisted in these studies. Published with the approval of the Monographs Publication Committee, Oregon State College. Research paper No. 370, Department of Entomology.

Cerceris illota Banks. 1947. Psyche 54:23. Male. (New synonymy.)
Cerceris isolde Banks, 1947. Psyche 54:24. Male. (New synonymy.)

This extremely variable species was first described by Cresson from a male of the darker form which is more common in the northern range of the species. In the lighter forms the black changes to an amber or light amber. The lighter forms gradually replace the darker ones in the south so that in the southwestern desert area only the very light forms are found. The southwestern forms also show a tendency to have a considerable red on the proximal segments of the abdomen. A wide variation may be found in a single colony as was shown in collections made by Linsley and MacSwain. (Ann. Ent. Soc. Am. 49:71–84, 1956.) As a result of this wide variation numerous species have been described by different workers where a limited number of specimens was available for study. However, the present writer, after examining many hundreds of specimens from throughout the range, must consider them all the same species. Further studies may show it desirable to recognize two or more subspecies.

The holotype male of *C. californica* Cresson is at the Philadelphia Academy of Natural Sciences, (No. 1953). As indicated, it is one of the darker forms. The holotype male of *C. ferruginior* Viereck and Cockerell is at the Philadelphia Academy, (No. 10378). It is one of the medium forms. The holotype male of *C. garciana* Viereck and Cockerell is also at the Philadelphia Academy, (No. 10380). It is somewhat medium in its coloration. The holotype male of *C. populorum* Viereck and Cockerell is at the Philadelphia Academy, (No. 10385). It, also, is somewhat medium in its colors. The holotype female of *C. argyrotricha* Rohwer is at the U. S. National Museum, (No. 28485). It is one of the medium forms. The holotype female of *C. cognata* Mickel is at the University of Nebraska. It is one of the black and yellow forms and is from Colorado. Several type females and males of *C. denticularis* Banks are at the Museum of Comparative Zoology, (No. 10028) and are black and yellow forms from the northwest. The holotype male of *C. interjecta* Banks is at the Museum of Comparative Zoology, (No. 13767). It is a medium dark form with some red showing on the first tergite. The holotype female of *Cerceris arno* Banks is at the Museum of Comparative Zoology, (No. 23542). This is an extreme light form. The holotype male of *C. illota* Banks is at the Museum of Comparative Zoology, (No.

23541). It is medium in its colors. The holotype male of *C. isolde* Banks is at the Museum of Comparative Zoology, (No. 23540). It is an example of the extreme light form.

CERCERIS CLYPEATA Dahlbom

Cerceris clypeata Dahlbom, 1845. Hym. Europaea, v. 1, pp. 221, 500. Female, male.

Cerceris imitator Cresson, 1865. Ent. Soc. Phil., Proc. 5:125. Male. Preocc. (New synonymy.)

Cerceris imitatoria Schletterer, 1887. Zool. Jahrb., Ztschr. f. System. 2:494. New name for *C. imitator* Cresson.

Cerceris zobeide Brimley, 1929. Ent. News 40:194. Male. (New synonymy.)

Cerceris zosma Brimley, 1929. Ent. News 40:195. Female. (New synonymy.)

The holotype female and allotype male of *C. clypeata* Dahlbom are at the Universitetets Zoologiska Institution, Lund, Sweden. A note relative to these types was published by the writer in 1949 (Pan-Pac. Ent. 25:70). The holotype male of *C. imitator* Cresson is at the Philadelphia Academy of Natural Sciences, (No. 1951). The holotype male of *C. zobeide* Brimley and the holotype female of *C. zosma* Brimley are both at the North Carolina State Department of Agriculture, Raleigh, N.C.

CERCERIS COMPACTA Cresson

Cerceris compacta Cresson, 1865. Ent. Soc. Phil., Proc. 5:127. Female, male.

Cerceris solidaginis Rohwer, 1908. Canad. Ent. 40:323. Male. (New synonymy.)

Cerceris belfragei Banks, 1917. Harvard University, Mus. Compar. Zool., Bull. 61:114. Female, male. (New synonymy.)

The holotype female (No. 1940.1) and the allotype male of *C. compacta* Cresson are at the Philadelphia Academy of Natural Sciences. The holotype male of *C. solidaginis* Rohwer is at the U. S. National Museum (No. 28486). The holotype female (No. 10029) and the allotype male of *C. belfragei* Banks are at the Museum of Comparative Zoology.

CERCERIS COMPAR Cresson

Cerceris compar Cresson, 1865. Ent. Soc. Phil., Proc. 5:126. Male.

Cerceris zelica Banks, 1912. Ent. Soc. Amer., Ann. 5:23. Male, female. (New synonymy.)

Cerceris catawba Banks, 1912. Ent. Soc. Amer., Ann. 5:25. Female, male. (New synonymy.)

The holotype male of *C. compar* Cresson is at the Philadelphia Academy of Natural Sciences, (No. 1949). The holotype female (No. 13787) and allotype male of *C. catawba* Banks as well as the

holotype female (No. 13773) and allotype male of *C. zelica* Banks are at the Museum of Comparative Zoology.

CERCERIS FEMURRUBRUM Viereck and Cockerell

Cerceris femurrubrum Viereck and Cockerell, 1904. N.Y. Ent. Soc., Jour. 12:135. Male.

Cerceris athene Banks, 1947. Psyche 54:20. Female. (New synonymy.)

The holotype male of *C. femurrubrum* Viereck and Cockerell is at the Philadelphia Academy of Natural Sciences, (No. 10040). The holotype female of *C. athene* Banks is at the Museum of Comparative Zoology, (No. 23537). As indicated in the Synoptic Catalog, Hymenoptera of America North of Mexico, the writer considered *C. athene* Banks the possible female of *C. femurrubrum* Viereck and Cockerell. They have often been collected in the same location. In 1956 M. S. Wasbauer made some biological observations of *C. athene* Banks found nesting at Mecca, Riverside County, California. From his observations and collections it was shown that *C. athene* Banks is the female of *C. femurrubrum* Viereck and Cockerell. (Wasbauer, Pan-Pacific Ent. 33:131, 1957.)

CERCERIS GNARA Cresson

Cerceris gnara Cresson, 1872. Amer. Ent. Soc., Trans. 4:229. Male.

Cerceris firma Cresson, 1872. Amer. Ent. Soc., Trans. 4:229. Female. (New synonymy.)

The holotype male of *C. gnara* Cresson (No. 1938) and the holotype female of *C. firma* Cresson (No. 1945.1) are at the Philadelphia Academy of Natural Sciences.

CERCERIS HALONE Banks

Cerceris halone Banks, 1912. Ent. Soc. Amer., Ann. 5:24. Female.

Cerceris architis Mickel, 1916. Amer. Ent. Soc., Trans. 42:409. Female. (New synonymy.)

Cerceris salome Banks, 1923. Canad. Ent. 55:21. Female. (New synonymy.)

Cerceris shermani Brimley, 1928. Elisha Mitchell Sci. Jour. 43:200. Female. (New synonymy.)

The holotype female of *C. halone* Banks is at the Museum of Comparative Zoology, (No. 13777). The holotype female of *C. architis* Mickel is at the University of Nebraska. The holotype female of *C. salome* Banks is at the Museum of Comparative Zoology, (No. 14705). The holotype female of *C. shermani* Brimley is at the North Carolina State Department of Agriculture, Raleigh, N.C.

CERCERIS NIGRESCENS F. Smith

Cerceris nigrescens F. Smith, 1856. Cat. Hym. Brit. Mus. 4:466. Female.
Cerceris munda Mickel, 1917. Nebr. Univ. Studies. 17:337. Female, male. (New synonymy.)

The holotype female of *C. nigrescens* F. Smith is in the British Museum (Natural History). The holotype female and allotype male of *C. munda* Mickel are at the University of Nebraska. *C. nigrescens* F. Smith shows a tendency to have the light markings more yellow as one goes south in the western states. *C. munda,* which was taken at Sacramento, Calif., is a yellow form of *C. nigrescens*. Mating pairs have been taken in southern Oregon where one sex is the lighter form and the other the more yellow form. It is possible a subspecies difference should be recognized.

CERCERIS SEXTA Say

Cerceris sexta Say, 1837. Boston Jour. Nat. Hist. 1:382. Male.
Cerceris biungulata Cresson, 1865. Ent. Soc. Phil., Proc. 5:118. Female. (New synonymy.)

The type of *C. sexta* Say has been lost. The writer bases his recognition of the species on material named by E. T. Cresson, Sr. The holotype female of *C. biungulata* Cresson is at the Philadelphia Academy of Natural Sciences, (No. 1956). Cresson (1865, p. 120) makes this statement relative to *C. sexta* Say and *C. biungulata* Cresson: "May possibly be the male of the preceding species." From a study of material available, the present writer concurs in this opinion. Banks (Psyche 54:10, 1947) also intimates these are synonymous.

C. sexta Say is very close to *C. sextoides* Banks of the Pacific Coast states and *C. stigmosalis* Banks of the western plains states.

CERCERIS STIGMOSALIS Banks

Cerceris stigmosalis Banks, 1916. Ent. News 27:64. Male.
Cerceris fugatrix Mickel, 1917. Nebr. Univ. Studies 17:335. Male. (New synonymy.)
Cerceris sayi Banks, 1923. Canad. Ent. 55:21. Female, male. (New synonymy.)
Cerceris stevensi Banks, 1923. Canad. Ent. 55:22. Female. (New synonymy.)

The holotype male (No. 13778) of *C. stigmosalis* Banks, the holotype female (No. 14706) and the allotype male of *C. sayi* Banks and the holotype female (No. 14707) of *C. stevensi* Banks are all at the Museum of Comparative Zoology. The holotype male of *C. fugatrix* Mickel is at the University of Nebraska. As indicated above, this species is very close to *C. sexta* Say. On October 1, 1957,

the author collected several specimens of *C. stigmosalis* Banks at San Luis Potosi, S.L.P., Mexico, 7300 ft. elevation, on *Baccharis* sp. The species is not otherwise recorded south of Mitchell, Nebraska. It extends north into Alberta, Canada.

CERCERIS VANDUZEEI Banks

Cerceris vanduzeei Banks, 1917. Harvard Univ. Mus., Compar. Zool., Bull. 61:114. Female.

Cerceris complanata Mickel, 1917. Nebr. Univ. Studies 17:340. Female, male. (New synonymy.)

The holotype female of *C. vanduzeei* Banks is at the Museum of Comparative Zoology, (No. 10030). The holotype female and allotype male of *C. complanata* Mickel are at the University of Nebraska.

CERCERIS FINITIMA subspecies VIERECKI Banks (New status)

Cerceris vierecki Banks, 1947. Psyche 54:30. Female.

The holotype female of *C. vierecki* Banks is at the Museum of Comparative Zoology, (No. 23544). The markings on *C. f. vierecki* Banks are a creamy white and not yellow as in *C. f. finitima* Cresson. The former takes over as the usual form in the southwest desert area.

CERCERIS FRONTATA subspecies RAUI Rohwer (New status)

Cerceris raui Rohwer, 1920. U.S. Nat. Mus., Proc. 57:230. Female, male.

The holotype female (No. 21610) and allotype male of *C. raui* Rohwer are at the U. S. National Museum. *C. f. raui* Rohwer is much darker than *C. f. frontata* Say and so far has been seen only from the extreme northeastern part of the range from eastern Texas and Oklahoma to southern Illinois.

CERCERIS LUZONENSIS Crawford

Cerceris luzonensis Crawford, 1910. U.S. Nat. Mus., Proc. 38:120. Male. Philippine Islands.

Cerceris fukaii Rohwer. 1911. U.S. Nat. Mus., Proc. 39:482. Male. (Cat. No. 13377.) Horisha, Formosa. (New synonymy.)

This synonymy was discovered while working over types at the U. S. National Museum. The male types of both species are at that institution. The type No. of *C. luzonensis* Crawford is 12887, and the type No. of *C. fukaii* Rohwer is 13377.

DISTRIBUTION RECORDS FOR TRICHOBIUS SPHAERONOTUS JOBLING, WITH A FIRST REPORT FOR ARIZONA

(Diptera: Streblidae)

ANTHONY ROSS
University of Arizona, Tucson

Trichobius sphaeronotus Jobling (1939) was described from seven specimens taken by Mr. H. Hoogstraal from the long-nosed bat, *Leptonycteris nivalis* (Saussure), (Phyllostomidae), at Cerro Potosi, 9000 ft. elevation, Nuevo Leon, Mexico.

In the late summer of 1940, Kohls and Jellison (1948) obtained several specimens of *T. sphaeronotus* collecting in the following caves in Texas: Ney Cave, Medina County, Sept. 14, 1940, from the Brazilian free-tailed bat, *Tadarida mexicana* (Saussure) [now *T. brasiliensis* (St. Hilaire)], (Molossidae); Frio Cave, Uvalde County, Sept. 16, 1940, from *T. mexicana*. Kohls also collected one female specimen near Shumba, Texas, in an abandoned railroad tunnel, 1940, no host noted.

Ryckman (1956) collected specimens of *T. sphaeronotus* in the following two locations: Ney Cave, ten miles southwest of Bandera, Medina County, Texas, July 13, 1954, from the Brazilian free-tailed bat; Boca del Rio, Veracruz, Mexico, July 22, 1954, from the long-nosed bat.

Mr. G. Bradshaw (Dept. of Zoology, University of Arizona) presented me with four males and one female of *T. sphaeronotus* from the Brazilian free-tailed bat, collected at Carbo Cave, 14.9 road miles southwest of Carbo, Sonora, Mexico.

On July 28, 1959, along with Mr. William Musgrove (Dept. of Zoology, University of Arizona), I collected 40 (19 males: 21 females) specimens of *T. sphaeronotus* from two juvenile long-nosed bats at Colossal Cave, 20 east, seven south, airline miles of Tucson, south end of the Rincon Mountains, Pima County, Arizona. One bat harbored 25 of the ectoparasites, and the other had 16. I do not believe that this is the normal incident of parasitism of this host by these dipterous ectoparasites. The mature colony had left several days before, presumably returning to Mexico, leaving the juveniles behind, and therefore it seems likely that these bats were the only available hosts for the newly emerging streblids.

Coquillett (1900) listed *Trichobius dugesii* Townsend 1891,

collected by Mr. H. F. Wickham at Tucson, Arizona (no host or date). Through the courtesy of Dr. A. Stone of the U.S.N.M. I have seen this single male specimen and it is a specimen of *T. sphaeronotus*.

On August 7, 1959, I accompanied Dr. L. Cockrum and Mr. G. Bradshaw (Dept. of Zoology, University of Arizona) on a return trip to Carbo Cave, Mexico. There we encountered a very large maternal colony of the Brazilian free-tailed bats. Individuals of *T. sphaeronotus*, normally a rare bat ectoparasite, were flying about in tremendous numbers. In a random sample of one tunnel, ten sweeps were taken with a standard aerial net from a stationary position, and 261 (112 males: 149 females) specimens were obtained. At another location in the same tunnel, where there was a cluster of streblids on the cave ceiling measuring three feet long and four inches wide, one sweep netted 193 (92 males: 101 females) streblids. These counts were obtained by freely pouring a mixture of K.A.A.D., which killed the flies upon contact, over the netting immediately upon completion of the sampling. The bats which I did inspect had a range of zero to four streblids apiece. In all, I obtained 771 (347 males: 424 females) specimens in a very short period.

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Kohls, G. M. and W. L. Jellison

1948. Ectoparasites and other arthropods occurring in Texas bat caves. National Speleological Soc., Bull. 10:116–117.

Ryckman, R. E.

1956. Parasitic and some non-parasitic arthropods from bat caves in Texas and Mexico. Amer. Midl. Nat. 56(1):186–190.

DESCRIPTIONS OF NEW SPECIES OF ARGYROTAENIA IN THE SOUTHWESTERN UNITED STATES

(Lepidoptera: Tortricidae)

JERRY A. POWELL
University of California, Berkeley

The genus *Argyrotaenia* Stephens as characterized by Freeman (1958) comprises 20 North American species. During the course of current studies on the taxonomy and biology of the Tortricinae in California, a number of apparently undescribed species have accumulated. The following descriptions are offered at the present time in order to make the names available for use by Dr. N. S. Obraztsov in his treatment of the Archipsini, the first section of the generic revision and catalogue of the North American Tortricidae.

I wish to acknowledge with sincere thanks the hospitality and assistance of the following on my recent visit to the eastern institutions: Dr. J. F. Gates Clarke, U.S. National Museum; Dr. N. S. Obraztsov and Dr. Fred H. Rindge, American Museum of Natural History, and Dr. T. N. Freeman, Entomology Research Institute, Ottawa, Canada. In addition to the above I would like to thank H. H. Keifer, California State Department of Agriculture, Sacramento; Lloyd M. Martin, Los Angeles County Museum, and Charles F. Harbison, San Diego Museum of Natural History for the use of specimens in their care.

Argyrotaenia cupressae Powell, new species

A reddish species having the forewings flushed with rosaceous and crossed with pale transverse bands and markings.

Female.—Length of forewing 9.4 mm. *Head:* palp reddish-brown exteriorly at base fading to pale orange apically, paler interiorly; second segment abruptly expanded in outer half by dorsal rounded scale tuft; head tufts ochreous-orange, paler on vertex; a small dark reddish-brown tuft below each antennal scape adjoining eye; scales behind eye ochreous basally, red-brown apically; antenna reddish-brown, darker dorsally and basally, scape ochreous with a red-brown blotch anteriorly. *Thorax:* collar red-brown; ochreous above with scattered pale red-brown scales tending to form median and terminal bands on tegula (holotype thorax mostly rubbed above); shining whitish below, broad flat tuft below palpi ochreous; prothoracic leg red-brown exteriorly, tibia and tarsus mottled with ochreous, whitish interiorly; mesothoracic legs lacking; metathoracic leg shining whitish. *Forewing:* broad, less than 2.5 times longer than wide, costa abruptly rounded basally (giving the wing a broad appearance), slightly flattened beyond middle, apex rounded, termen only slightly angled back. Ground color light red-brown

with scattered ochreous scales and with areas of shining rosaceous overscaling; markings pale, whitish with some pale rosaceous scaling as follows, costa just outside base, basal anal tuft, an indistinct but complete oblique band from basal one-third of costa to just before middle of anal margin (more evident on paratypes), a second band from middle of costa to anal angle which is continued outward at end of cell into a curving bar to costa just before apex, leaving a distinct, semicircular patch of ground color on outer third of costa; area between bands with two broad patches of shining rosaceous, a similar patch in costal semicircle and in lower area of ground color in terminal area; a pale rosaceous vertical bar just before apex from costa to middle of termen; fringe ochreous in upper half, paler in lower half. Underside pale, brownish in central area, costal area indistinctly mottled with ochreous-orange. *Hindwing:* shining whitish with a tinge of brownish through central area; fringe white, tinged with ochreous at apex. Underside white. *Abdomen:* shining whitish (apparently discolored on holotype). Genitalia as in fig. 4 (drawn from paratype, La Mesa, JAP slide No. 583, three slides examined).

Male.—Length of forewing about 7.3 mm. A single male with abdomen intact available for study and in very poor condition. Apparently marked essentially as described for female. Forewing with some dark scales through outer half of cell and central part of terminal area. Genitalia: nearly identical to that of *A. paiuteana* Powell (fig. 1); uncus apparently a little more slender and aedeagus slightly more curved (fig. 2, drawn from allotype, JAP slide No. 161).

Range of forewing length in paratypes, 8.3 to 9.0 mm. Forewings of paratypes more distinctly marked although all in worn condition. Those from San Diego with a little blackish scaling through the central portion of forewing in outer half, but none with the dark scaling bordering the ground color areas which emphasize the spots in *A. beyeria* Powell.

Holotype female, Los Angeles, Los Angeles County, California, March 22, 1931, reared from Italian cypress [*Cupressus sempervirens*] June 9, 1931 (Burke) deposited in the California Academy of Sciences. Allotype male, "San Diego Co., Calif." VI–27–32 (no further data) deposited in the San Diego Natural History Museum. Four female paratypes, all California, as follows: Los Angeles County, Glendale, III–31–31, reared from *Cupressus macrocarpa* V–28–31 (Burke); San Diego County, San Diego, VI–3–33 (no collector given); La Mesa (Collier Park), light trap VI–25–26 (A. A. Lee); "Costal Area," VI–23–40 (F. T. Thorne) deposited in collections of California State Department of Agriculture, San Diego Natural History Museum, U.S. National Museum, and author. One additional male apparently referable to this species but not designated as a para-

type, San Diego, VI–27–24 [E. Piazza], having had a wing and genitalia slide made by Busck, "AB Mar. 24, 1929" which cannot be located, in Los Angeles County Museum. The latter specimen also bears a cotype label with an apparently unpublished Busck manuscript name.

Argyrotaenia beyeria Powell, new species

A brightly marked species, having the tan forewings banded and blotched with pink or rose colored markings which are emphasized by rust and black margins.

Male.—Length of forewing 8.8 mm. *Head:* palp orange exteriorly, sprinkled with brownish, paler interiorly; second segment moderately expanded toward apex; third segment brownish, nearly obscured by apical scales of second. Front margin at eye and antennal scape interiorly rust-red; remainder of head scaling dark to pale orange; pale yellowish below. *Thorax:* apparently uniform orange above (notum rubbed on holotype), tegula darker basally; metanotum unscaled with well developed white lateral hair tufts which are appressed over posterior half; white below except inner eye tuft and tegula base dark brown. Prothoracic leg dark brown below, femur, tibia and first tarsal segment tinged linearly with orange, tarsal segments pale apically; pale interiorly. Mesothoracic leg paler, similarly tinged with orange. Metathoracic leg whitish. *Forewing:* about 2.5 times longer than broad; costa evenly curved, flattened beyond middle, termen straight, not strongly angled inward. Ground color shining rosaceous tan marked (in general way) by three broad, variously developed transverse bands. Base dark rose, first band at basal one-fourth shining rose-pink, bordered narrowly outwardly and inwardly below cell by deep rust-red scales, those on lower fold nearly black; second band from costa before middle, angling outward and expanded outward abruptly in the cell by a black double crescent; above this bordered with rust-red; below this broadly bordered with dark rust and black, the latter most conspicuous at lower fold, the shining rosaceous area reduced to a round spot above and below the crescents; outer band incomplete, consisting of a half circle on costa and a sigmoid blotch tapering to a point at anal angle, both dark rust colored; the sigmoid spot margined outwardly and inwardly at middle with black. A triangular spot in apical area, dark rust bordered below with black which joins the sigmoid spot. Fringe pale shining orange. Underside dull brownish, the dark markings of the upper side reproduced as grey markings. Apical area yellowish between these. *Hindwing:* shining white above, whitish below with three faint grey spots around apex. *Abdomen:* whitish, genital tuft moderate. Genitalia essentially as in *A. paiuteana* Powell (fig. 1) from which it apparently differs by the apically tapered uncus and slightly more angulate aedeagus (fig. 3; drawn from paratype, Napa, JAP slide No. 562, three slides examined).

Female.—Length of forewing 9.0 mm. External features essentially as described for male. Legs paler, entirely whitish. Forewing marked as male except having less dark scales in the markings, which, therefore, although distinct are lighter (this may be due to the older condition of the allotype).

Hindwings, abdomen as in male. Genitalia as in *A. cupressae* (fig. 4) differing only by the more well developed lateral flanges of the signum (fig. 5, drawn from paratype, Rio Nido, JAP slide No. 604, two slides examined) and the less distinctly sclerotized neck of the ductus below ostium (as in *A. paiuteana*, fig. 6a.) The development and placement of the signum is variable within species throughout the genus, and it cannot always be used as a differentiating character within species groups. Apparently the outward projecting curved lateral flange always arises from the higher side on the bursa, and mirror image forms occur within a species.

Range of length of forewing in paratypes, males 8.0 to 9.2 mm.; females 9.1 to 9.9 mm. The series is more or less uniform in wing pattern, but exhibits considerable individual variation in development of color, especially the rust-red. Most of the paratypes have less dark reddish and black scales than the holotype, these being replaced by orange or yellow-orange scales. Some lack the black entirely and show very little rust-red so that the markings are less contrasting and at times obscure. The specimens from Petaluma, in particular, tend to have a paler, washed out appearance. A specimen from "Alameda Co." has more black than the holotype so that the rust-red is nearly all replaced by darker scales. The specimen from Santa Cruz County is the most distinctly marked, having the bands somewhat reduced and very well defined by narrow borders of deep rust-red. The shining rosaceous in the bands fades out, probably with the age of the individual when it is alive.

Holotype male and allotype female, BERKELEY, ALAMEDA COUNTY, CALIFORNIA, May 15, 1959 and June 26, 1959, at light (J. Powell), deposited in the collections of California Academy of Sciences. Twenty-four paratypes, all California, as follows: Lake County: Kelseyville, 1♂ no date given (Guedet). Sonoma County: Guerneyville, 1♂ not date given (Guedet); Rio Nido, 1♂, 1♀ VII-3-27 (G. D. Hanna); Petaluma, 2♂♂ VI-16-36, 1♂ VIII-10-36, 1♀ VI-27-37, 3♂♂, 1♀ VIII-6 to 17-37, 1♀ VII-28-37, 1♂ VI-18-38 (E. C. Johnston). Napa County: Napa, 1♂ "Jun. 6," 1♂ VIII-4-30, 2♂♂ no date given (Guedet). Marin County: Mill Valley, 1♂ VI-8-24 (E. P. Van Duzee), 1♂ VI-15-58, light trap (H. B. Leech). Alameda County: 1♂ "Alameda Co. June" [Koebele]; U.C. Campus, Berkeley, 1♂ VI-23-59 (D. D. Linsdale). Santa Clara County: Stanford University, 1♀ VI-5-30 "resting on Itatian Cypress" [Italian Cypress, *Cupressus sempervirens*] (collector not given). Santa Cruz County: Big Basin, 1♀

VII-4-59, at light (J. Powell). Deposited in collections of American Museum of Natural History, California Academy of Sciences, California Insect Survey, California State Department of Agriculture, Canadian National Collection, U.S. National Museum and author.

One additional male referable to this species but not designated as a paratype, "Alameda Co. June" having had a genitalia slide made by Busck "AB Mar. 20, 1929" which cannot be located, in Los Angeles County Museum. The latter specimen also bears a Busck Type label with an apparently unpublished manuscript name.

Argyrotaenia paiuteana Powell, new species

A shining, pale species, the forewings golden, marked with tan or pale red-brown.

Male.—Length of forewing 7.7 mm. *Head:* palp small, second segment shorter than vertical eye diameter, expanded apically above and slightly below into a somewhat truncate tuft which nearly obscures third segment; pale yellowish with a few scattered orange scales. Head tufts rather short and appressed, pale yellowish, whitish medially on vertex, a small bright orange patch adjoining eye below antennal scape; antennal scape pale except some orange scales anteriorly. *Thorax:* pale yellowish above with some scattered orange scales in collar, tegula apex and toward posterior tip; metanotum unscaled with lateral posterior flat tufts of long white hairs; underside white. Legs whitish, the prothoracic mottled with orange-brown exteriorly (according to paratype; holotype prothoracic legs broken below femora), tarsal apices white. *Forewing:* costa evenly and slightly rounded from base to apex; apex acute, termen angled rather steeply back; ground color pale yellowish or whitish with pale red-brown or orange indistinct banding as follows: basal one-fourth, within this area darker at base, outwardly on costa and with some dark red-brown scales along fold, especially on outer border of basal area; a broad oblique transverse band from middle of costa, expanding to meet anal margin from middle to anal angle; a second oblique band from outer fourth of costa to termen just above anal angle, interrupted by a line of ground color, forming a rounded costal spot, and including some dark scales in middle; anal apical area orange. Fringe white. Underside whitish with a faint brownish tinge over basal two-thirds and on veins in terminal area. *Hindwing:* shining white above and below including fringe. *Abdomen:* entirely whitish; genital tuft large. Genitalia as in fig. 1 (drawn from paratype, Clark County, Nevada, JAP slide No. 527, two slides examined), uncus broadest near apex (evident only when uncus is flattened). The scale-like cornuti, not shown for preceding two species are dehiscent and are often seen in the female bursa.

Female.—Length of forewing 9.0 mm. Essentially as described for male. Head uniform yellow-orange; forewing with some dark red-brown scales through the central part of all transverse markings, in the outer band, form-

ing a rounded spot which tapers toward anal angle, suggestive of the pattern in *A. beyeria*. Genitalia as in *A. cupressae* apparently differing only by the better development of the flanges of the signum and by the less distinctly sclerotized neck of the ductus below ostium (fig. 6a, b drawn from paratopotype, JAP slide No. 601, three slides examined), signum apparently somewhat less well developed than in *A. beyeria*.

Range of forewing length of paratypes, males 7.6 to 9.1 mm.; females 7.4 to 9.5 mm. The extent and distinctness of the markings is variable within the various individual spots, but all the paratypes have essentially the same pattern. The color of the markings tends to be paler than the holotype, often being a yellow-orange or deep tan.

Holotype male and allotype female, ROCK CREEK, ONE MILE WEST OF TOM'S PLACE, MONO COUNTY, CALIFORNIA, August 13, 1957, at light (J. Powell) deposited in the California Academy of Sciences. Fifteen paratypes as follows: California: 2♀♀ same data as holotype (the type series was collected VIII-10 to 13, one each night); 1♀ same locality, VIII-7-59 (C. D. MacNeill); 1♂ Lone Pine, Inyo County, V-26-37 (E. C. Van Dyke); Nevada: 1♀ Mina, Mineral County, VII-20-53 (R. H. Reid); 1♀ Wheeler Springs, Charleston Mts., Clark County, XI-(5-13)-34 (G. H. and J. L. Sperry); 4♂♂, 1♀ "Clark Co., June 24-30" (no further data); Utah: 1♂, 3♀♀ Eureka, Juab County, VI-28 to VIII-26-11 (Tom Spalding). Deposited in the collections of American Museum of Natural History, California Academy of Sciences, California Insect Survey, Los Angeles County Museum, U.S. National Museum and author.

Two additional females appear to relate to this species but are not designated as paratypes, "Pinyon Flats," Riverside County, California V-26-52 (R. H. Reid) in the Los Angeles County Museum collection.

The species forms, together with *A. cupressae* and *A. beyeria*, a closely knit group unlike any other North American *Argyrotaenia* in external features. The similarity of the genitalia and

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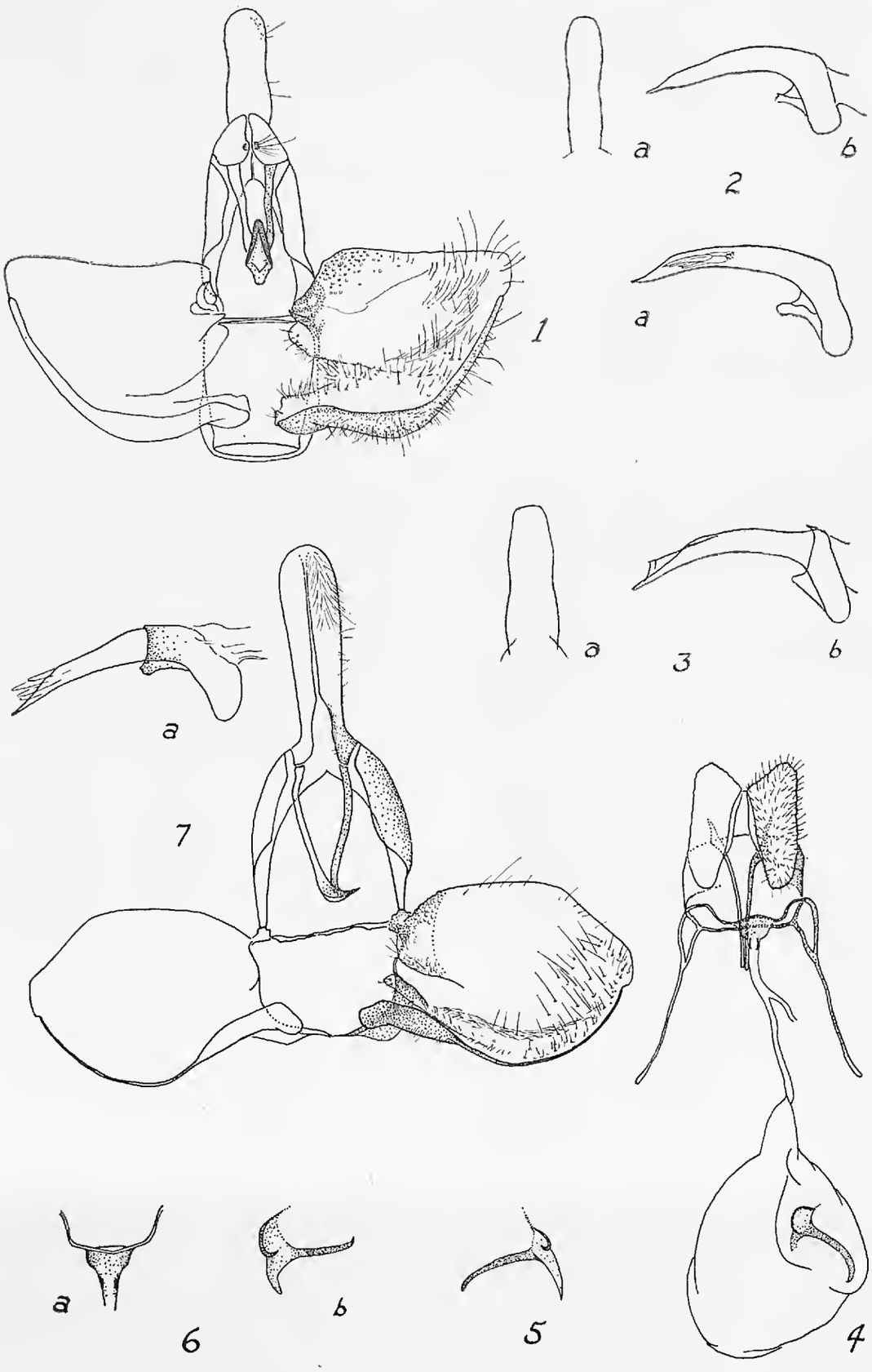
EXPLANATION OF FIGURES

Fig. 1. *Argyrotaenia paiuteana* Powell, male genitalia, *a.* aedeagus, lateral aspect; 2. *A. cupressae* Powell, *a.* uncus, inner aspect flattened, *b.* aedeagus, lateral; 3. *A. beyeria* Powell, *a.* uncus, *b.* aedeagus; 4. *A. cupressae*, female genitalia; 5. *A. beyeria*, signum; 6. *A. paiuteana*, *a.* ostium and neck of ductus, *b.* signum; 7. *A. burnsorum* Powell, male genitalia, *a.* aedeagus, lateral.

the allopatric distribution suggest the possibility of a single widespread, geographically variable species. As Freeman (1958) has pointed out, the genitalia characters in many of the North



American *Argyrotaenia* are very similar, and specific differences are usually very subtle. The likelihood of their being subspecific relationships in several complexes of presently conceived species nonetheless exists. However, until a better understanding of the distribution patterns and biological characteristics is available, illustration of these is not possible. The lack of knowledge on the geographic range of the western forms in this group is particularly emphasized.

It seems probably that the *cupressae* group is most closely related to the *franciscana* (Walsingham) group according to the characters of the genitalia.

Argyrotaenia lautana Powell, new species

A large species with broad pale tan forewings marked only by a small outer costal spot of red-brown.

Male.—Length of forewing 9.4 mm. *Head:* palp rather compressed, not expanded greatly by scale tufting; second segment about equal to eye diameter; third segment mostly visible, porrect; tan; second segment basally and third segment sprinkled with brown exteriorly; pale interiorly. Head tufts prominent, dense, tan; antennal scape dark brown anteriorly and above, pale posteriorly and below. *Thorax:* pale tan above and below except metasternum white; prothoracic leg brown exteriorly, tarsal segments with white apical bands; mesothoracic leg paler, tarsal segments marked with pale brown (one mesothoracic leg lacking from holotype); metathoracic leg whitish; all legs pale interiorly. *Forewing:* broad, only about 2.4 times longer than wide, costa evenly rounded in basal half, flattened and slightly convex beyond; termen straight only slightly angled back. Color a uniform pale tan; costa margined narrowly and faintly with red-brown; a costal triangle from slightly before end of cell nearly to apex, extending only about one-fifth the width of wing towards anal margin, red-brown with some grey scales continued outward into a narrow costal tuft to apex; a dorsal mark faintly indicated by a few red-brown scales on margin just before anal angle. Fringe concolorous with wing. Underside pale tan, greyish centrally, apical costal tuft showing red-brown. *Hindwing:* whitish, fringe long, whitish, some yellowish scales at apex; underside the same. *Abdomen:* of holotype treated in caustic solution, of paratype entirely whitish, genital tuft long, conspicuous. Genitalia nearly identical to those of *A. dorsalana* (Dyar), (fig. 8, a, c, plesiotype, Modoc County, California, JAP slide No. 544) apparently differing by the more elongate, (in relation to size of tegumen) less tapered, parallel sided uncus (fig. 8b drawn from holotype, JAP slide No. 590, two slides examined) and by minor differences in greater development of sculpture on the anterior margin of the sacculus.

Female.—Length of forewing 11.4 mm. External features nearly exactly as described for male. Wing markings somewhat reduced, so that only obscure indications of the markings are evident. Abdomen whitish, dorsal and lateral genital tuft straight. Genitalia as in fig. 11 (drawn from allotype,

JAP slide No. 605, one slide examined); similar to *A. dorsalana* (Dyar), differing by having less distinctly formed lateral flanges of the signum and more pronounced scobination above the signum than in *dorsalana* (based on only one slide of each).

Length of forewing in paratypes 9.6–9.7 mm. As described for holotype except topotypic specimen has a second costal spot, near middle which forms with the better developed dorsal spot, a faint suggestion of a transverse band.

Holotype male and allotype female, CAMP BALDY, SAN BERNARDINO MOUNTAINS, SAN BERNARDINO COUNTY, CALIFORNIA "June 24–30" (no further data) deposited in the U.S. National Museum. Two male paratypes; one same data as holotype, "AB slide Feb. 10, 1929," and one, Palomar Mountain, San Diego County, California VII-3-45 (Comstock and Martin) deposited in the U.S. National Museum and Los Angeles County Museum collections.

Two additional males, apparently referable to *lautana* but not designated as paratypes, Greenhorn Mts., Kern County, California VII-1-40 (C. Henne) more nearly resemble *A. dorsalana* in a pale straw ground color, and the markings suggest a relationship with that species. However, the large size (length of forewing 10.8 mm.) and markings are that of *lautana*. The mid costal spot extends indistinctly into the cell, forming a definite broken transverse band. The outer costal spot is extended downward by a subterminal line, outside of which there is some obscure brownish. In the less distinctly marked forms of *A. dorsalana* the costal spots are lacking, and the dorsal spot remains and is heavier in intermediate forms, whereas in the Greenhorn Mts. specimens this spot is less distinct than the costal spots, as in the other *lautana* specimens.

The nearly identical genitalia and similar wing pattern relate *A. lautana* most closely to *A. dorsalana* (Dyar), and *lautana* may prove to be a southern California mountain race when specimens become available from intervening areas. *A. dorsalana* is widespread in western North America from southern British Columbia to Arizona and New Mexico, but I have seen California specimens only from Modoc and Shasta Counties in the northeast corner of the state.

Argyrotaenia burnsorum Powell, new species

A large species having the forewings brown, crossed by indistinct ochreous bands.

Male.—Length of forewing 10.5 mm. *Head:* palp ochreous mottled with brownish exteriorly, pale yellowish interiorly; tufts mixed with ochreous and brownish, vertex white; antenna brownish, annulated paler, scape whitish exteriorly. *Thorax:* collar ochreous, tegula and notum brown; metanotum unscaled except for pale flat apical tufts; underside shining whitish; a conspicuous flat tuft of broad white scales at base of fore coxae below head; pro- and mesothoracic legs brownish exteriorly, paler interiorly; metathoracic leg whitish, spurs darker, small tarsal spines conspicuously dark. *Forewing:* broad, costa evenly bowed before middle, straight beyond, apex broadly rounded, termen only slightly angled back. Brown, crossed by two broad indistinct and incompletely formed pale ochreous bands; base with some reddish-brown scales: first band at inner one-third, angling outward, apparently consisting at times of three parallel narrow bands (holotype somewhat rubbed); central area of wing generally over-scaled reddish-brown, outside inner band and outward through second band which begins at middle of costa and curves outward to anal angle, consisting in general of two parallel bands, especially below cell; apical area with an indistinct costal spot and two narrow vertical bands from costa to mid-termen, all pale ochreous; fringe brownish in upper half, becoming pale ochreous in lower half. Underside greyish-brown (showing a bluish sheen in certain lights), costa with about twelve dark spots or vertical dashes about evenly spaced along length; outer half of costa and apex pale; fringe ochreous tinged with brownish near apex. *Hindwing:* grey, paler basally, fringe whitish. Underside whitish with a few dark vertical strigulae around apex. *Abdomen:* greyish above, genital tuft, laterally and below pale ochreous. Genitalia as in fig. 7 (drawn from paratopotype, JAP slide No. 569, two slides examined).

Female.—Unknown.

Length of forewing range in paratypes 9.8–10.5 mm. The paratypes are somewhat rubbed specimens but show some variation in wing markings. The bands can consist, at least in part, of nearly solid patches of pale ochreous, the narrow bands fusing. The reddish-brown scales are sometimes replaced by yellow-orange, and the dark spots on the underside of the costa are not always evident.

Holotype male, Madera Canyon, 5800′, Davis Mountains, Jeff Davis County, Texas, April 30, 1959 (J. M. and S. N. Burns) deposited in the California Academy of Sciences. Three paratype males, same data except IV-28 to V-3-59 deposited in California Insect Survey, U.S. National Museum and author's collections.

In size, wing shape and genitalia *A. burnsorum* is closely allied to *A. mariana* (Fernald), of the east coast, but the two are quite distinct in wing color and pattern.

I take pleasure in naming the species for Sara and John Burns,

who have collected many fine Microlepidoptera for me on their extensive trips throughout the southwest states in search of Hesperiidae.

Argyrotaenia graceana Powell, new species

A large, pale species with indistinct brownish or reddish-brown banding on the forewing.

Male.—Length of forewing 10.0 mm. *Head:* palp relatively small, second segment only about 1.5 times greatest eye diameter and third segment; expanded above by scaling on second segment apically into a gradually rounded shape, third segment thus about half obscured; second segment pale orange or whitish exteriorly mottled by brown scale tips, white interiorly, third segment brown. Head tufts dense, long, reaching to apices of scapes at vertex, white on crown, brownish at vertex, orange-brown below scapes, brown on front; antenna brownish, scape white below. *Thorax:* collar and tegula orange, the latter white apically; dorsum pale orange; metanotum unscaled with lateral posterior tufts only weakly developed, underside shining white. Legs whitish, pro- and mesothoracic tibiae and tarsi brownish exteriorly except apical bands. *Forewing:* costa nearly straight, only slightly curved in basal half, giving the wing a narrow appearance; termen angled back only slightly but anal angle broadly rounded. Ground color pale grey, blending to whitish apically, costa whitish; marked with dull orange-brown very indistinctly as follows: a broad basal area except costa, a broad oblique band from middle of costa to inside anal angle in large part interrupted by ground color, a very faint second band from outer fourth of costa toward anal angle consisting of a rather distinct costal spot and indication of a vertical portion in pale apical area, not reaching anal angle, suggestion of a narrow terminal band. Fringe grey. Underside pale, central area greyish, margins whitish. *Hindwing:* uniform pale grey; fringe long, white with a narrow basal band of pale brownish scales. *Abdomen:* whitish above, brownish on apical segments (discolored on holotype); pale below; genital tuft conspicuous, whitish. Genitalia as in fig. 10 (drawn from paratopotype, JAP slide No. 566, three slides examined). Uncus and upper part of tegumen very heavily sclerotized and forming a hood-like structure, which cannot be flattened back apically to give comparable view to the other *Argyrotaenia* drawings.

No females available from the type locality, but a single example from the same mountain range appears, on the basis of size and coloration, to represent this species.

Female.—Length of forewing 9.2 mm. In general as described for male except the brownish coloration replaced by orange-brown or pale rust colored scales. Forewing: whole basal half, except costa, somewhat covered with orange scales, pale band outside median band remaining distinct; outer orange band and terminal band more distinct and broader than in male, nearly filling the apical area with color. Fringe orange-brown, darker toward apex. Genitalia as in fig. 9 (drawn from allotype, JAP slide No. 587, one slide examined), bursa scobinate over entire surface.

Range of forewing length of paratypes, 8.4–10.4 mm. The

wing markings are somewhat variable both in distinctness and color, ranging to a form with rather complete and distinct bands as described for holotype and to a rust-brown although not so bright an orange as that of the single female.

Holotype male, HATHAWAY CREEK, SAN BERNARDINO MOUNTAINS, RIVERSIDE COUNTY, CALIFORNIA, August 2, 1940 (C. Henne). Allotype female, Lake Arrowhead, San Bernardino Mountains, San Bernardino County, California, August 29, 1940 (H. Buckwalter) both deposited in the U.S. National Museum. Six male paratypes, all California, as follows: four, same data as holotype, one, same data except J. A. Comstock, one Upper Santa Ana River, San Bernardino Mts., VIII-1-46 (Grace H. and John L. Sperry) deposited in collections of American Museum of Natural History, California Academy of Sciences, U.S. National Museum and author.

A. graceana is a manuscript name of Dr. N. S. Obraztsov who kindly turned over his specimen for use in the present description. The species is named for Grace H. Sperry who helped to contribute to the knowledge of this and many other species of Tortricidae through the years of diligent collecting with her husband.

The species is very distinct both in external features and in genital characters of both sexes from any of the described *Argyrotaenia* species.

Besides the above material, I have studied ten additional females from the White Mountains, Arizona, collected on various dates in 1925 by O. C. Poling which appear to represent *A. graceana.* However, without having a male available for study from the area I hesitate to definitely refer these to the southern California species.

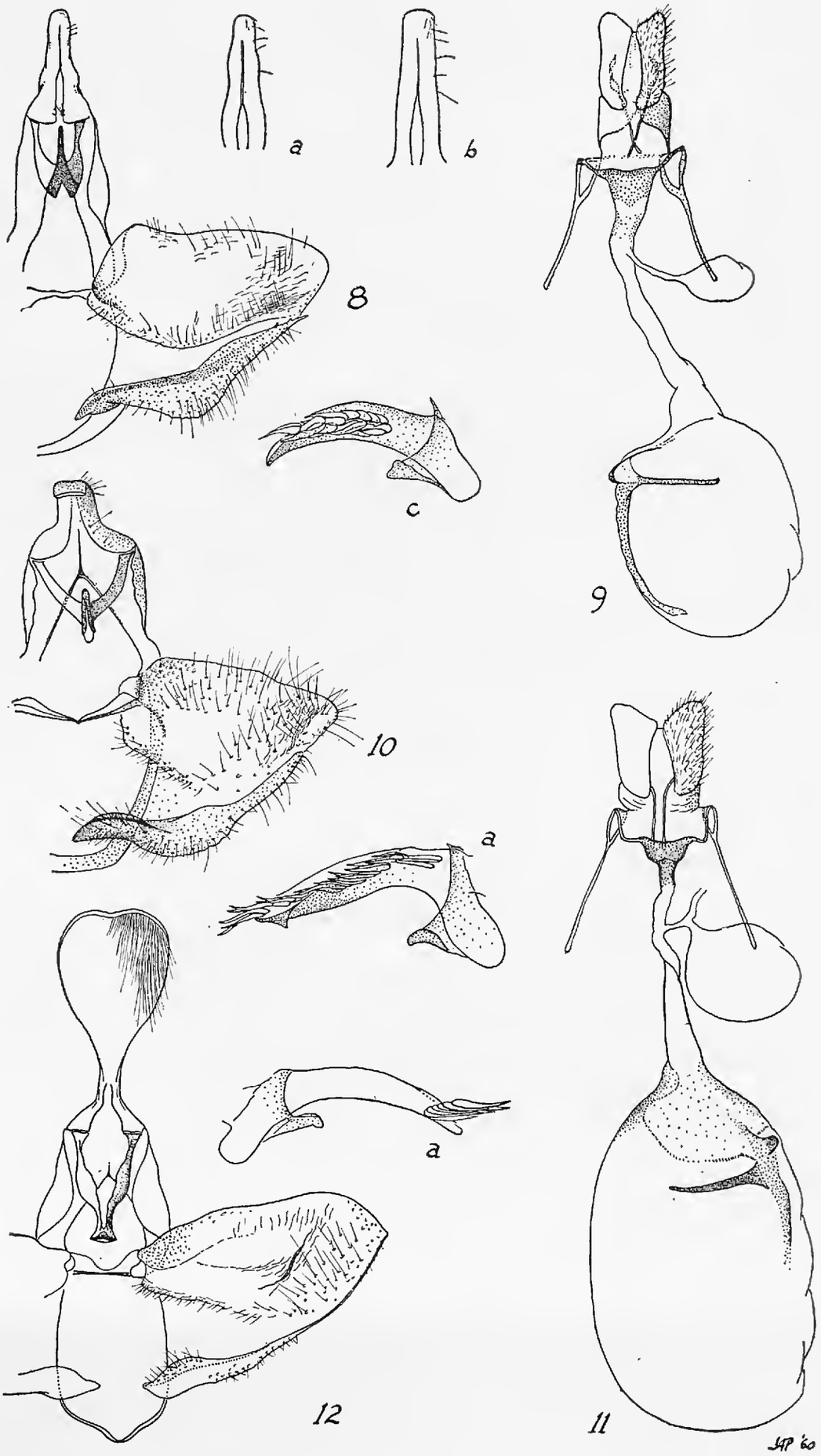
Argyrotaenia martini Powell, new species

A shining golden species having the forewings marked with broad, ochreous-brown spots and bands.

Male.—Length of forewing 9.8 mm. *Head:* scaling pale ochreous;

EXPLANATION OF FIGURES

Fig. 8. *Argyrotaenia dorsalana* (Dyar), male genitalia, *a.* uncus, inner aspect flattened, *b. A. lautana* Powell, uncus, inner aspect flattened, *c. A. dorsalana,* aedeagus, lateral aspect; 9. *A. graceana* Powell, female genitalia; 10. *A. graceana,* male genitalia, *a.* aeadeagus, lateral; 11. *A. lautana,* female genitalia; 12. *A. martini* Powell, male genitalia, *a.* aedeagus, lateral.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labial palpus second segment broadly expanded above and below to the truncate appearing apex, with a few orange-brown scales exteriorly; third segment not obscured by scaling of second, smooth scaled. Antenna brownish, each segment annulate with pale scales and marked by a brown spot above; scape brownish above. *Thorax:* collar pale ochreous; tegula orange-brown, pale at apex; orange-brown continued as a band across dorsum of thorax which is otherwise paler (discolored on holotype). Legs pale ochreous, prothoracic tibia and tarsus marked with brown exteriorly. *Forewing:* about 2.6 times longer than broad; costa curved abruptly at base, nearly straight beyond basal one-third, termen only slightly angled back, the wing thus rather rectangular in appearance. Ground color very pale ochreous, shining, the markings somewhat diffuse, not well defined, scattered orange or brownish scales occurring between the markings in most areas; basal one-third with an orange-brown patch, indistinct in costal half, outwardly angulate at middle; a broad, transverse, ochreous-brown band from middle of costa to before anal angle, widened on margin to angle, broken along upper edge of cell by ground color; a large, semicircular, brown spot at outer one-fourth of costa; a subsquare, ochreous-brown spot of about equal size slightly outside and below costal semicircle, its lower corner nearly reaching termen, the two being the most distinct markings of the wing; a narrow band of small, joined, brownish spots along termen and around anal angle to basal patch. Fringe shining pale ochreous. Underside, greyish in central portion and to costa at costal markings of upperside, reflecting purplish; terminal, apical and outer costal areas pale ochreous. *Hindwing:* shining whitish, lightly infuscated in anal half. Underside whitish, apex ochreous. *Abdomen:* of holotype treated in caustic solution and placed on slide; paratype whitish with some brownish scaling at base of genital tuft. Genitalia as in fig. 12 (drawn from holotype, JAP slide No. 514, one slide examined); uncus very broadly expanded, spatulate, socii lacking.

Female.—Unknown.

Length of forewing of paratype, 9.9 mm. Varying from the holotype only by a greater infusion of orange-brown scales into the markings, especially along the costa; hindwings with the anal area more heavily infuscated, the apical area marked with some faint, ochreous strigulae; uncus with a deeper apical emargination.

Holotype male, PINE CREST, MT. GRAHAM, PINALENO MOUNTAINS, GRAHAM COUNTY, ARIZONA, 7300′, June 28, 1955 (Lloyd M. Martin) deposited in the Los Angeles County Museum. One male paratype, Pinery Canyon, Chiricahua Mts., Cochise County, Arizona, June 27, 1955 (L. M. Martin) in author's collection.

Superficially the species appears somewhat like *A. paiuteana* Powell. However, the two are easily distinguished, and the

extremely aberrant genitalia form places *A. martini* remote from any of the known nearctic species. I suspect that its nearest relatives occur to the south, the types representing a northern cordilleran extension of a species with tropical affinities.

I take pleasure in naming the species for Lloyd M. Martin, veteran collector of the Arizona Lepidoptera fauna, who has been most cooperative in making material available from the Los Angeles County Museum collections.

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A NEW SPECIES OF DIANDRENA ASSOCIATED WITH OENOTHERA IN CALIFORNIA

(Hymenoptera: Andrenidae)

E. Gorton Linsley
University of California, Berkeley

The following new species of *Andrena (Diandrena)* collects pollen in the morning from *Oenothera dentata* at various sites in the southern San Joaquin Valley, California. It is named in honor of my colleague, John W. MacSwain, with whom I have collected it on several occasions.

Andrena (Diandrena) macswaini Linsley, new species

Female.—Integument dull greyish blue, abdomen with slight greenish reflections, antennae and legs dark brownish-black, clypeus black, the base and sides of face green with violet reflections; pubescence pale, white on clypeus, black or dark brown near eyes, antennae, and vertex, anal fimbria brown, tibial scopa intermixed with brown, abdominal hair bands pale, distinct, complete. *Head* tessellate, moderately densely punctate; frons finely, longitudinally striate; clypeus without a median impunctate line; labrum with apical process deeply incised and bilobed, the lobes elevated, polished, separated, and slightly divergent. *Mesosoma* with mesoscutum dull, tessellate, the superimposed punctures moderately large, crater-like, mostly separated by their own diameters, pubescence uneven in length, moderately dense, pale; propodeum feebly shining, tessellate and finely rugulose, enclosure finely, irregularly rugulose, the rugulae only a little less fine than those of adjacent areas; wings very lightly tinted with brownish; posterior trochanters with a long, curved white floccus, tibial scopa long, loose, simple beneath, denser dorsally, the hairs mostly shorter than width of tibia and denser, darker, and somewhat plumose toward the femur. *Metasoma* dull, tessellate, first tergite with numerous, large, irregular punctures with the anterior margin elevated

like tilted craters, pubescence long, erect, pale, successively shorter on succeeding segments, apical hair bands distinct on tergites two to four, basal elevation of tergites two to four finely, irregularly, transversely and somewhat sinuously reticulate, fifth tergite densely, coarsely punctate; first sternite greenish, sternites two to four violaceous brown, posterior margins with a row of long, pale, suberect but posteriorly slightly recurved hairs. Length, approximately 9 mm., anterior wing 6.3 mm.

Male.—Integumental coloration and sculpturing generally similar to female, but legs with a distinct greenish reflection and rugulosity of metasomal tergites slightly more pronounced; facial hairs all white; metasomal hairs very long, white, many exceeding the length of the tergites. Length, approximately 7.5 mm., anterior wing, 6 mm.

Holotype female (California Academy of Sciences, San Francisco), from EIGHTEEN MILES EAST OF BAKERSFIELD, KERN COUNTY, CALIFORNIA, April 11, 1958, visiting flowers of *Oenothera dentata* (but not collecting pollen) between 7:30 and 7:45 a.m. PST. (E. G. Linsley); allotype male (California Academy of Sciences) from the same locality, February 27, 1959 (E. G. Linsley); and 137 paratypes (California Insect Survey) also from the same locality: 34♀♀ taken between March 9 and April 2, 1959 (E. G. Linsley and J. W. MacSwain), 26♂♂ and 59♀♀ collected between March 5 and April 3, 1960 (E. G. Linsley and J. W. MacSwain), and 18♀♀, April 9, 1960 (E. G. Linsley and Juanita M. Linsley). Most of the females were taking pollen or nectar from *Oenothera dentata;* a few were captured in their nesting area.

This species is closely related to *A. (D.) cyanosoma* Cockerell, but may be recognized in both sexes by the slightly less bluish integument, and the stronger, denser, and less regular sculpturing. The female also differs from *cyanosoma* in the distinct, complete hairbands of the abdomen, the irregular mesonotal pubescence and the longer erect hairs of the first metasomal tergite, the male by the all white facial pubescence and the very long hairs of the abdomen.

RECENT LITERATURE

OBLIGATORY AND FACULTATIVE INSECTS IN ROSE HIPS: THEIR RECOGNITION AND BIONOMICS, by W. V. Balduf. Illinois Biological Monographs, No. 26, vi + 194 pp., including 12 pls. The University of Illinois Press, Urbana: March 16, 1959.

A thorough and carefully documented study, written in a style suitable for the general reader. A stimulating model for other investigators.

PARACRASPEDOMERUS, A NEW GENUS OF STAPHYLINID BEETLE FROM NEW CALEDONIA

(Coleoptra: Staphylinidae)

IAN MOORE

San Diego Museum of Natural History, San Diego, California

In 1911 Bernhauer described the genus *Craspedomerus*, basing it on *Philonthus glenoides* Schubert from India. He placed it in a new subtribe, Craspedomeri, in the tribe Staphylinini of the subfamily Staphylininae. Three more species of the genus have since been described from India by Cameron (1932). In 1927 Bernhauer placed in the subtribe a new genus and species, *Pseudocraspedomerus alutaceus* from New Guinea. I have recently received from Dr. William C. Stehr a series of fifteen specimens from New Caledonia of a species which obviously belongs in this subtribe but is sufficiently distinct from the other two genera to require the proposal of a new genus. It was described in 1877 by Fauvel as *Cafius speculifrons* and later in 1889 removed by him to *Hesperus*, where it is equally out of place.

Paracraspedomerus Moore, new genus

Type species: *Cafius speculifrons* Fauvel

Head large, orbicular; disc impunctate; base and sides strongly, coarsely and closely punctate. Eyes occupying little more than half the side of head, not interrupting side margin; a short, infraorbital ridge directly beneath eye, not extending to base of head. Neck about one-third the width of head. Labrum transverse, emarginate in middle, with a very wide, arcuate, membranous border which is emarginate centrally. Mandibles long, curved, sharply pointed, each with a small basal tooth internally, with a deep groove on outer margin. Maxillary palpi moderately long; first segment short and curved; second long, narrow at base, strongly curved, thick at apex; third about as long as second, narrower, widened to apex; fourth a little longer and narrower than third, a little narrowed at base and at apex, apex truncate. Ligula small, rounded in front, membranous. Gular sutures united at basal third (very narrowly separated in one specimen), diverging anteriorly. Mentum transverse, narrowed to the front, side margins slightly curved and raised in a strong ridged edge, anterior margin gently arcuate. Labial palpi with first segment twice as long as wide, second a little longer and somewhat thicker apically, third about as long as second, somewhat thicker at middle and thence narrowed to the truncate apex. Antennal fossae located near anterior margin of head, inside bases of mandibles. Antennomeres densely pubescent from fourth segment, outer segments as wide as long. Pronotum subtrapezoidal, anterior angles prominent, narrowed basally; disc with a series of three punctures each side of middle and a small group of large and small punctures laterally; anterior angles and lateral margins with

a few large and small punctures. Hypomera strongly inflexed, superior and inferior lateral lines united far forward near neck, with a oblique carina joining superior lateral line at about basal third, crossing hypomera and uniting with inferior lateral line near apical third, areas between lines impunctate. Prosternal epimera absent. Prosternum tumid in middle, divided by a transverse carina which is posteriorly angulate centrally; posterior section expanded under coxae. Mesocoxae widely separated. Mesosternal process extending about one-third the distance between coxae, broadly rounded; metasternal process extending about one-fourth the distance between coxae, broadly rounded; region between the two processes depressed. Elytra wider and a little longer than pronotum, strongly, densely punctured. Abdomen shining, strongly, sparsely punctured at bases of tergites. First three tergites deeply impressed at base. First two sternites strongly constricted basally. First five sternites very strongly sculptured basally, the sculpture consisting of several very closely placed transverse rows of very large, deep punctures arranged in an imbricate pattern, each puncture shaped like an elongate horseshoe, with a large seta near its anterior margin. Tibiae strongly spinose. First four segments of anterior tarsi dilated in both sexes, more strongly so in male. Middle tarsus with first segment thickest, longer than next three together; next three short, decreasing very slightly in length; fifth slender, a little shorter than preceding three. Posterior tarsi very similar to middle tarsi, but with segments two, three and four slightly longer relative to their width.

This genus differs from the other two genera of the subtribe in many features, several of which are outlined in the key to the genera below. A very striking feature of the genotype is the unusual sculpture of the abdominal sternites. The fifteen specimens studied were identified from Fauvel's description, and Dr. Charles Seevers later verified my determination by comparison with a specimen so identified in the Bernhauer collection. Specimens have been sent to the following people or institutions: California Academy of Sciences, Chicago Natural History Museum, United States National Museum, Dr. Milton Sanderson and Dr. William C. Stehr. The remainder are at present in my own collection.

Key to the Genera of the Subtribe Craspedomeri

1—Middle coxae narrowly separated; mesosternal process acute; metasternal process not produced between the coxae; tergites not impressed at base; prontum moderately densely punctured throughout ..... *Craspedomerus* Bernhauer

—Middle coxae widely separated; mesosternal process broadly rounded; metasternal process produced between the coxae; first two tergites impressed or shallowly concave at base; pronotum with a series of two or three discal punctures each side 2

2—Sternites 1 and 2 strongly constricted at base; first five sternites coarsely, densely sculptured; third tergite impressed at base; prono-

tum with a series of three discal punctures on each side; third segment of labial palpi not shorter than second....*Paracraspedomerus* Moore
—Sternites not constricted at base, not strongly sculptured; third tergite not impressed at base; pronotum with two discal punctures on each side; third segment of labial palpi shorter than second .....*Pseudocraspedomerus* Bernhauer

Dr. William C. Stehr has generously given me the fine series of specimens which made this study possible. Dr. Charles Seevers and Mr. Rupert Wenzel arranged for the loan of specimens of two species of *Craspedomerus* from the Bernhauer collection. Dr. Seevers has taken considerable pains to supply me with additional information concerning the type of *Pseudocraspedomerus alutaceus* Bernhauer, including several original sketches. Mrs. Mildred Meeder has kindly negotiated the loan of several publications not available locally. To the above and to Mrs. Helen Moore, who has spent many tedious hours typing for me, I wish to express my gratitude.

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THE MAYFLY GENUS BAETISCA IN WESTERN NORTH AMERICA

(Ephemeroptera: Baetiscidae)

GEORGE F. EDMUNDS, JR.[1]

University of Utah, Salt Lake City

With one possible exception, no records of the mayfly genus *Baetisca* are reported from western North America. Eaton (1885, Trans. Linn. Soc. London, 2nd Ser. Zool., 3:229) reported *Baetisca obesa* from California. The record never has been repeated nor confirmed, and considering the subsequent distribution record of species of the genus the record has been largely ignored.

In many years of study of the mayfly fauna of western North America only two specimens of the genus *Baetisca* have been sent to me for identification. The first was a young nymph collected in 1948 by John L. Steele from the Big Laramie River, Albany County, Wyoming. The specimen represented an apparently undescribed species, probably nearest *Baetisca bajkovi* Neave. The nymph was returned to Mr. Steele at the Department of Zoology, University of Wyoming. I have been unable to locate it for subsequent study.

A second specimen of *Baetisca* was collected in the Columbia River, Washington, by J. J. Davis in 1948. There is little doubt but what the species is undescribed, and that it is distinct from the Wyoming species. In Traver's[2] keys to the North American species of nymphs the specimen runs to *B. callosa* Traver. The new species differs from *B. callosa* in the shape of the mesonotum, in having postero-lateral spines on abdominal segments 6–9, in lacking a black band at the base of the terminal filaments, and in having a better developed apical projection on the second segment of the labial palpi.

I would like to thank Mr. J. J. Davis for making the specimen available for study, and David I. Rasmussen and Richard K. Allen for the figure.

BAETISCA COLUMBIANA Edmunds, new species

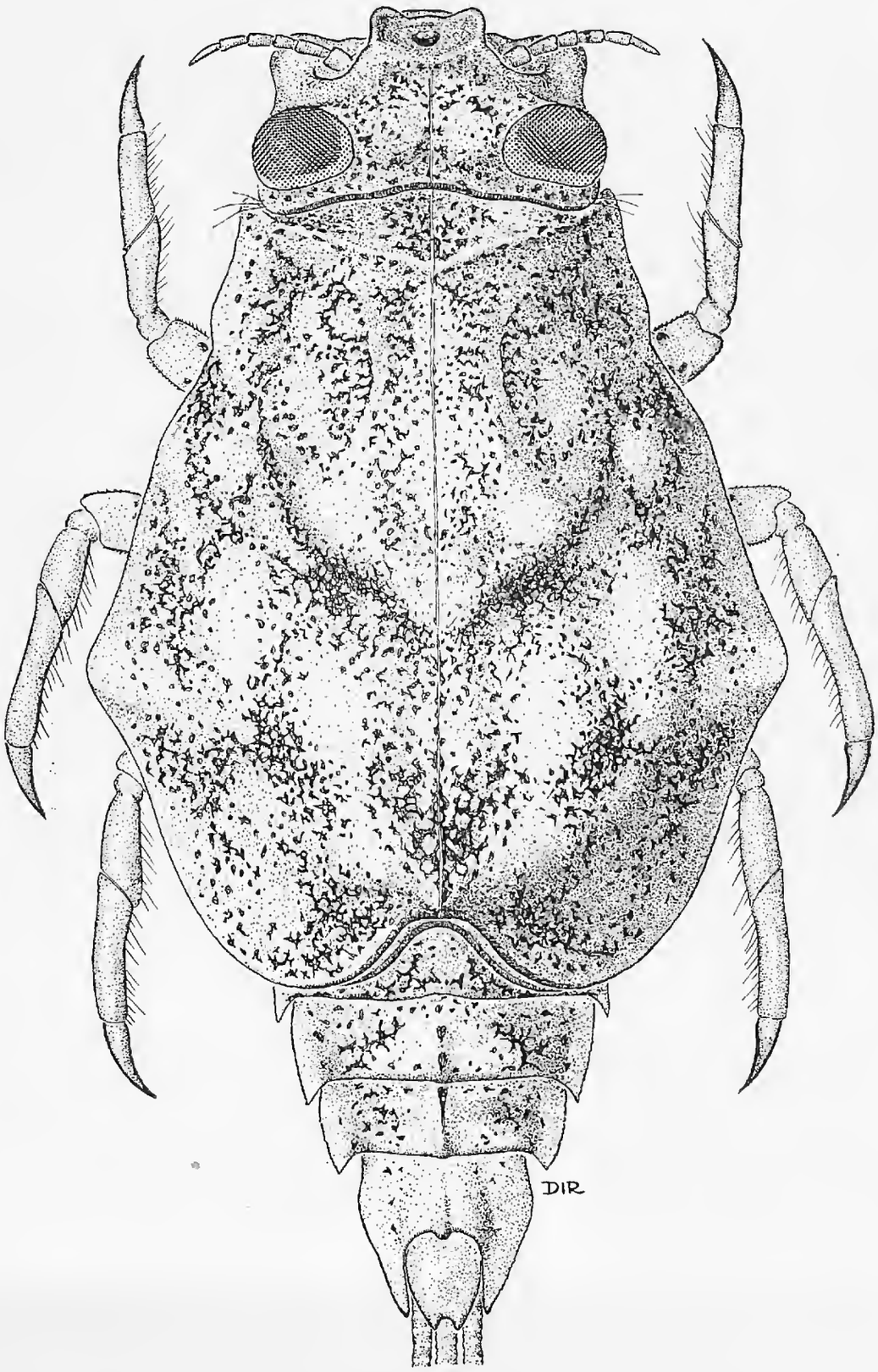
(Fig. 1)

Length, body 6 mm., terminal filaments 2 mm. *Color*. body light brown, with dark brown mottling and spots as in figure 1. Dark spots on venter larger and more sparse than on dorsum. Eyes black. Antennae pale smoky

[1] The research on which this paper is based was supported by a grant-in-aid from the University of Utah Research Fund.

[2] Traver, J. R., 1935, in: The Biology of Mayflies. Comstock Pub. Co., Ithaca, N.Y., 759 pp.

brown. Tails smoky brown. Genal and frontal projections pale. margined with smoky brown. A distinct larger dark spot at the base of the coxal insertion of each meso- and metathoracic leg. The tibiae and tarsi without



EXPLANATION OF FIGURE

Fig. 1. Dorsal view of holotype nymph of *Baetisca columbiana* Edmunds.

dark spots. Claws smoky brown, becoming darker apically. *Head,* with genal projections extending only to front, rounded; frontal projections small, rounded; apex of second segment of maxillary palpi produced into a finger-like projection. *Thorax,* mesonotum moderately wide and only moderately humped; without lateral mesonotal spines, only a gently rounded protuberance: no dorsal mesonotal spines. Claws moderately long and tapered. *Abdomen,* tergites 7 and 8 without a median spine, a poorly developed one on 9. Entire body covered with fine tubercles, giving a granular texture; these tubercles are much fainter on the tibiae and tarsi.

Holotype nymph, COLUMBIA RIVER, PASCO, FRANKLIN COUNTY, WASHINGTON, November 4, 1948 (J. J. Davis), deposited in collection of California Academy of Sciences, San Francisco.

LECTOTYPE DESIGNATION FOR LETHOCERUS ANGUSTIPES (MAYR)

(Hemiptera: Belostomatidae)

In 1871 Mayr described *Belostoma angustipes* from an unknown number of syntypes. Some of the material is located in the Vienna Museum of Natural History, and the remainder supposedly is deposited in the Stockholm Natural History Museum. Dr. Max Beier of the Vienna Museum has been kind enough to loan me the two *angustipes* syntypes under his care. One specimen is a female and the other, which I am designating as lectotype, is a male. The lectotype bears the following data on labels: #517; angustipes, det. Mayr; Bilimek, Mexico, 1871; and Typus (machine printed on red paper). The specimen is 58 mm. long and 22 mm. wide and agrees with all the essential details of Mayr's description.—A. S. MENKE, *Department of Entomology, University of California, Davis.*

RECENT LITERATURE

CYNIPID GALLS OF THE PACIFIC SLOPE (Hymenoptera, Cynipoidea), AN AID TO THEIR IDENTIFICATION, by Lewis H. Weld. Ann Arbor, Michigan, offset. Privately printed; published October, 1957. For sale by: Robert J. Lyon, Los Angeles City College, 855 North Vermont Ave., Los Angeles 29, Calif.; or by the author, 6613 North Washington Blvd., Arlington 13, Virginia. Price $1.00, postpaid.

This booklet contains [ii +] 64 pp., 30 text figs. to illustrate the identification keys, and 205 figs., all but one of galls, on 16 un-numbered plates. There is an annotated synoptic list of the species described or recorded from the Pacific Slope of California, Oregon, Washington and British Columbia, a host index, including one arranged by the part of the plant affected, and notes on collecting. A challenge to students are the many galls illustrated whose makers are unknown.

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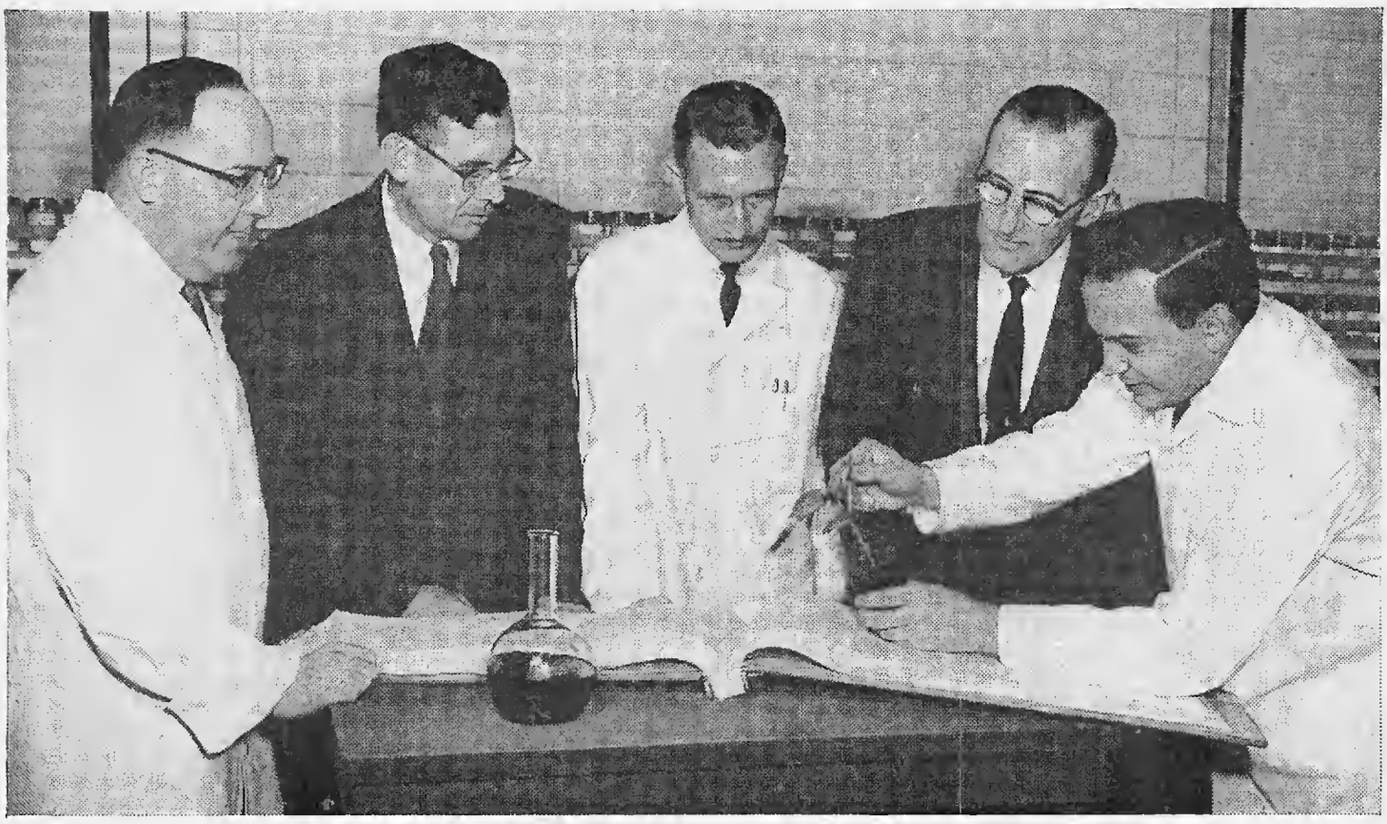

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THE ICHTHYURINI OF NORTH AMERICA

(Coleoptera: Cantharidae)

KENNETH M. FENDER [1]

Linfield Research Institute, McMinnville, Oregon

The tribe Ichthyurini may be recognized by the small size of the beetles, 2.5–9 mm., abbreviated elytra, which are narrowed and dehiscent for the apical half or more of their length, leaving the secondary or flying wings largely exposed, the securiform or cultellate apical palpal segments, the small and quadrate mentum, and the male aedeagi which are asymmetrical and strikingly similar to those of *Chauliognathus*.

On the basis of the similar male genitalia and the fact that some species of *Chauliognathus* have somewhat apically narrowed and dehiscent elytra, this tribe should be placed between the Chauliognathini and the Cantharini.

In the new world, the Ichthyurini attain their greatest diversity in the tropics. They are represented in North America by only six species in three genera.

KEY TO THE GENERA OF ICHTHYURINI

1 Antenna bases approximate, terminal abdominal segments forcipiform ..... *Ichthyurus* Westwood

1′ Antennal bases separated, terminal abdominal segments not forcipiform

2 Tarsal claws appendiculate..... *Trypherus* LeConte

2′ Tarsal claws simple..... *Belotus* Gorham

ICHTHYURUS Westwood

This genus is readily distinguished by its short, dehiscent elytra; antennae approximate; the eyes very large, extending nearly to the base of the mandibles, inwardly emarginate, giving a hymenopteroid appearance when viewed frontally, separated by the combined widths of the antennal sockets; the seventh visible abdominal segment bilobate or forcipiform (Fig. 4); the claws slender and acute, armed with a large acute tooth, the teeth of each pair of claws closely overlapping to form a large platelike process between the claws (Fig. 2).

ICHTHYURUS ARIZONENSIS Fender

Ichthyurus arizonensis Fender, 1948, Wasmann Coll. 7:121–122

Nigro-piceus; mandibles fuscous, pronotum piceous with the margins narrowly paler, these pale areas more extensive near the angles; scutellum

[1] This study was supported by National Science Foundation Grant G-7112.

piceous, elytra flavous with the suture rather widely infuscate from base to a little beyond the point of dehiscence; abdomen brunneus to the apical segment which is nigro-piceous in the female. Length 6 mm.

Male.—Unknown.

Female.—Head longitudinally concave behind antennae, surface finely microreticulate, apical segment of maxillary palpi cultellate, not as long as preceding two segments combined; pronotum transverse, microreticulate and finely sparsely punctate, pubescence evident, the anterior margin and sides more or less evenly rounded to the obtuse hind angles, strongly dehiscent apically, ultimate tergite produced on each side into subconical processes (Fig. 4).

This species is known only from the type series, a pair of dilapidated females from the Leng collection. They were collected in the Huachuca Mts., Arizona, July 1905. The types are in the collection of the California Academy of Sciences.

Trypherus LeConte

Trypherus LeConte, 1851, Proc. Acad. Nat. Sc. Phila. (2)5, p. 346.
Lygerus Kiesenwetter, 1852, Linn. Ent. 6, p. 246.

Eyes moderately large and prominent, the inner margins convex, separated one and a half times the width of the combined antennal sockets; antennae separated; apical maxillary palpal segment elongate securiform; claws similar to *Ichthyurus*, the claw proper somewhat stouter (Fig. 1).

Key to the Species of Trypherus

1 Mesofemora not dilated in the male (female unknown)
2 Apical flavous area of elytra short, transverse; right ventral process of apical abdominal armature of male triangularly foliate ..... *pauperculus* Fender
2′ Apical flavous area of elytra as long as wide; right ventral process of apical abdominal armature of male large, ovate.... *blaisdelli* Fender
1′ Mesofemora dilated in the male, twice as wide as others; mesofemora normal in the female
3 Pronotum evidently transverse; right ventral process of apical abdominal armature of male transverse digitate.. *latipennis* (Germar)
3′ Pronotum subquadrate, nearly as long as wide; right ventral process of apical abdominal armature of male transverse, longate securiform; pale margins of pronotum usually very narrow in the female..... *frisoni* Fender

Trypherus pauperculus Fender, new species

(Figs. 5, 9)

Head black, front and bases of mandibles eburneous, palpi piceous, antennae piceous with basal two or three segments pale beneath and basally; prothorax testaceous, pronotum with a large, transverse, irregular piceous spot, margins of which are indented near the anterior angles and medially at the base; elytra piceous, becoming darker beyond the middle,

testaceous below the humeri; apices narrowly transversely flavous; mesothorax testaceous with the sides somewhat infuscate; metathorax piceotestaceous medially and anteriorly, becoming piceous posteriorly and towards the sides, sutures somewhat paler; abdominal sternites piceous, sides and apices rather widely flavous; all coxae and trochanters testaceous, front legs testaceous with dusky tarsi, middle legs testaceous with femora and tibiae fuscous above, hind legs piceous with tarsi somewhat paler; pubescence cinereous, sparse, subdecumbent to suberect. Length 3.5 to 4 mm.

Male.—Head wider than pronotum, eyes large and prominent, separated by one and one-third times width of an eye, membranous clypeus biarcuate, protuberant, front smooth, shining, apically bisinuate, apical segment of maxillary palpi shorter than second and third combined, head behind antennae and between eyes strongly transversely concave, microreticulate, becoming finely sparsely punctured on sides of neck; pronotum transverse, anterior margin evenly arcuate, anterior angles feebly prominent, feebly depressed and explanate, sides short, nearly straight, converging slightly to rounded hind angles, basal margin sinuate each side of middle, base strongly margined, apex margined with a row of hyphenated punctures, disc medially flattened, feebly shining, very finely microreticulate; elytra a little over twice as long as pronotum, apices separately rounded, dehiscent beyond apical fourth, alutaceous, sparsely, coarsely, confusely punctured; body beneath feebly shining, pubescence fine, sparse and decumbent; penultimate tergite widely shallowly emarginate at the apex, hind angles not obliquely produced as tubuliform processes, ultimate tergite narrower, short, with a narrow, deep median incision extending nearly to base of segment, sixth sternite widely shallowly emarginate apically, seventh sternite widely deeply emarginate apically, apex of emargination arcuate, sides sinuate, apical angles acute; right ventral process large, subfoliate, caudally produced, left ventral process podiform, smaller than the right, median spiniform process feebly sinuate (Plate 1, Fig. 4).

Female.—Unknown.

Holotype male: ELIZABETHTOWN, HARDIN COUNTY, ILLINOIS, June 25, 1932, collected by Ross, Dozier and Park, in the collection of the Illinois Natural History Survey. Paratype (1), Greene Co., Ohio, V1-2, collected by D. J. and J. N. Knull, in the Knull collection.

Trypherus blaisdelli Fender, new species

(Figs. 6, 10)

Head testaceous to flavotestaceous in front, piceous to black behind middle of eyes, with a narrow median prolongation extending to and between antennae, antennae piceous, basal segment flavous, second and third segments flavous beneath; pronotum testaceous with a wide trifoliate, brunneous discal spot extending to lateral margins, basal margin narrowly and apical margin widely pale, anterior angles with large subquadrate pale areas, posterior angles widely pale; scutellum testaceous; elytra brunneous, humeri obscurely paler, the apical fourth flavous, these pale

areas extending narrowly down lateral margins to basal third; body beneath flavous, trochanters, coxae and bases of femora flavous, legs piceous apically, fifth and sixth sternites infuscate, seventh fuscous, seventh tergite castaneous; pubescence aureous, fine, sparse, and suberect. Length 4 to 5.5 mm.

Male.—Head shining, slightly wider than pronotum, concave between large, prominent eyes, impunctate in front, finely microreticulate and with fine, sparse punctures behind, more coarsely punctured on sides of neck, antennae slender, intermediate segments about three times as long as wide; pronotum shining, transverse, anterior margin evenly arcuate to more sharply rounded anterior angles, sides nearly straight, converging slightly to obtusely rounded hind angles, posterior margin arcuate medially, becoming sinuate towards sides, apex and sides not margined, base deeply margined, disc very finely microreticulate and finely sparsely punctulate, punctures confusedly and unevenly distributed; scutellum alutaceous, subquadrate, apex feebly incised; elytra dehiscent from a little beyond middle, alutaceous, finely sparsely punctured basally, more coarsely so and feebly rugulose apically; body beneath weakly shining, finely punctulate, legs normal, mesofemora not dilated; sixth sternite broadly shallowly emarginate apically, seventh sternite broadly deeply emarginate, apex of emargination shallowly arcuate, a wide impression extending nearly to base, a large ovate ventral process extending posteriorly from right half of emargination, a smaller digitate ventral process extending obliquely from left half of emargination, internal to these a short ovate median process, seventh tergite elongate, sides enveloping the sides of the seventh sternite, hind angles produced into conical tubuliform processes each with an apical cusp, apical margin widely shallowly emarginate; eighth tergite short, transverse, apex arcuately produced at the middle, a pair of terete ovate lobes descending from apex.

Female.—Unknown.

Holotype male: Bolivar, Polk County, Missouri (no date), collected by Blaisdell, in the collection of the California Academy of Sciences. Paratypes: "Ill."; Homer, Illinois.

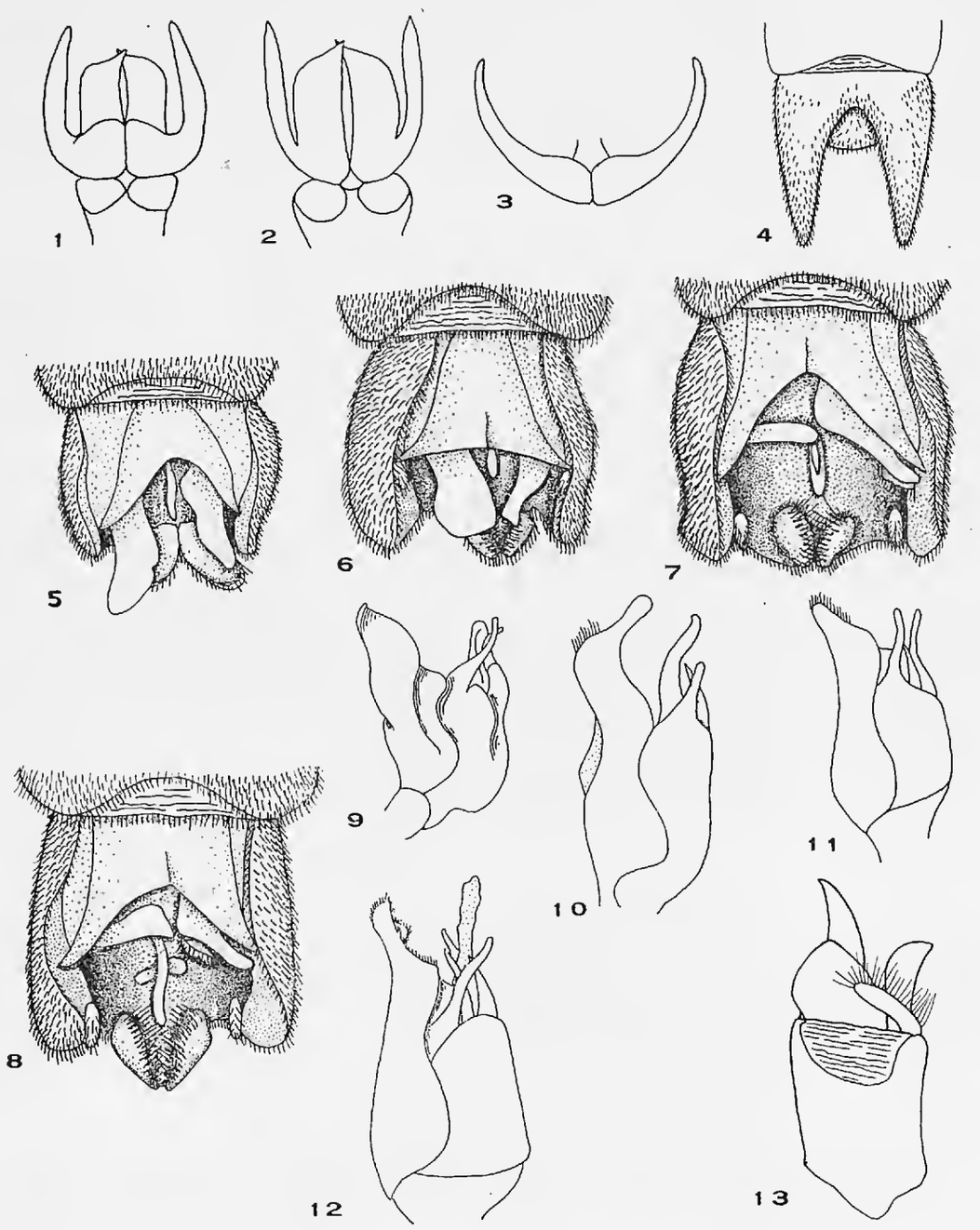
This species can be readily separated from *T. latipennis* and *T. frisoni* by its normal mesofemora and from *T. pauperculus* by its large apical elytral marks.

Trypherus latipennis (Germar)

(Figs. 1, 7, 11)

Malthinus latipennis Germar, 1824, Insectorum species novae, Halae, p. 72.
Molorchus marginalis Sap, 1824, Long's Expedition 2, p. 192.
Trypherus latipennis LeConte, 1851, Proc. Acad. Nat. Sc. Phila., p. 346.
Lygerus latipennis Kiesenwetter, 1852, Linn. Ent. 6, p. 246.
Trypherus latipennis LeConte, 1881, Trans. Am. Ent. Soc. 9, p. 58.

Testaceous to flavotestaceous, eyes black, head behind basal half to third of eyes castaneous; pronotal disc with a large castaneous spot of irregular outline, pale margins usually widest at angles and medially on basal margin, all margins wider in female; elytra castaneous to flavotestaceous, usually with outer margins, humeri and bases more or less pale,



Explanation of Plate

Figs. 1–3, tarsal claws; 1. *Trypherus latipennis* (Germar); 2. *Ichthyurus arizonensis* Fender; 3. *Belotus abdominalis* (LeConte); fig. 4. terminal abdominal segments of *Ichthyurus* sp., female, dorsal aspect;

Figs. 5–8, terminal abdominal segments of male, ventral aspect; 5. *Trypherus pauperculus* Fender; 6. *Trypherus blaisdelli* Fender; 7. *Trypherus latipennis* (Germar); 8. *Trypherus frisoni* Fender;

Figs. 9–12, male genital armature, lateral aspect; 9. *Trypherus pauperculus* Fender; 10. *Trypherus blaisdelli* Fender; 11. *Trypherus latipennis* (Germar); 12. *Trypherus frisoni* Fender; fig. 13. male genital armature of *Belotus abdominalis* (LeConte), dorsal aspect.

apices flavous, this flavous area nearly as long as wide with basal margin oblique, often produced down lateral elytral margins; metasternal epimeron castaneous, thorax beneath usually testaceous, sclerites sometimes castaneous with pale sutures; abdomen testaceous to flavocastaneous, margins widely pale, seventh sternite usually darker; last two tergites castaneous to flavocastaneous; legs flavous, metafemora more or less widely piceous, annulate beyond middle, metatibiae piceous with bases pale; pubescence aureous, fine sparse and suberect. Length 6.5 to 9 mm.

Male.—Head shining, impunctate in front, very finely microreticulate and finely punctured behind eyes, more coarsely so on sides of neck, head shallowly transversely concave between eyes, eyes large and prominent, separated by about one and a half times width of an eye, apical palpal segment longer than second and third segments combined, membraneous clypeus protruding, biarcuate; pronotum transverse, sides straight and parallel, anterior margin arcuate and more or less widely margined, anterior angles obliquely rounded, hind angles arcuate, basal margin rather widely deeply margined, sinuate each side of middle, disc finely microreticulate, unevenly and confusedly punctured; scutellum rounded with a small apical notch; elytra more coarsely microstrigulose, confusedly punctured with interspersed fine and coarse punctures, dehiscent at about the middle; body beneath finely microreticulate, seventh sternite with sides somewhat enfolded by sides of seventh tergite, apically subtriangular emarginate, the emargination wide and deep, sides sinuate, apex rounded; left ventral process digitate, directed transversely in, inside these a median spiniform process directed caudally; posterior angles of seventh tergite subangulately produced as short stout tubuliform processes, apex shallowly emarginate; eighth tergite transverse, bisinuate, a short cordiform process with a median tubercle descending from the apex, mesofemora dilated, twice as wide at middle as the others.

Female.—Similar to male, eyes a little smaller and less prominent, mesofemora not more dilated than others, sides of seventh tergite recurved but not enveloping sides of semicircular seventh sternite, the tergite transversely cordiform, hind angles more strongly produced inwardly and tubulate, apical margin narrowly deeply triangularly emarginate.

LeConte recorded this species from Pennsylvania, Georgia and Virginia. I have studied specimens from the following localities: GEORGIA: Stone Mt., Rabun Co.; ILLINOIS: Oakwood; KENTUCKY: "Ky."; MARYLAND: Beltsville, "Md."; MISSOURI: Branson; NEW JERSEY: S. Orange; NEW YORK: Nyack, "N.Y.," "S.I." (Staten Island?); OHIO: Delaware Co., Franklin Co., Hocking Co., Scioto Co., Shawnee Forest; PENNSYLVANIA: Lingleston; SOUTH CAROLINA: Clemson College; VIRGINIA: Fairfax Co., "Va."

Trypherus frisoni Fender, new species

(Figs. 8, 12)

Head brunneous to castaneous, testaceous to flavotestaceous in front

of eyes, tips of mandibles darker, palpi flavotestaceous with apical segment flavocastaneous, pronotum testaceous to flavotestaceous, median discal spot large, trifoliate, brunneous to castaneous, not or seldom attaining lateral margin in male, usually larger in female, pronotum castaneous, margins very narrowly pale, more widely so at anterior angles; scutellum testaceous to flavotestaceous; elytra piceobrunneous, tips widely obliquely flavous to flavotestaceous and humeri narrowly flavotestaceous, markings discontinuous along lateral margins, epipleurate pale, usually darker medially; body beneath testaceous, metathorax often darker medially, lateral margin of metasternal epimeron darker, coxae, tronchanters and bases of femora testaceous; tibia, tarsi and apices of femora darker, becoming castaneous on hind legs; abdomen flavotestaceous apical segment darker, at times becoming castaneous; pubescence aureous, short, sparse and suberect. Length 6 to 9 mm.

Male.—Head shining, transversely concave between eyes and in back of head, impunctate in front of antennae, finely, moderately closely punctate behind, more coarsely so on sides of neck, antennae long and slender, extending to apical fourth of elytra, intermediate segments about three times as long as wide; pronotum transversely subquadrate, nearly as long as wide, anterior margin evenly arcuate and widely, shallowly margined to the rounded anterior angles, sides straight, not margined, nearly parallel to the rounded hind angles, posterior margin sinuate each side of middle which is narrowly shallowly indented, base more narrowly deeply margined, disc shining, finely sparsely unevenly punctulate, a broad shallow horseshoe shaped depression medially near base, extending anteriorly to middle; scutellum quadrate, very finely punctulate; elytra short, extending to middle of first sternite, dehiscent beyond middle, more coarsely microreticulate, finely confusedly punctate; body beneath very finely punctured, mesofemora dilated, medially about twice as wide as the others; seventh sternite widely deeply emarginate, apex of the emargination rounded, an elongate securiform ventral process arising from right side of the emargination and directed transversely inward, a podiform ventral process arising near middle of the emargination and directly outward towards left side, internal to these an elongate spiniform process, apically ascending; seventh tergite half again as long as sixth, sides strongly descending and recurved to envelope sides of seventh sternite, hind angles triangularly produced and with a small apical cusp, apical margin widely shallowly emarginate; eighth tergite short, transverse, apically arcuate, with an apical sharply descending bilobate saucer shaped process.

Female.—Similar to male, dark markings broader, mesofemora not dilated, seventh tergite broadly semicircular in general outline, apically produced each side of the middle into large tubulate processes, narrowly deeply emarginate between the processes, apex of the emargination rounded, eighth tergite short, narrow, apically arcuate; seventh sternite transverse, the apex arcuate to the triangularly produced middle.

Holotype male: STRANG, MAYES COUNTY, OKLAHOMA, June 18, 1939, collected by Kaiser and Nailon, in the collection of the

Illinois Natural History Survey. Allotype female, Prophetstown, Whiteside County, Illinois, July 7, 1925, T. H. Frison, collector, in the collection of the Illinois Natural History Survey. Paratypes: ILLINOIS: De Kalb, Evanston, Homer Park, Moline, Prophetstown, Rock Island, Urbana, Vermillion Co.; IOWA: Sioux City; KANSAS: Lawrence; MINNESOTA: Hennepin Co., Olmstead Co., river near Shakopee, Shakopee; OHIO: Hocking Co., Pickaway Co.; OKLAHOMA: Elco Springs, El Reno, Flint, Grove, Taloga.

BELOTUS Gorham

Belotus Gorham, 1881, Biol. Centr. Am., Coleop. III, 2, pp. 99, 308. (1885) (Sine descr.).

Lobetus LeConte, 1881, Trans. Am. Ent. Soc. 9, pp. 58–59 (nec. Keisenwetter).

Head moderately developed, mandibles toothed, antennae simple, apical palpal segments stout and subsecuriform, pronotum subquadrate, elytra abbreviated and apically dehiscent, claws simple (Fig. 3), penultimate abdominal tergite emarginate, ultimate sternite elongate oval, capping the asymmetrical genital armature.

BELOTUS ABDOMINALIS (LeConte)

(Fig. 3, 13)

Malthinus abdominalis LeConte, 1851, Proc. Acad. Phil. 5, p. 347.

Lobetus abdominalis LeConte, 1881, Trans. Am. Ent. Soc., 9, p. 59.

Belotus abdominalis Gorham, 1881, Biol. Cent. Am., 3 (2), pp. 99, 308, pl. 6, fig. 8.

Dark reddish brown, basal three segments of antennae and bases of palpi somewhat paler, head in front of middle of eyes, pronotum, scutellum and elytral apices flavous to flavotestaceous, apical and lateral margins of abdominal sternites more or less widely testaceous, legs pale brunneous, pubescence cinerous, fine, sparse and suberect, short on head, pronotum and body beneath, longer on the elytra. Length: male, 2.5 to 4 mm.; female, 3 to 5 mm.

Male.—Head shining, moderately large, slightly wider than pronotum, concave between eyes; labium finely alutaceous, narrow, apically notched, sinuate towards sides; clypeus apically arcuate, sides oblique, coarsely closely punctured; front finely sparsely punctured; back of head and neck more coarsely closely punctured; eyes moderately large and prominent; antennae remote at bases, closer to eyes than each other, second segment subquadrate, third slightly longer, intermediate segments two and a half times as long as wide; maxillary palpi stout, apical segment terete, subsecuriform, penultimate short and transverse; pronotum subquadrate, longitudinally concave, anterior edge arcuate, not margined, anterior angles sharply rounded, depressed, sides straight, parallel, feebly convergent or

feebly divergent to rounded hind angles, posterior edge margined nearly to angles, median third straight, oblique each side to the hind angles, disc shining, finely sparsely punctured, scutellum apically rounded, finely punctured; elytra dehiscent beyond middle, lateral margins converging to acutely rounded apices, alutaceous, coarsely rather closely punctured, somewhat rugose medially; body beneath alutaceous, finely closely punctured, last sternite elongate oval, cupped to enclose genital armature, claws simple, feebly dilated towards base.

Female.—Similar to male, larger average size, eyes smaller and less prominent, third antennal segment half again as long as second, scutellum apically rounded to apically truncate, last sternite apically narrowed, hind angles rounded, apex widely shallowly arcuately emarginate medially, the surface finely postulate.

LeConte recorded this species from Georgia, Florida and Texas; Champion cited it from Southern United States, Mexico, Guatemala, Honduras and Panama as did Blackwelder who may have used Champion's records. Specimens have been studied from: FLORIDA: Baldwin, Jacksonville, LaGrange in Brevard Co.; GEORGIA: Billy's Island in Okefenoke Swamp; KANSAS: "Kans."; OKLAHOMA: Henryetta, Pawnee Co., Stillwater; TEXAS: Brownsville, Cypress Mills, Dallas, Davis Mts., Gillespie Co., Seabok, Uvalde Co., Val Verde Co.

I am indebted to the following persons and institutions for the loan or gift of specimens for this study; to: J. N. Knull of Ohio State University, Milton W. Sanderson and H. H. Ross of the Illinois Natural History Survey, J. W. Green and E. S. Ross of the California Academy of Sciences, C. P. Alexander of the University of Massachusetts, John H. Robinson. To these and to any I may have omitted, I am most grateful.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE: NOTICE OF PROPOSED USE OF PLENARY POWERS IN CERTAIN CASES (A.[N.S.]44)

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. 17, Parts 6/8, published on 8 April, 1960:

(1) Validation of the generic name *Delphax* Fabricius, 1798 (Class Insecta, Order Hemiptera). Z.N. (S)47;

(2) Designation of a type-species for the nominal genus *Macropsis* Lewis, 1834 (Class Insecta, Order Hemiptera). Z.N. (S)456;

(3) Suppression of the generic name *Promecopsis* Duméril, 1806 (Class Insecta, Order Hemiptera). Z.N. (S)483;

(4) Suppression of the specific name *longicorne* Latreille, 1804 (*Acrydium*) (Class Insecta, Order Orthoptera). Z.N. (S)675;

(5) Stabilization of the names of the North European species of the *Tipula oleracea* group (Class Insecta, Order Diptera). Z.N. (S)896;

(6) Validation of the familiar usage of the generic name *Tanytarsus* van der Wulp, 1874 (Class Insecta, Order Diptera). Z.N. (S)1245;

(7) Designation of a neotype for the nominal species *Dytiscus cinereus* Linnaeus, 1758 (Class Insecta, Order Coleoptera). Z.N. (S)1389;

(8) Validation of the generic name *Acilius* Leach, 1817 (Class Insecta, Order Coleoptera). Z.N. (S)1391;

(9) Validation of the specific name *dardanus* Brown, 1776 (*Papilio*) (Class Insecta, Order Lepidoptera). Z.N. (S)1403.

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 8 October 1960. 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 8 October 1960, 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, *Assistant Secretary, International Commission on Zoological Nomenclature.*

OBSERVATIONS ON THE HABITS OF OXYBELUS SERICEUM ROBERTSON

(Hymenoptera: Sphecidae)

R. M. Bohart and P. M. Marsh
University of California, Davis

The discovery of a large nesting site of *Oxybelus sericeum* Robertson two miles northwest of Goleta, Santa Barbara County, California, made possible a number of interesting observations on the behavior of this wasp. The nest area extended along a strip of sand bordering a lagoon back of the ocean. This area was approximately 150 feet long by two feet in width and contained many hundreds of nests. The primary study extended over a 23 day period from June 23 to July 15, 1959, and additional observations were made more than a month later. Wasp activity began at about 8:00 a.m. Pacific Standard Time on a clear day and at about 9:00 a.m. on a day with low overcast of fog. Activity tapered off about 4:00 p.m. and ceased at 5:00 p.m. High daily temperature during this time ranged between 75°F. and 83°F.

Nest-building.—A typical burrow is constructed in moist, solid sand, free of vegetation. It is about 90 mm. deep, 3 mm. in diameter, straight down and terminating in 1-4 cells in a cluster. The female burrows into the sand head first, pushing the sand out of the hole with her hind legs as she proceeds. The cells are unlined oval chambers about 9 mm. long. The female takes about two hours to complete a burrow and one cell, after which she smooths the sand pushed out of the nest entrance and flies off for provisions.

After the first cell is provisioned the female goes head first into the burrow, closing the entrance behind her with sand which is apparently excavated from a second cell. Occasionally, over a two hour period sand is forced from the entrance. Then the female emerges head first, smooths the area around the entrance and flies away for more provisions. Ordinarily a nest will be completed over a period of two days, and a female will build several nests in her lifetime.

Provisioning.—The observed prey in 16 cells involving five separate nests and more than 200 flies were exclusively ephydrids, *Ephydra riparia* Fallen (identified by W. W. Wirth). These flies were abundant on the surface of the brackish lagoon adjacent to

the nesting site. However, a variety of other flies of similar size were numerous in the area. Female *Oxybelus* were observed many times lighting on the sand near the nest, the paralyzed fly held by the hind legs of the wasp. The female straddled the fly which was ventral side up, facing forward, and extending well behind the body of the wasp. Portal to portal provisioning time averaged about two minutes, and 15-25 seconds were consumed in placing the fly in a nest. The cells examined had 10 to 20 paralyzed flies with an egg laid on the prosternum of the first prey member placed in the cell. Including mating activities described below, a single cell was provisioned in about 45 minutes.

Mating.—Many males were seen in the area about flowers and lighting on the sand of the nesting site. At all times there appeared to be an excess of males over females. Before starting a burrow a female mates, copulation taking place on the sand with the male in the superimposed position for 15 to 30 seconds. During this period the male uses his antennae to tap his mate on her face, rapidly but intermittently. If disturbed the pair may separate or will fly a few inches away. After completion of the burrow and one cell, a female again pairs off with a male, who takes a position on the sand near the nest entrance and strikes at any insects approaching it, including dipterous parasites, pompilids, bembicids, and rival male *Oxybelus*. Each time the female arrives at the nest with prey the male jumps on her and copulation takes place. Exceptions to this routine occur when the male is defending the nest and the female may proceed directly into the burrow. Occasionally, a female hesitates upon leaving the nest and mating takes place under these circumstances, also.

Marking experiments indicated that females are monogamous while provisioning a particular cell, but the male disappears while she is constructing a new cell. She then pairs off with a new mate. In one case a female completed a nest with four separate males and the following day started a new nest with the help of the original male. It was estimated that normal nest-building activity for a female might involve 50 or more periods of copulation in a day.

Larvae.—Length of larval life was not observed, but several cocoons were found. These were fashioned of agglutinized sand grains.

Parasites.—Small miltogrammine sarcophagids were always in association with the wasps. They continually buzzed around the females and occasionally struck them in what appeared to be larviposition. Several cells were found with parasitic maggots or puparia which were reared to adults identified by H. J. Reinhard as *Senotainia litoralis* Allen.

Seasonal History.—At the time of the first observations, June 23, all stages of *O. sericeum* from egg to adult were found at the breeding site. Activity continued at a high rate through July 15. The site was revisited August 20 and the colony appeared to be even more vigorous. This leads to the supposition that there are a series of overlapping broods during the warmer months. Previous California records taken from Bohart and Schlinger (1957) give a collecting span from June 19 to September 1.

Discussion.—A brief summary of *Oxybelus* biology was given by Bohart and Schlinger (1957). Krombein (1955) described the subspecies *crocatum* of *sericeum* and gave the following biological note based on observations of H. E. Evans, the collector. "Dr. Evans writes that these specimens were taken on a small beach of white sand along the Gulf (Pascagoula, Mississippi), with adjacent salt marsh and mud banks. Numerous individuals were flying around close to the sand and landing on it, and several pairs were flying in copula. One female was taken with prey, an otitid fly, *Chaetopsis fulvifrons* (Macq.). The fly is carried beneath the wasp during flight." This reference to pairs in copula may be significant in the light of the rather extraordinary mating behavior outlined above.

Previously published notes on nesting behavior in American species were based on *O. uniglumis quadrinotatum* Say, a relatively common form. Peckham and Peckham (1898), Parker (1915), and Williams (1936) have given similar accounts. The habits of *quadrinotatum* appear to differ from those of *sericeum* in several important details. First, the nest entrance is closed each time the female leaves in search of prey. Secondly, the prey is carried impaled on the sting. Thirdly, a variety of flies are utilized, including therevids, anthomyiids, calliphorids, sarcophagids, and muscids. Fourthly, no mention was made of mating habits, which were presumably unobtrusive. Ferton (1902), referring to European species, postulated that *Oxybelus* which carry the

prey impaled on the sting cover the nest entrance on going out, whereas those which clasp the prey by means of their hind legs leave the entrance open. *O. sericeum* obviously belongs in the latter category. More noteworthy are the unusual mating habits with frequent copulation and defense of the nest by the male.

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NEW NAMES IN THEREVIDAE AND BOMBYLIIDAE

(Diptera)

In the July 1959, number of Pan-Pacific Entomologist I proposed the name *nana* for the preoccupied *Thereva pygmaea* Cole (1923). I succeeded in setting up another homonym — this time a name preoccupied by *Thereva nana* Fallén (1820, Dipt. Suec. Rhizom., 4.4), now in the genus *Catharosia* of the Tachinidae. I propose the name *nanella*, with a hope for final stability.

I am informed by Dr. R. H. Painter that *Villa arenicola* Cole (1923, Proc. Cal. Acad. Sci.) is preoccupied by *Villa lateralis arenicola* Johnson (1908, Psyche, XV, p. 14), described as an *Anthrax*. I propose the name *psamminus*, from the Greek, "of the sand."—Frank R. Cole, *University of California, Berkeley*.

TAXONOMIC STUDIES ON SOME NEOTROPICAL LEPTOPHLEBIID MAYFLIES

(Ephemeroptera: Leptophlebiidae)

THOMAS B. THEW

451 16th Ave., East Moline, Illinois

The family Leptophlebiidae is found throughout the world and is frequently encountered in collections from Central and South America, where it forms a large and interesting part of the mayfly fauna. This paper consists of the descriptions of seven new species and notes on several others, all of which belong to this group. For the most part, the specimens considered here are from a large collection made for me by Fritz Plaumann in Nova Teutonia, province of Santa Catarina, Brazil (lat. 27°-11′, long. 52°-23′; elevation 300-500 m.), and they are in my personal collection unless stated otherwise. Also, I have taken this opportunity to report upon a new species from Chile in the collections of the Illinois Natural History Survey.

GENUS THRAULODES Ulmer

At present, this genus consists of 21 described and named species. Two new species are described below.

Thraulodes daidaleus Thew, new species

Male Imago.—Lengths: body 7.2 mm.; forewing 6.6 mm.; caudal filaments 15.0 mm. *Head:* white, shaded with grey-black about ocelli; vertex white; frontal shell white with median anterior margin lightly suffused with red-brown; face and vestigial mouthparts white, marked with greyish black. Antennal scape yellow-white; pedicel white, shaded with yellow-brown distally; flagellum very light yellow-brown. Turbinate portion of compound eyes light brownish orange, contiguous on meson; lower portion black. *Thorax:* pronotum yellow-white with median and lateral portions of posterior margin black; pleura yellow-white with short oblique black stripe; sternum yellow-white, shaded with red-brown medially. Mesonotum light yellow-brown; antero-lateral margins and posterior median area (not including tip of scutellum) broadly white; sutures finely margined with dark brown; pleura yellow-white with broad brown oblique stripe running from wing base past anterior margin of coxal cavities; areas about coxal cavities and wing base broadly marked with blackish brown; extreme anterior margin of sternum with broad medium brown band; remainder white anteriorly, medium brown posteriorly. Metanotum light brown with lateral margins broadly white and with posterior edge finely margined with black; pleura yellow-white, broadly marked with blackish brown about coxal cavities; sternum light brown. *Wings:* hyaline; longitudinal veins of forewing yellow-hyaline; crossveins hyaline; stigmatic area milk-white. All veins of hindwing hyaline. In both wings, area about humeral brace suffused with dark brown. *Legs:* all legs similar; coxae and trochanters yellowish white, marked with black-

brown; femora yellowish white for basal two-thirds with faint brown band on the outer surface and black dot on inner surface, one-third of distance from base; distal one-third medium brown, proximal edge of which shade into a narrow dark brown band; edges of brown area finely black; tibiae yellowish white with pre-apical brown band and with apex white; tarsi very light brown with joints white. *Abdomen:* tergites of segment 1 white with light brown anterior margin and median and lateral black spots; segments 2–6 transparent white with large postero-median black spot, large lateral black spots with a small black spot lateral to these and another faint black blotch on each antero-lateral margin; median area very lightly suffused with red-brown; median portion of posterior margin of segment 6 light red-brown; segments 7–10 reddish brown with black median streak and lateral black spot. All segments with black stigmatic dots. Sternites of segments 2–7 white with two small black dots on each side of median line and a larger black dot in each postero-lateral corner; sternites 8–10 yellowish white, 8 with postero-lateral dots. *Genitalia:* yellow-white, as in fig. 1. *Caudal filaments:* white with every fourth segment dark brown.

Female Imago.—As in the male, with the following exceptions. Lengths: body 6.3 mm.; forewing 7.5 mm.; caudal filaments 7.5 mm.; abdominal segments 1–6 and proximal half of 7 medium brown; distal half of 7 and all of 8 white; 9–10 light pinkish brown. This pinkish coloration is undoubtedly due to the presence of eggs within the abdomen.

Holotype male: Nova Teutonia, Santa Catarina, Brazil, January 1956 (Fritz Plaumann, collector); preserved in alcohol. Allotype, female: same data, except collected in November 1956; preserved in alcohol. Both types are in the collections of the Illinois Natural History Survey. Paratypes: 2♂♂, same data as for holotype and preserved in alcohol, in my personal collection; 8♂♂, 2♀♀, all pinned, from Nova Teutonia, Brazil, January 3-5, 1956, with 1♂ in the collection of the Illinois Natural History Survey and the remainder in my personal collection. Also, there are 3♂♂ and 3♀♀ subimagoes from the same locality collected in September 1956.

Etymology: from Gr., daidaleos-dappled, spotted.

Thraulodes daidaleus belongs to the *trijunctus* group. The male genitalia will separate it from all other species for which figures of this structure have been published. For the remaining species, the coloration is considerably different.

Thraulodes traverae Thew, new species

Male Imago.—Lengths: body 6.3–7.0 mm.; forewing 7.0–8.0 mm.; caudal filaments 10.0 mm. *Head:* dark brown; face and vestigial mouthparts marked with white. Antennal scape and pedicel dark brown, flagellum missing. Turbinate portion of compound eyes pink, lower portion black. *Thorax:* pronotum yellowish white with median area suffused with medium brown; pleura yellowish white with broad, dark brown oblique stripe running from posterior

corner of pronotum to forecoxal cavities; sternum yellowish white. Mesonotum deep brownish yellow with sutures finely margined in dark brown; pleura deep brownish yellow, except around coxal cavities, where it is white and is marked broadly with black; anterior half of sternum yellowish-white and with broad transverse brown band; posterior half light brown laterally and medium brown medially. Metanotum light yellow-brown with several faint transverse black-brown lines; pleura same as mesopleura; anterior half of sternum light transluscent brown, posterior half medium brown. *Wings:* hyaline; longitudinal veins of forewing light yellow; crossveins hyaline; area about humeral brace suffused with dark brown; stigmatic area milky. Hindwing completely hyaline, except for area around humeral brace, which is suffused with dark brown. *Legs:* all coxae and trochanters yellowish white, marked with black-brown. Fore femur white for basal one-fourth, then next fourth dark brown, followed by a narrow band of white and then a narrow band of dark brown, and apical fourth medium brown; tibia yellowish white with apex dark brown; tarsi yellowish white. Mid and hind femora with basal broad band of white, followed by a narrow band of dark brown and then a narrow band of light brown, next another broad white band, followed by a narrow band of dark brown and a narrow band of medium brown, and with apex white; tibiae and tarsi yellowish white with bases of tibiae suffused with light brown. *Abdomen:* segments 2–6 transparent white, 7–10 light brownish orange; segment 1 light brown. Tergites 1–7 with the following maculation of dark brown: 1) submedian spot on each side of middorsal line, narrowly joined to each other on posterior margin; 2) a large spot lateral and contiguous to these; 3) a large spot in postero-lateral corner; 4) small dark median and faint, small, posterior stigmatic dots. Sternites with median area lightly suffused with very light red-brown and with small dark brown dot in extreme postero-lateral corners. *Genitalia:* as in fig. 2. *Caudal filaments:* white, with every fourth segment black, the following segment black proximally, and with distal joint of this segment narrowly black.

Female Imago.—As in the male, with the following exceptions: lengths, body 6.3 mm.; forewing 6.3 mm.; caudal filaments 9.0 mm.; head suffused with grey dorsally with two submedian black dots between the eyes. Legs similar but fore tibia lacking distal brown band. All veins and crossveins in forewing yellowish hyaline. Abdominal segments 1–6, proximal half of 7, and all of 9–10 light brownish-orange, but with the maculation as in the male.

Holotype male, and allotype female: Nova Teutonia, Santa Catarina, Brazil, January 1956 (Fritz Plaumann, collector); preserved in alcohol. Both types are in the collections of the Illinois Natural History Survey. Paratypes: all with the same data, except for the dates; 1♂, November 1956 preserved in alcohol and in my personal collection; 7♂♂, January 1956 and 1♀ November 1956 preserved in alcohol, two males each in the collections of Dr. Jay R. Traver and Institut Royal des Sciences naturelles de Belgique; 50♀♀, January 1-7, 1956, all pinned, two females each in the collections of Dr. Lewis Berner, Dr.

G. F. Edmunds, Jr., the California Academy of Sciences, and the Illinois Natural History Survey, with the remainder in my personal collection. In addition, there are 9♂♂ and 6♀♀ subimagoes with the same data, but collected in September 1956 and 2♂♂ subimagoes collected in November 1956 which also appear to be of this species, in my personal collection

Etymology: I am pleased to name this species in honor of Dr. Jay R. Traver in recognition of her outstanding work on the Neotropical mayflies and, also, of the constant aid which she has given me in the study of the group.

The markings of the abdomen would place this species close to *T. furficulus* Traver, but *T. traverae* is much smaller and has greatly differing male genitalia and a different maculation pattern on the legs.

Genus Traverella Edmunds

This genus was proposed in 1948 by Edmunds for the two North American species then placed in the genus *Thraulus*, *albertana* (McDunnough) and *presidiana* (Traver), with the former as the type of genus. It was characterized in the adults from the type of *Thraulus, T. bellus* Eaton, by the assymetrical forking of vein R_{4+5} in the forewing and by the presence of basal spines on the male forceps plate. Later (1950) Edmunds placed two Neotropical species in the genus—*T. erhardti* (Ulmer) and *T. maculipennis* (Ulmer). Thus the matter rested until Demoulin (1955*c*) noted that all of the remaining American species placed in *Thraulus* also had an assymetrical forking of vein R_{4+5}, but did not possess the basal spines characteristic of *Traverella.* For these species he proposed another genus, *Homothraulus*, with *H. missionensis* (Esben-Peterson) as the type.

In at least two cases, however, it appears that the species assigned to *Homothraulus* should have been placed in *Traverella.* The first is that of the species *roundsi* Traver. The figure of the male genitalia given by Traver (1947) in the original description definitely shows basal spines present on the forceps plate; they are similar in form to those of *T. presidiana* (Traver). Secondly, in the same paper (1947) Traver states that there appeared to be such basal spines in the species *bradleyi* Needham and Murphy, although they were difficult to determine for certain. As the shape of the penis lobes is very much like that of *T. erhardti* (Ulmer) a form not found in *Homothraulus*, it appears likely that *bradleyi*

should also be included in *Traverella*. As a result, I hereby place these two species as *Traverella roundsi* (Traver), (new combination), and *Traverella bradleyi* (Needham and Murphy), (new combination).

In addition, the figure presented by Ulmer (1943) of the male genitalia for *H. montium* (Ulmer) seems to show basal spines. The genitalia are so unusual, however, that I think it is best to leave it in *Homothraulus* until more is known about it.

Traverella erhardti (Ulmer)

This species hae been known previously only from Hansa, province of Santa Catarina, Brazil. One male and one female, collected from Nova Teutonia, Brazil, January 3 and January 1, 1956, respectively, are present in my collection and appear to be of this species.

Genus Ulmeritus Traver

The genus *Ulmeritus* was first described by Traver in 1956 for the unusual new species, *U. carbonelli*, from Uruguay. At the same time, she described a variant of this form as *Ulmeritus* sp. and transferred *sao-paulense* Traver from *Atalophlebiodes* to the new group. This action left only two neotropical species in *Atalophlebiodes*. Somewhat earlier, Harker (1954) had shown that the type of *Atalophlebiodes* and the other Australian and New Zealand species were not congeneric with those placed therein from South America. This was noted by Traver (1959), whereupon she transferred *Atalophlebiodes flaveopodes* (Spieth) and *Atalophlebiodes haarupi* (Esben-Peterson) to *Ulmeritus*. At the same time, Traver also described two new species in this genus, *U. uruguayensis* and *U. luteotinctus*, and then separated the known species into three subgenera—*Ulmeritus*, *Pseudulmeritus*, and *Ulmeritoides*.

In my material from Brazil there are specimens of the *Ulmeritus* sp. of Traver, which I am considering to be a distinct and new species, as well as specimen representing two other new species. *Ulmeritus* sp. definitely belongs to the subgenus *Ulmeritus;* the new species *U. adustus* can be placed in *Ulmeritoides* as described by Traver. The other species described below, *U. patagiatus*, is known only in the subimagal form and does not conform well to any of the subgenera as now delimited. The hind wing is similar to those of both *Ulmeritoides* and *Pseudulmeritus*, the male genitalia is of an intermediate type, and the

ratios of the leg segments are not known, of course, for the imagal state. Therefore, I am not placing the species in any subgenus at the present time.

Ulmeritus balteatus Thew, new species

Ulmeritus sp. Traver, 1956. Proc. Ent. Soc. Wash. 58:11.

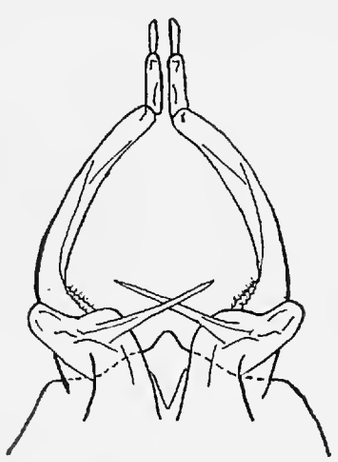
Male Imago.—Lengths: body 10.0 mm.; forewing 10.5 mm.; caudal filaments missing. *Head:* white; frontal shelf, vertex between compound eyes, and lateral margins black. Face white, marked with black; venter white, with vestigial mouthparts black. Antennal scape and pedicel light yellow-brown; flagellum light brown. Turbinate portion of compound eyes peach colored; lower portion blackish grey. *Thorax:* pronotum yellow-white; median area with a narrow black longitudinal line, which forks like a "Y" a short distance before reaching the posterior margin; the "arms"—narrow black lines—join a broad black line which margins the lateral edges; a narrow black longitudinal line in each lateral area; pleura yellow-white, heavily infuscated with black; sternum deep yellow with a transverse black band between fore coxae and with blackish infuscation posteriorly. Mesonotum very deep yellow with median line and other sutures very narrowly black; extreme antero-lateral areas lightly infuscated with grey; pleura light yellow, heavily marked with black; sternum deep yellow with median line broadly black and with basisternum and lateral edges brownish. Metanotum deep yellow with a few narrow transverse streaks; pleura as for mesothorax; sternum yellow-brown. *Wings:* forewing hyaline, except for costal and subcostal interspaces and basal three-quarters of membrane posterior of Cu_1, which are brown; crossveins dark brown with membrane surrounding each stained with dark brown; longitudinal veins yellow-brown. Hindwing light brown, fading to almost hyaline posteriorly; longitudinal veins brownish-hyaline; crossveins dark brown, each surrounded by a dark brown spot as in the forewing. *Legs:* fore coxae and trouchanters deep yellow, marked with dark brown; fore femur deep yellow, with apex shaded with dark brown; tibia medium brown, somewhat lighter proximally, and with apex yellow; tarsi medium brown, with joints narrowly ringed with yellow. Mid and hind legs similar, except tibiae and tarsi light yellow and tarsal joints narrowly ringed with brown. *Abdomen:* medium brown; tergites with pale median stripe, bordered on each side by a very narrow dark brown stripe; large pale spot antero-laterally and the lateral ganglionic area suffused with dark brown; each segment with narrow dark brown transverse band on posterior margin. Sternites light yellow-brown, with dark brown median spot on the anterior margin, which has a very narrow dark brown stripe running to middle of segment from each side; posterior margins shaded with medium brown. *Genitalia:* forceps light yellow-brown, becoming darker distally; penis lobes yellow-white, as in fig. 3. Caudal filaments missing.

Female Imago.—There seem to be no major differences between the females of this species in my collection and the description of this sex as presented by Traver (1956).

Holotype male: Nova Teutonia, Santa Catarina, Brazil,

February 1957 (Fritz Plaumann, collector); preserved in alcohol. Allotype, female: same data as for holotype, except collected on January 6, 1956; pinned. Both types are in collections of the Illinois Natural History Survey. Paratypes: all with the same data as for holotype, except for dates; 1♂, February 1957, and 1♂, September 1956, both in alcohol and in my personal collection; 1♀, January 4, 1956, pinned, and in my personal collection. In addition, there are many subimagoes of both sexes collected at the same locality in January, September, and November of 1956 and in February of 1957 in the collections of Dr. Lewis Berner, the California Academy of Sciences, Dr. G. F. Edmunds, Jr., Institut Royal des Sciences naturelles de Belgique, Dr. Jay R. Traver, and the author.

Etymology: from L., balteus-belt or band.



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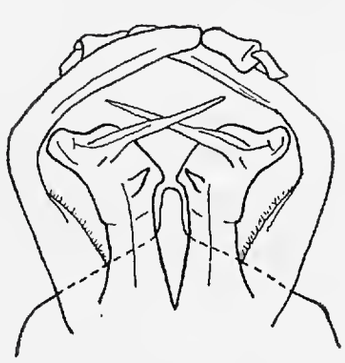

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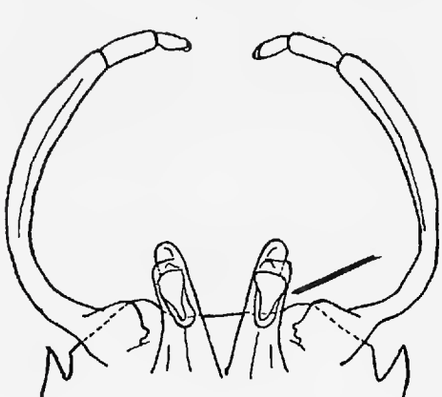

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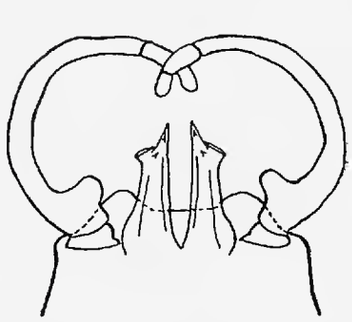


4

EXPLANATION OF FIGURES

Figs. 1–4, male genitalia. 1. *Thraulodes daidaleus* Thew; 2. *Thraulodes traverae* Thew; 3. *Ulmeritus balteatus* Thew; 4. *Ulmeritus adustus* Thew.

Variation in the male paratypes: there seem to be no striking differences between the male paratype collected at the same time as the holotype. For the other one, the following differences were noted: fore femora shaded with dark brown on the inner surface; infuscation of the basal region of the forewing and also that of the hindwing somewhat lighter in color and less extensive.

In the genus *Ulmeritus* as here considered, *U. balteatus* is closely related to *U. carbonelli* Traver, the type of the genus. Traver (1956) had specimens of this species which she referred to as *Ulmeritus* sp.; she placed no name on them, for she had no imaginal males in her collection and so could not determine if there were genitalic differences; she also questioned whether the coloration differences were taxonomic or ecological. The specimens described here not only show small, yet definite differences in the male genitalia in comparison with *U. carbonelli*, but also possess the same color characters, *i.e.* the heavy bands of dark spots across the middle and base of the forewing as did Traver's specimens. As Nova Teutonia is about 450 miles from the Santa Lucia River, Arequita, Lavealleja Province, Uruguay, the locality from which her specimens came, I conclude that these differences are taxonomic and not ecological and that both series represent the same new species.

Ulmeritus adustus Thew, new species

Male Imago.—Lengths: body 5.4 mm.; forewing 5.9 mm.; caudal filaments broken. *Head:* yellow-white; vertex between compound eyes with two dark brown spots and with posterior margin dark brown; median area around ocelli shaded with dark brown; face and vestigial mouthparts yellow-white, marked with brown. Antennal scape and pedicel yellow, flagellum white. Ocelli normal. Turbinate portion of compound eyes light orange in preserved specimens, lower portion black. *Thorax:* pronotum light yellow-brown; lateral margins shaded with black; median line with narrow black longitudinal line, which is intersected near the posterior margin by a similar short transverse stripe, with a lateral black longitudinal stripe on each side; anterior margin black-brown; pleura yellowish white, marked with blackish brown, which blends into medium brown basisternum. Mesonotum deep medium brown, with sutures finely marked with black; antero-lateral margins and tip of scutellum broadly margined with brown; pleura similar, but with yellow-white areas about wing base and coxae; sternum deep medium red-brown, except around coxae, where it is light brown. Metanotum medium brown, with posterior finely margined in black; pleura deep medium brown, with sutures marked with black; sternum light brown. *Wings:* hyaline; longitudinal veins of forewing light yellow-brown anteriorly, whitish hyaline posteriorly; crossveins hyaline; extreme wing bases lightly suffused with brown;

stigmatic area milky. Hindwing with extreme basal subcostal space suffused with brown; veins hyaline, as in fig. 4. *Legs:* all coxae and trochanters yellowish white, marked with brown. Fore femora light yellow-brown, with preapical and apical dark brown bands; tibiae dark brown, with broad median and narrow apical bands of pure white; tarsi yellowish white, with joints pure white. Mid-femora yellowish white with faint basal and median and dark apical bands of brown; tibiae white with brown apical band; tarsi white, except for distal segment, which is light brown. Hind femur yellow-white with basal, median and apical bands of dark brown; tibiae pure yellowish white; tarsi as in midleg. *Abdomen:* tergites dark brown; posterior margins of segments 1–9 yellow-white, all segments with anterior margin yellow-white in median area; segments 1–2 with two submedian light brown dots, these fusing on segments 3–10 to form mesal, yellowish white triangles, which are gradually larger posteriorly; all segments with large lateral light spot on each side and possessing black stigmatic dots; segments 1–8 with yellow spot in antero-lateral area, which is attached by a narrow yellow oblique stripe to the lateral spot. Sternites light yellow, with segments 1–4 shaded with very light brown, except for median light spot; segments 9–10 shaded with light brown medially; segments 7–8 with lateral brown dot on each postero-lateral corner; all segments with posterior margins shaded with light brown and with dark brown lateral ganglionic marks. *Genitalia:* forceps yellowish white penis lobes yellow-brown, as in fig. 5. *Caudal filaments:* white, with joints very finely marked with brown.

Female Imago.—As in the male, with the following exceptions: lengths, body 6.0 mm.; forewing 6.8 mm.; caudal filaments 6.3 mm. Head yellow, with anterior and posterior margins broadly black and with black median spot, which has narrow oblique black lines proceeding anteriorly. Mesonotum yellow. Abdominal color lighter; second lateral spots not so distinct. Wing membrane without brown suffusions.

Holotype male, and allotype, female: Nova Teutonia, Santa Catarina, Brazil, February 1957 (Fritz Plaumann, collector); preserved in alcohol. Both in the collections of the Illinois Natural History Survey. Paratypes: same data as for holotype; 44♂♂ and 61♀♀; preserved in alcohol; two of each sex in the collections of Dr. Lewis Berner, the California Academy of Sciences, Dr. G. F. Edmunds, Jr., Institut Royal des Sciences naturelles de Belgique, and Dr. Jay R. Traver; the remainder are in my personal collection; 6♂♂ and 1♀, same data as for holotype, but collected in January 1956, and 5♂♂ and 2♀♀, same as for holotype, except collected in September 1956; all in alcohol and in my personal collection. Also, there are many male and female subimagoes, which have the wing membrane and the veins black, collected in February 1957 and in my personal collection.

Etymology: from L., adustus-tanned, brown, swarthy.

This species is very closely allied to *U. uruguayensis* Traver.

The male genitalia of the two are very similar, except that the penis lobes of *adustus* bear two small spines which are lacking in *uruguayensis*. In addition, the coloration, especially of the legs and abdomen, but also in many lesser details, is definitive for each of the species. Thus, I feel that they are distinct, but closely related species.

Ulmeritus patagiatus Thew, new species

Male Subimago.—Lengths: body 10.7 mm.; forewing 10.9 mm.; caudal filaments 7.0 mm. *Head:* yellow-white; black-brown spot on vertex between the compound eyes; face and vestigial mouthparts white, marked with black-brown. Antennal scape yellow-brown; pedicel white for proximal one-fourth, remainder yellow-brown; flagellum yellow-brown. Turbinate portion of compound eyes light tanish pink, lower portion black. *Thorax:* pronotum yellowish white, with oblique black-brown stripe on each side of median line, leading from postero-lateral corners to median line; lateral margins broadly brown-black; pleura and venter light brown, with sutures broadly marked with yellowish white. Mesonotum light yellow-brown, except for anterior region, which is light yellow; median line and oblique antero-lateral sutures white; pleura brown, marked with yellow-white; sternum medium brown. Metanotum light yellow; pleura and sternum as for mesothorax. *Wings:* translucent (would be hyaline in imago); forewings with veins C, Sc, and R yellow; all remaining longitudinal veins and crossveins whitish hyaline; all veins narrowly margined on all sides with brown. Hindwing with all veins whitish hyaline, except in basal radial area, which is brown. *Legs:* all coxae and trochanters yellow, heavily marked with brown; fore femora yellow with dark brown band one-third distance from apex and with apex brown; edges distally shaded with brown; heavy brown longitudinal stripe on outer margin for basal two-thirds; tibia dark brown with extreme base and median area light and with apex white; first tarsal segment white; remainder grey proximally, white distally. Mid femur yellow with apex brown and with median brown spot on outer margin; tibia and tarsi yellow-white, faintly shaded with light brown. Hind femur yellow, with median and apical brown bands and with proximal half heavily shaded with dark brown on both sides; tibia and tarsi as for midlegs. *Abdomen:* tergites light brown, with following yellow markings: 1) a median stripe, gradually increasing in width posteriorly; 2) immediately lateral to this, a large spot on the anterior margin on each side (distinction between stripe and spots obliterated on segment 1); 3) a lateral spot; 4) a spot in the antero-lateral corner; 5) a median spot in the stigmatic area. Sternites light brown with median line and extreme lateral areas yellow. All segments narrowly margined with black posteriorly. *Genitalia:* yellow-white, as in fig. 6. *Caudal filaments:* white, with joints ringed with dark brown, which is darker on every other segment.

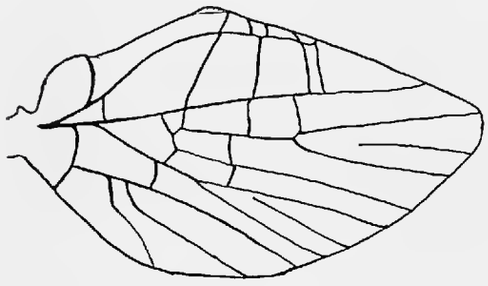
Female Subimago.—As in the male, with the following exceptions: length of body 11.0 mm.; forewing 11.4 mm.; caudal filaments missing. Coloration in general lighter than in male; maculation of abdominal tergites somewhat diffuse; sternites with posterior margin yellow, extending foreward about

half the length of the segment medially and with antero-lateral yellow spots.

Holotype subimagal male, and allotype, subimagal female: NOVA TEUTONIA, SANTA CATARINA, BRAZIL, September 1956 (Fritz Plaumann, collector); preserved in alcohol. Both types are in the collection of the Illinois Natural History Survey. Paratypes: same data, except for dates; 2♂♂, September 1956, and 1♀, February 1957; all are subimagoes, preserved in alcohol, and in my personal collection.

Etymology: from L., patagiatus-bordered.

Ulmeritus patagiatus is closely related to *U. adustus* Thew, *U. flaveopodes* (Spieth), and *U. uruguayensis* Traver. The brown bordering of the veins of the wings, the maculation of the legs and abdomen, and the forms of the penis lobes make it easily separable from them, however.



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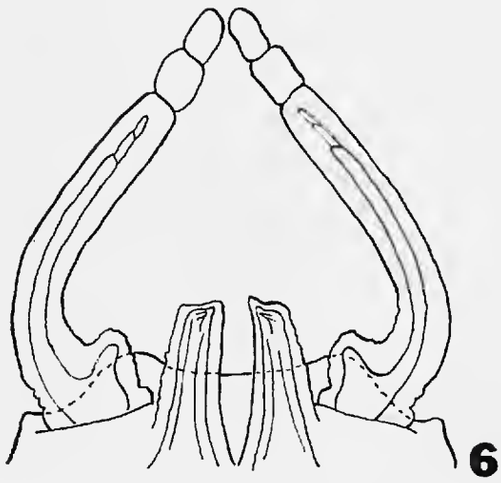

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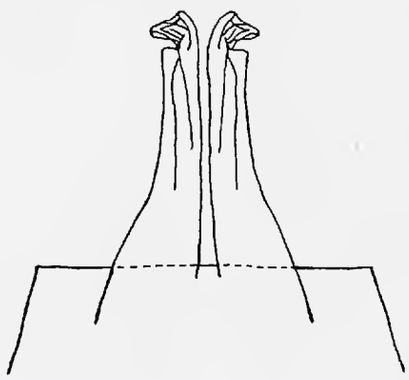

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EXPLANATION OF FIGURES

Fig. 5. *Ulmeritus adustus* Thew, hind wing; fig. 6. *Ulmeritus patagiatus* Thew, male genitalia of subimago; fig. 7. *Atalophlebia sepia* Thew, penis lobes.

Genus Deleatidium Eaton

Deleatidium vittatum Thew, new species

Female Imago.—Lengths: body 8.1 mm.; forewing 10.3 mm.; caudal filaments 11.0 mm. *Head:* yellow-white; vertex between compound eyes with broad transverse black-brown band; black stripes between lateral and median ocelli and beneath antennae; vestigial mouthparts broadly marked with black-brown. Antennal scape yellow-white, pedicel yellow-brown, flagellum missing. Compound eyes black. *Thorax:* pronotum yellow-white, with fine median longitudinal black line and two broad black oblique stripes; lateral margins and extreme median posterior margin broadly black; pleura yellow-white, shading into deep brown ventrally; sternum brown, except for extreme median area, which is yellow. Mesonotum light yellow with sutures faintly black; tip of scutellum white; pleura yellow-white, broadly marked with medium brown; sternum light yellow-brown laterally, darker medially. Metanotum yellow with broad dusky transverse bands in lateral areas and with lateral margins finely black; sternum and pleura same as for mesothorax. *Wings:* forewing hyaline, with costal and subcostal spaces infuscated with light red-brown. Veins C, Sc, and R light brown, other yellowish hyaline. Crossveins brown in the anterior region, fading to yellowish hyaline posteriorly. Hindwings hyaline, with veins slightly yellowish and with basal one-third of radius brown. *Legs:* all legs similar; femora light yellow, with faint brownish shading, which is concentrated into median and apical bands; tibiae and tarsi yellowish white, the latter lightly shaded with brown distally. *Abdomen:* yellow-white; tergites with posterior edges and lateral areas broadly infuscated with light brown; segments 1–4 with this shading continued medially on the anterior margin. All segments with black stigmatic dots. Sternites light yellow, with posterior margins broadly brown and anterior margins lightly infuscated with light brown. *Caudal filaments:* yellow-white, with joints brown.

Holotype female: Nova Teutonia, Santa Catarina, Brazil, November 1956 (Fritz Plaumann, collector); preserved in alcohol; in the collections of the Illinois Natural History Survey. Paratype: 1♀, same data as for holotype; preserved in alcohol and in my personal collection.

Etymology: from L., vittatus-decorated or bound with a ribbon.

The genus *Deleatidium* Eaton is known from Australia, New Zealand, and South America; from this latter region seven species have been described, all of which are from the Andean mountain country. None possess the exact abdominal color pattern nor the thin brown ribbon on the anterior edges of the forewing, which are characteristic of *D. vittatum* Thew.

Genus Atalophlebia Eaton

Atalophlebia sepia Thew, new species

Male Imago.—Lengths: body 10.0 mm.; forewing 12.0 mm.; caudal fila-

ments 19.0 mm. *Head:* blackish brown; face and vestigial mouthparts deep yellow, sparsely marked with black-brown. Antennal scape and pedicel deep brown, marked with black; flagellum yellow-brown. Compound eyes dark red-brown dorsally, changing to blackish ventrally. Ocelli deep yellow, ringed with black at base. *Thorax:* pronotum yellow-white, mottled with brown; median line very finely black; median posterior margin black; mid-way between median line and lateral edge there is a thick longitudinal black stripe; at the base of this commences a thick oblique black stripe; lateral margins bordered with black; dorsal half of pleura black, ventral half yellowish white; sternum yellow-brown. Mesonotum medium yellow-brown, with sutures finely black and with tip of scutellum black; pleura yellow, marked with brown, and with longitudinal stripe of white next to the antero-lateral margin of the notum; sternum yellow-brown. Anterior half of meta-notum yellow-brown, posterior half yellow-white; median area suffused with black and posterior edge finely margined with black; pleura and sternum as for mesothorax. *Wings:* hyaline; veins yellow-hyaline; extreme basal areas of C, Sc, and R interspaces of forewing infuscated with yellow-brown. Hindwing hyaline, except for extreme base anteriorly, which is shaded with brown; veins yellowish hyaline. *Legs:* all legs similar; coxae yellow, marked with blackish brown; trochanters yellow-white; femora yellow-brown, with median black-brown band and with apex dark brown; tibiae yellow-brown with apex dark brown; tarsi light yellow. *Abdomen:* tergites translucent white with the following black-brown markings on segments 1–7: 1) a median light stripe, finely bordered on each side with black (weak on segments 4–5); 2) immediately lateral to this, a thick longitudinal stripe, which angles away from the median line slightly at the anterior edge of the segment; 3) a wide band on posterior margin; 4) a large lateral spot, connected to the oblique stripe and the posterior band by thin dark suffused areas; 5) stigmatic dots. These markings reduced on segments 4–5, heavy on segments 6–7. Segment 8 yellow with thick black longitudinal stripes anteriorly on each side of median line, with a black oblique stripe on the lateral margin, and with a black stigmatic dot. Segment 9 similar but with stripes running the entire length of the segment and with the markings heavier. Segment 10 yellow, with median line and lateral edges black. Sternites yellow-brown with anterior margin hyaline and with anterior median area dark brown; segment 8 with pair of dark brown dots. *Genitalia:* yellow-brown, as in fig. 7. *Caudal filaments:* white, with every other joint widely banded with brown and the remainder only finely margined with brown.

Holotype male: FRUTILLAR, CHILE (province not known), February 15, 1950 (J. Herreci, collector); pinned in the collections of the Illinois Natural History Survey. Parataypes: 7 ♂ ♂, same data as for holotype; all pinned; six in the collections of the Illinois Natural History Survey, one in my personal collection.

Etymology: from L. sepia-cuttlefish, squid; ink; perverted to mean the rich brown color of such ink.

Outside of the seven unrecognizable species described by L.

Navas, there are four others from the neotropical region placed in this genus; they have been thoroughly reviewed by Demoulin (1955*a* and 1955*b*). The abdominal markings of *Atalophlebia sepia* Thew are very similar to those of *A. chilensis* Eaton, only the sternites presenting basic differences. Other specific characteristics are as follows: the penis lobes of each species are distinctive; in *sepia* the crossveins of the C and Sc interspaces are thickened as in *chilensis,* but, unlike this species, the remaining crossveins show no thickening or infuscation into the wing membrane; the crossveins of the C interspace in *sepia* number 18, with a space immediately distal to the triad R_{2+3} completely devoid of such veins, while *chilensis* has 22 crossveins in this space, evenly placed along the entire length; and last, the second joint of the fore tarsi of *sepia* is two-thirds of the third joint, while that of *chilensis* is six-sevenths of the third.

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A NOTE ON THE SYSTEMATIC POSITION OF THE GIANT LYCAENID BUTTERFLY LIPHYRA BRASSOLIS WESTWOOD

(Lepidoptera: Papilionoidea)

PAUL R. EHRLICH

Department of Biological Sciences, Stanford University

The Indo-Australian butterfly *Liphyra brassolis* Westwood is one of the most unusual members of the family Lycaenidae. It is the largest member of the family (the length of the forewing in the male specimen examined was 36.9 mm.) and it has rather unusual habits. The larva lives in the nest of the green tree ant *Oecophylla smaragdina* (Fabricius) and preys upon the brood. It is protected from the ants by a smooth, very heavily sclerotized cuticle. The pupa is formed within the last larval skin, which continues to serve as a protective shield. The newly emerged adult is covered with loose scales which are torn off by attacking ants, diverting them long enough to permit the butterfly to escape.

At the time of his study of the higher classification of the butterflies, the author was unable to obtain a specimen of this unusual species for study. Since then a number of people have expressed the opinion that such a large and unusual lycaenid might not show the skeletal structure typical of the other members of the family. Recently, through the courtesy of Mr. J. Sedlacek of the California Academy of Sciences, a single damaged male specimen of this species has been obtained for dissection. It was found to possess the following characters (numbers refer to the characters enumerated in the diagnosis of the family Lycaenidae in Ehrlich, 1958, pp. 356-357; "Clench" indicates characters missing on the specimen studied, but described in Clench, 1955.): 1) eyes emarginate; 2) eyes bare; 3) face flat; 4) laterofacial sutures nearly contiguous with eye margins; 5) paraocular areas extremely narrow; 6) antennae close together; 7) anterior tentorial pits very low on face; 8) proboscidial fossa deep; 9) labial palps shorter than thorax; 10) labial sclerite well sclerotized around the palpal sockets; 11) anterior tentorial arms slightly crested; 12) antennae not carinate; 13) cervical sclerites not united beneath neck; 14) dorsal plate of pronotum broad; 15) ? (spinasternum destroyed); 16) profurcal arms simple; 17) intercoxal lamella prominent; 18) lateral plates of pronotum fused dorsally to form a V-shaped structure; 19) patagia membranous (apparently — area partially destroyed);

20) ? (area of parapatagia destroyed); 21) presternum present; 22) adnotale not sagittate; 23) lamella of mesodiscrimen curves down to base of furca; 24) processes of second phragma fairly prominent; 25) precoxal suture present, nearly complete; 26) pre-episternum of same magnitude as katepisternum; 27) mesothoracic anepisternum not present as a sparate sclerite; 28) prescutum vertical; 29) meral suture and lamella absent; 30) third phragma consisting of simple stalks; 31) metatergum not completely overhung by mesotergum; 32) caudal part of metathoracic epimeron thin; 33) prespiracular bar fully developed; 34) postspiracular bar reduced; 35) cubitus of forewing apparently trifid; 36) 3V present, weak, fusing with 2V; 37) hind wing with two vannal veins; 38) prothoracic legs bearing claws (Clench); 39) protibial epiphyses absent (Clench); 40) tarsal claws simple; 41) aroliar pad well-developed; 42) pupa in skin of last larval instar; 43) larva without osmateria.

As can be seen from the foregoing, *Liphyra* conforms well to the diagnosis given for the family Lycaenidae. The only notable difference is in character no. 11; the tentorial arms are enlarged to approximately the degree seen in the papilionid genus *Cressida* (Ehrlich, 1958, fig. 21). Although it was not possible to determine the condition of the spinasternum (character no. 15), it seems safe to assume that it is not laterally produced since this structure is simple in all of the butterflies except the Papilionidae and the Pieridae. Similarly the parapatagia (character no. 20) are membranous in all of the butterflies except for a small group of the Nymphalidae. It therefore seems unlikely that they would be sclerotized in *Liphyra*.

Within the family Lycaenidae *Liphyra* appears to fit into the typical subfamily, Lycaeninae. It shows none of the characters (e.g. spinelike projection of the male prothoracic coxae below the articulation of the trochanter, distinct mesothoracic anepisternum, development of humeral and/or marginal veins in hind wing) usually associated with the other major subfamily, the Riodininae. It would seem, therefore, that at least on the basis of the adult morphology there is no reason to place *Liphyra* in a distinct family or subfamily, as has been done by various authors.

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TWO NEW SPECIES OF TYPHLODROMUS FROM CALIFORNIA

(Acarina: Phytoseiidae)[1]

D. A. Chant[2]

Entomology Research Institute, Belleville, Ontario

While on a recent visit to California I collected Phytoseiidae in the area around Riverside and San Bernardino and also examined several excellent collections of these predacious, plant-inhabiting mites. Two hitherto unknown species were recognized, and descriptions and figures of these are given herein with specific diagnoses and an indication of their places in the keys to the family recently prepared by Chant (1960). Both species are of the subgenus *Amblyseius* as recently defined (Chant, 1957).

Typhlodromus (Amblyseius) newelli Chant, new species

(Figs. 1–3)

Female.—Length 420 μ; width 290 μ. *Dorsal shield* smooth, with 17 pairs of setae, of which nine are in the lateral row, two in the median, and six in the dorsal (Fig. 1). All dorsal (D) setae minute except D_1. Seta M_1 minute; M_2 longer, equal to L_6. Seta L_1 longer than D_1, L_2, or L_3. Setae L_2 and L_3 equal. Seta L_5 minute, much shorter than L_6. Seta L_9 the longest on the shield. Setae S_1 and S_2 on interscutal membrane. *Sternal shield* with only two pairs of setae. Two pairs of small metasternal plates, each with a seta. *Genital shield* normal, with a pair of setae. *Peritremal plates* broad, extending posteriorly around bases of coxae IV and anteriorly to the level of setae D_1. *Metapodal plates*, two pairs, one minute. *Ventrianal shield* (Fig. 2; 140 μ long, 115 μ wide) approximately rectangular with posterior margin rounded and lateral margins concave, and three pairs of preanal setae, a pair of pores, and a crease around anal opening. Four pairs of setae surrounding ventrianal shield; one (VL_1) long, curved. *Gnathosoma* and *maxillary palps* normal for the genus. Fixed digit of chelicera multidentate. *Coxae* all slightly reticulated. *Leg IV* with three macrosetae (Fig. 3), genu, tarsus, and basitarsus.

Male.—Unknown.

Diagnosis.—The relative lengths of setae L_2 and L_3 and of L_5

[1] Contribution No. 3918, Entomology Division, Science Service, Department of Agriculture, Ottawa, Canada.

[2] Entomologist.

and L_6 make this species distinct. Differences from similar species are: from *T. (A.) neomexicanus* Chant (1960) by L_2 being equal to L_3; from *T. (A.) lichenis* Chant (1960) by L_1, L_9, and M_2 being longer and by having D_5; from *T. (A.) graminis* (Chant) by many setae being longer, by having only two pairs of setae on the sternal shield, and by the shape of the ventrianal shield; from *T. (A.) septa* (Garman) by L_5 being much shorter and by having D_5; and from *T. (A.) exopodalis* Kennett by having only two pairs of setae on the sternal shield, by having D_5, and by L_6 being longer. In my keys this species comes to *T. (A.) graminis.*

Holotype female (Canadian National Collection No. 6802) and nine other females were collected from litter "below edge of cliff" at PALOS VERDES ESTATES, LOS ANGELES COUNTY, CALIFORNIA, in June, 1956, by Dr. I. M. Newell, in whose honor the species is named. Two additional females were collected by Dr. Newell from the type locality in December, 1955, and March, 1956. One specimen was collected from magnolia 10 miles south of Santa Rosa, Sonoma County, California, in April, 1957, by Mr. R. O. Schuster, and a further specimen from buckeye on the University of California campus, Berkeley, in March, 1953, by Mr. N. Walker.

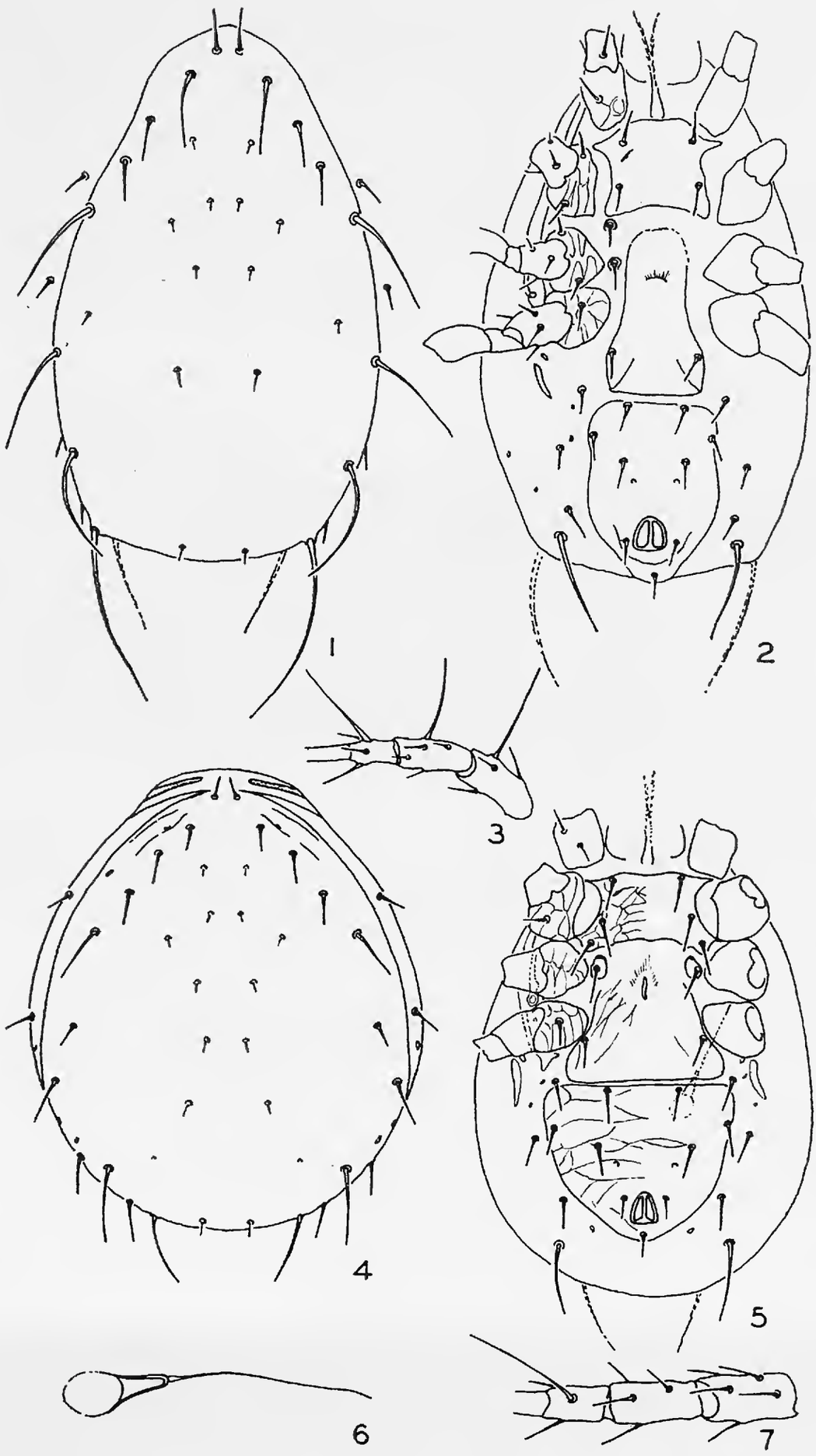
Typhlodromus (Amblyseius) palustris Chant, new species

(Figs. 4–7)

Female.—Length 400 μ; width 285 μ. Body globular. *Dorsal shield* smooth, with 18 pairs of setae, of which nine are in the lateral row. two in the median, and seven in the dorsal (Fig. 4). All setae short; dorsal (D) ones minute. Setae L_2 and L_3 equal, longer than L_1. Seta L_5 shorter than L_6. Setae L_9 and M_2 approximately equal. A distinct pore mesad of M_2. Four heavily sclerotized spots: near setae L_1, L_3, L_6, and L_7. Setae S_1 and S_2 on interscutal membrane. *Sternal shield* reticulated and with three pairs of setae. *Metasternal plates*, one pair, each with a seta. *Genital shield* slightly reticulated, very broad, with a pair of setae. *Peritremal plates* very broad, with posterior end truncate and lying close to coxa IV and anterior end extending to level of seta D_1 (Fig. 4). *Metapodal plates*, four pairs, three minute. *Coxal gland* (Fig. 6) unique with unusually long duct leading from coxa IV to trumpet-shaped distal portion. *Ventrianal shield* (Fig. 5; 140 μ long, 180 μ wide) reticulated, triangular, with lateral margins convex and posterior margin rounded, three pairs of preanal setae, and a pair of pores.

EXPLANATION OF FIGURES

Figs. 1–3, *Typhlodromus (Amblyseius) newelli* Chant. 1, Dorsal shield; 2, ventral surface; 3, leg IV. Figs. 4–7. *T. (A.) palustris* Chant. 4, Dorsal shield; 5, ventral surface; 6, coxal gland; 7, leg IV.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A small plate lying just behind ventrianal shield. Four pairs of setae surrounding ventrianal shield, one (VL_1) moderately long. *Gnathosoma* and *maxillary palps* normal for the genus. Fixed digit of chelicera multidentate. *Coxae* all heavily reticulated. *Leg IV* (Fig. 7) with macroseta on basitarsus.

Male.—Unknown.

Diagnosis.—The presence of seta D_7 makes this species unique among the Phytoseiidae. In some specimens a small seta occurs between the two D_7's but this is probably an aberration. *T. (A.) palustris* keys to *T. (A.) novaescotiae* Chant (1960) and it can be separated from this species as follows: in *T. (A.) palustris* seta L_6 is longer than L_5, D_7 is present, D setae are minute, and the anterior edge of the ventrianal shield is straight and meets the lateral margins acutely; in *T. (A.) novaescotiae*, setae L_5 and L_6 are approximately equal, D_7 is absent, D setae are short but not minute, and the anterior margin of the ventrianal shield is rounded.

Holotype female (C.N.C. No. 6803) and another female were collected at Balch Camp, Fresno County, California, in August, 1956, by Mr. R. O. Schuster. Other records are: one female collected from *Microtus montanus*, Cottonwood Basin, White Mountains, Mono County, California, June, 1954, by Dr. D. Furman; two females collected on marshy ground, Garner Valley, San Jacinto Mountains, California, June, 1956, by Dr. I. M. Newell; one female collected on ladino clover at Ferris Ranch, two miles east of Orland, Glenn County, California, August, 1953, by Dr. A. E. Pritchard.

Acknowledgments

I am grateful to the following for permission to examine and describe material from their collections: Dr. I. M. Newell, University of California, Riverside; Mr. E. A. McGregor, Whittier, California; Dr. A. E. Pritchard and Dr. D. P. Furman, University of California, Berkeley; and Mr. R. O. Schuster, University of California, Davis. I am also grateful to the Pinellas Biological Laboratory Inc. for the travel grant that was provided.

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A NEW SUBTERRANEAN RHIZOECUS MEALYBUG FROM ARIZONA

(Homoptera: Pseudococcidae)

HOWARD L. MCKENZIE
University of California, Davis

Each summer the University of California conducts a required undergraduate course in Entomology (Entomology 49), which deals primarily with the collection, identification and preservation of miscellaneous insects. During the summer of 1958 this course was held at the Southwestern Research Station of the American Museum of Natural History, which is approximately six miles northwest of Portal in southern Arizona. At that time Dr. Richard M. Bohart, Vice-Chairman of the Department of Entomology and Parasitology of the University of California, was in charge of the course. Among insect collections made by Dr. Bohart was a soil sample collected five miles southeast of Apache, in Cochise County, Arizona. The collected soil was processed in a Berlese insect trap and, among other arthropods, a single adult female hypogeic mealybug was recovered.

Due to the effort made by Dr. Bohart in procuring the mealybug, the author takes great pleasure in dedicating the species in his honor.

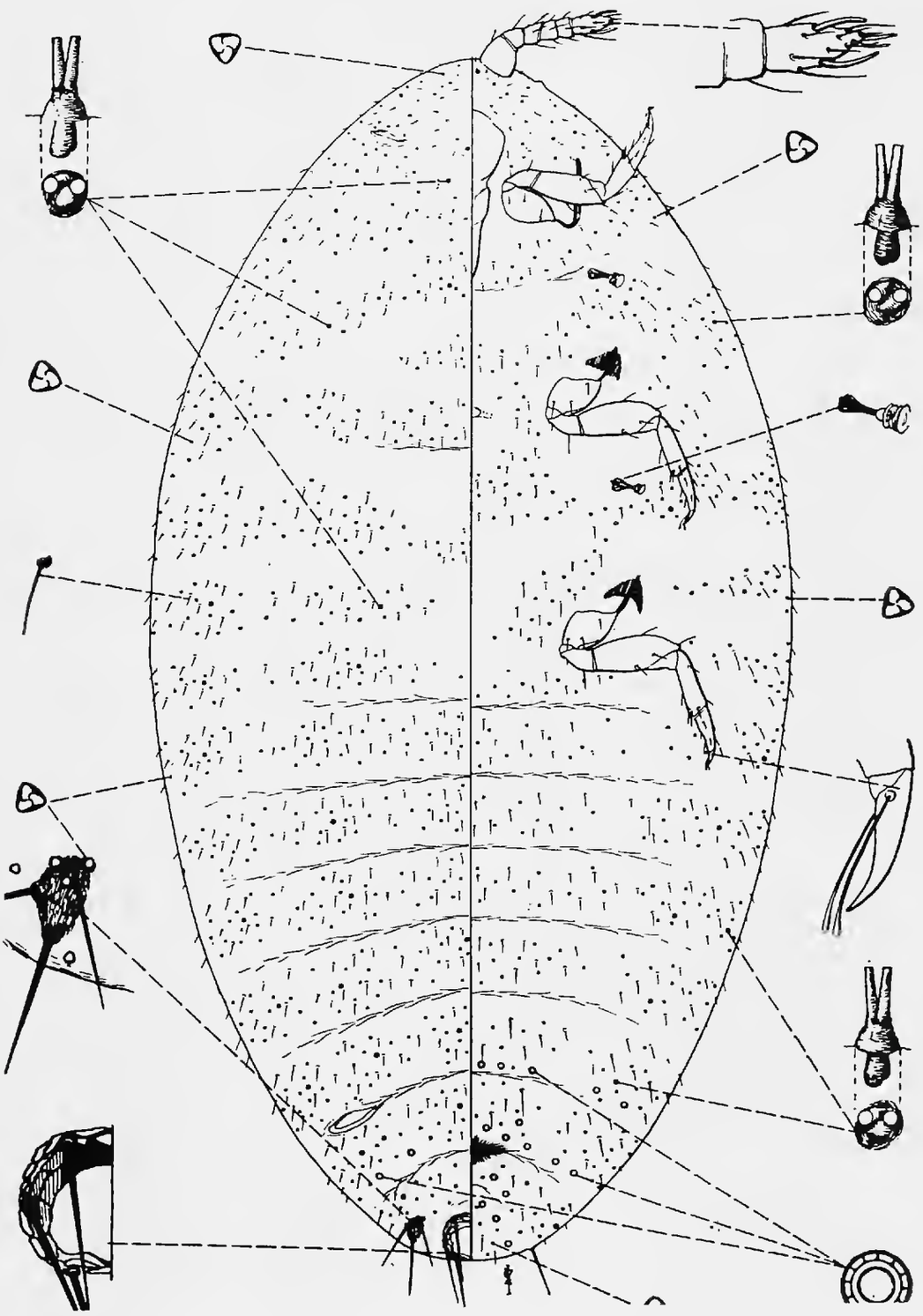
Rhizoecus boharti McKenzie, new species

(fig. 1)

Recognition characters—Adult female.—elliptical, broadened across the middle. Length approximately 1.20 mm. Cerarii entirely lacking on dorsum; anal lobes with several slender setae set in a quite distinct, but small, area of sclerotization. Bitubular pores rather small and inconspicuous, little larger than a trilocular pore, seemingly formed of a sclerotized cone from the apex of which arise two sclerotized tubes; these pores totalling as many as 54 for the entire dorsum. Dorsum moderately beset with trilocular pores and small body setae. Oral collar ducts lacking. Dorsal multilocular disk pores present in few numbers along posterior border of eighth abdominal segment. Anal ring borne at apex of abdomen, its six setae slightly longer than greatest diameter of ring, its pores large, oval and irregularly shaped, some appearing clear and open, others with varying amounts of pigmentation. Dorsal ostioles well-developed.

Ventrally, multilocular disk pores present from tip end of abdomen to posterior margin of seventh segment. Bitubular pores few, apparently confined to a series along body margin, extending from posterior abdomen to head region, apparently the same size as those of dorsum. Trilocular pores generally distributed on venter, but showing rather marked "clear areas" submarginally on abdomen and in thoracic region. Ventral oral collar ducts lacking. Setae on venter short and slender.

Circulus lacking. Eyes present. Antennae six-segmented, quite short and stout, apical segment bearing four sensory setae; placed close together near apex of head, interantennal space equal to slightly less than width of first antennal segment at its base. Legs comparatively stout, tibia and tarsi armed with stout spines. Tarsal claws with digitules exceeding apex of claw and very slightly knobbed.



EXPANATION OF FIGURE

Fig. 1. *Rhizoecus boharti* McKenzie, new species, collected in soil, 5 miles southeast of Apache, Cochise County, Arizona.

Holotype adult female, collected in soil, FIVE MILES SOUTHEAST OF APACHE, COCHISE COUNTY, ARIZONA, August 11, 1958, by R. M. Bohart, deposited in the University of California, Department of Entomology and Parasitology Museum Collection at Davis, California. Unfortunately, this lot represents the only known collection of the mealybug.

Using Ferris' key to North American species of *Rhizoecus* as presented in his 1953 Atlas of the Scale Insects of North America, Volume VI, page 427, this species runs to couplet 12 (11) including *Rhizoecus associatus* (Hambleton) and *R. distinctus* (Hambleton). However, it is quite different from these two species in possessing bitubular instead of tritubular pores, and lacking dorsal and ventral multilocular disk pores in the thoracic region.

It is related to *Rhizoecus kondonis* Kuwana, in the possession of bitubular pores, but differs from that species in lacking a circulus, possessing digitules which extend beyond apex of claw, and by the presence of a few multilocular disk pores along posterior margin of eighth abdominal segment.

Habits.—No information other than that the mealybug occurs in the ground where it presumably feeds on plant roots.

Suggested common name.—Bohart Rhizoecus mealybug.

The accompanying illustration was made, under the author's supervision, by Mrs. Julia Z. Iltis.

BOOK REVIEW

THE BEETLES OF THE PACIFIC NORTHWEST. PART II: STAPHYLINIFORMIA, by Melville H. Hatch, with the collaboration of Milton W. Sanderson and Gordon Marsh. University of Washington Publications in Biology, Vol. 16, pp. xii + 384, bound, offset. Published December 27, 1957. Price $7.00, from the University of Washington Press, Seattle 5.

Volume I of this important series was reviewed in this journal in 1956. Volume II covers the families Silphidae, Leptinidae, Leiodidae, Staphylinidae, Scydmaenidae, Scaphidiidae, Clambidae, Corylophidae and Ptiliidae, in that sequence. The subfamily Steninae of the Staphylinidae, with three new species, is treated by Dr. Sanderson, the family Scydmaenidae, with eight new species, by Mr. Marsh. The genus *Brathinus* is included in the tribe Antherophagini of the staphylinid subfamily Omaliinae. Pages 302–375 comprise 37 plates with their explanations; page *ii* is a frontispiece, figuring *Nicrophorus investigator* (Zetterstedt) by Daniel Bonnell.

This book is exceedingly helpful for anyone working over material from

the region covered, and its environs. Indeed it is essential, as the following data show. In the small silphoids (Leiodidae) Dr. Hatch has described 33 new species and renamed one; in the Staphylinidae he has proposed seven generic names and has described the following as new: two subgenera, 159 species, two subspecies, three aberrations; in the Ptiliidae, two new species. There are many new synonymies throughout the text.

A majority of the new Staphylinidae are small forms, and the total is hardly surprising, for they have been virtually untouched since Casey's day and never before worked by anyone having adequate series. Dr. Hatch is to be commended for his treatment of the species of *Philonthus* and *Quedius*, based on the male genitalia, and illustrated by sketches. The drawings of the secondary sexual characters of *Tachinus* spp. are also very helpful, as are those of the male genitalia of *Dianous* and *Stenus* by Dr. Sanderson.

The figures of species, nearly all by Mrs. Helen Houk, are a major part of the book and are invaluable to a person trying to key out some unknown entity. They are clear and well reproduced, yet in some cases they fail to suggest the habitus of the species, and even of the genus. For instance the reviewer has been familiar with *Staphylinus maxillosus villosus* Gravenhorst (pl. XXVII, fig. 8), *Eumalus nigrellus* LeConte (pl. XXXI, fig. 3) and *Dianous nitidus* LeConte (pl. XXXI, fig. 11) for years, yet the illustrations did not suggest these species to him at first glance. Many are shown with the front legs trailing backward like the middle pair (so as not to interfere with the drawing of the antennae), instead of held forward as in life.

Mention of the generic name *Staphylinus* draws attention to the one feature which is likely to draw criticism, especially in Europe where there is much interest in the proposal of *nomina conservanda.* It is the use of generic names *sensu* Blackwelder (1952. The generic names of the beetle family Staphylinidae with an essay on genotypy. Smithsonian Institution, U. S. National Museum, Bulletin 200; iv + 483 pp.). This results in transfers of well-known names and the use of others virtually unknown since their proposal. But for collectors on the Pacific Coast this possible annoyance is far outweighed by the blessing of having workable keys to genera and species in a most difficult group.

The subfamily Aleocharinae is given short treatment; in part it is simply a listing of species, with references. This is surely not to be criticized, for on the basis of Seever's preliminary studies it is clear that Fenyes' groupings, based largely on tarsal formulae, were polyphyletic. There is still a tremendous amount of work to be done in the subfamily before we are ready for a stable text-book coverage.

As in Volume I, the keys to species are long, containing as they do the descriptions of new species. With judicious underlining one can turn them into synoptic keys, much quicker to use.

Drs. Hatch and Sanderson and Mr. Marsh are to be congratulated for having brought out an indispensable and stimulating work. It has no predecessor in an area extending from Alaska to Mexico and from the shores of the Pacific to the Rockies. We look forward to Volume III, confident of its adequacy.—Hugh B. Leech, *California Academy of Sciences, San Francisco.*

NEW SPECIES AND RECORDS OF NEARCTIC PSYCHODIDAE

(Diptera)

LAURENCE W. QUATE
Bishop Museum, Honolulu, Hawaii

Since the publication of a revision of North American Psychodidae (Quate, 1955), additional information on Nearctic psychodids has acumulated. To be able to incorporate this into the forthcoming catalogue of Nearctic Diptera, the unpublished data are presented at this time. Included are descriptions of three new species of *Telmatoscopus* and one of *Threticus* and new distributional records for other Nearctic psychodids.

This paper is in effect a supplement to my 1955 revision, and to understand the relationships of the new species to previously described ones, the reader is referred to that earlier study. New distributional data for known species are given where the range has been extended to U.S. states not listed in that revision. Abbreviated biblographic citation only is given to the complete references given in 1955. In the case of generic reassignments, the reader is referred to Quate (1959) for details on the classification of the Psychodini.

Mr. W. E. Snow and Dr. R. H. Jones have provided interesting material, and their efforts and interest in collecting psychodids are appreciated. I also thank other collectors, listed with the collection data, for loans or gifts of specimens.

TRICHOMYIA NUDA (Dyar). Quate, 1955:119.

TENNESSEE: Morgan Creek, Kentucky Reserve, Decatur County, VII-7-54 (W. E. Snow); Sugar Tree, Decatur County, V-26-55, tree hole (Snow).

TRICHOMYIA WIRTHI Quate. Quate, 1955:119.

TENNESSEE: Edgemoor, Anderson County, VII-28-55 (Snow).

PERICOMA SCOTIAE (Curran). Quate, 1955:127.

COLORADO: Grand Lake, Grand County, VI-2-32 (H. G. Dyar); Steamboat Springs, 12 mi. S., Routt County, VII-24-55 (Quate).

PERICOMA LASSENICA LASSENICA Quate. Quate, 1955:130.

COLORADO: Steamboat Springs, 12 mi. S., Routt County, VII-23-55 (Quate).

PERICOMA KINCAIDI Quate. Quate, 1955:141.

COLORADO: Steamboat Springs, 12 mi. S., Routt County, VII-24-55 (Quate). IDAHO: Bear Lake, Bear Lake County, VI-25-48 (D.

G. Denning). ONTARIO: Black Ash Creek, Collingwood Township, V-23-55 (F. P. Ide).

PERICOMA SICULA Quate. Quate, 1955:145.

CALIFORNIA: Mt. Lassen, 3 mi. E., Lassen County, VII-8-52 (J. W. MacSwain).

TELMATOSCOPUS VARITARSIS (Curran). Quate, 1955:161.

MASSACHUSETTS: Holliston, Middlesex County, VI-21 (N. Banks).

Telmatoscopus latipenis Quate, new species

(Figs. 1 *a-j*)

Male.—Species similar to *quadripunctatus*; antenna with long scape, first flagellar segments with enlarged node; head and prothorax without sensory organs; wing with dark spots at apices of veins, other markings not discernible (pinned specimens unavailable); base of aedeagus very broad. *Head:* eyes separated by distance equal to nearly four facets, interocular suture convex with posterior spur at midline; frons with hairs arranged in rectangular patch on anterior part and band extending posteriorly nearly to suture; palpus about one-quarter as long as antenna, ratio of segments 5:6:6:10. Antenna with 16 segments, as figured. *Wing* narrow, three times as long as wide; membrane without infuscations; venation as figured. Sternite two of abdomen a narrow, strap-like sclerite. *Genitalia* as figured.

Measurements: antenna 1.4 mm.; wing length 1.9 mm.; wing width 0.6 mm.

Female.—Unknown.

Pupa.—Respiratory horn rather short, dark brown, surface reticulate, inner chamber expanded distally; double row of pits interrupted near center. Details of ornamentation on abdomen as figured.

Holotype male, MADISON, DANE COUNTY, WISCONSIN, May 22, 1954, adult reared from pupa (R. H. Jones), deposited in the U.S. National Museum. Male paratype, same data.

T. latipenis would key out to *varitarsis* in my key (Quate, 1955:158) but can be distinguished from that species by the unusually broad aedeagus, the enlarged first flagellar node of the antenna and the medial fork being well basad of the level of the radial rather than near the same level as in *varitarsis*.

Telmatoscopus subtilis Quate, new species

(Figs. 1 *k-o*)

Male.—Species similar to *nebraskensis*; antenna with long scape, basal flagellar segments with short internodes; head and prothorax without sensory organs; wings apparently unmarked (pinned specimens not available). *Head:* eyes separated by distance equal to two and one-half facets, interocular suture convex; frons with spatulate hairs arranged in rectangular patch on anterior part and band extending posteriorly nearly to suture; palpus about one-third as long as antenna, ratio of segments 7:10:10:17. Antenna with

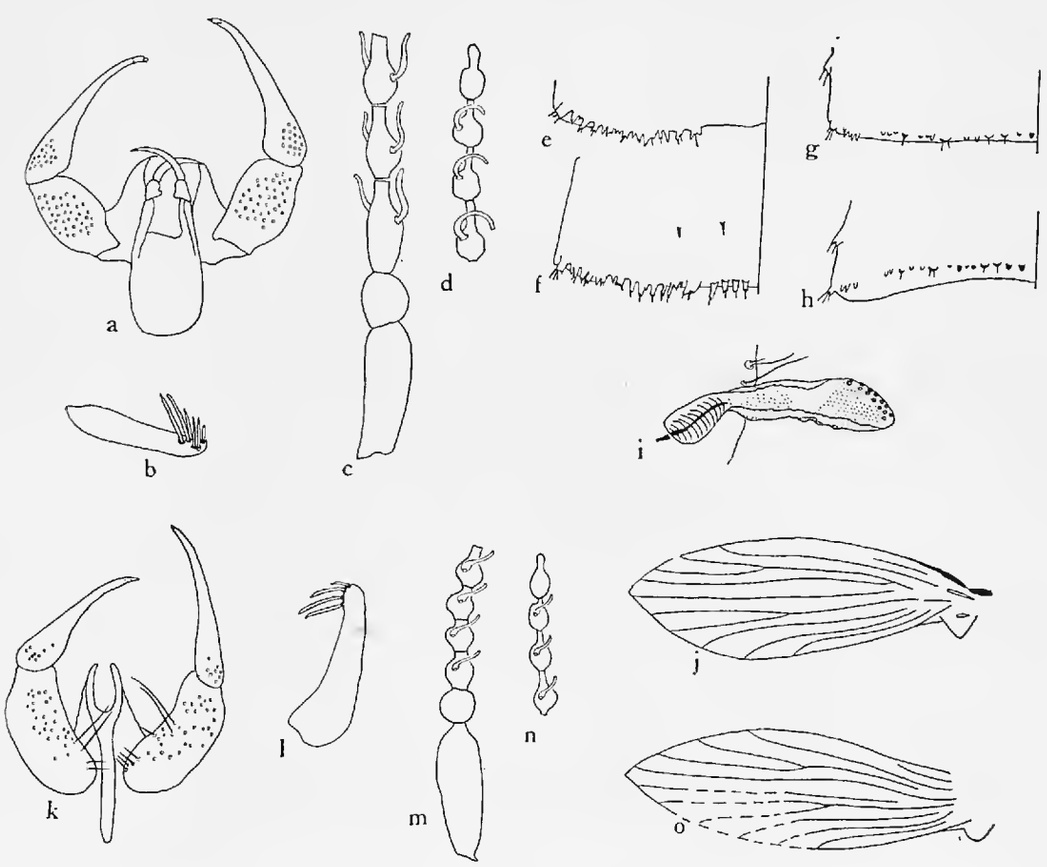
16 segments, as figured. *Wing* narrow, three times as long as wide; membrane lightly infuscated in costal and anal cells; venation as figured. Sternite two of abdomen a narrow, strap-like sclerite. *Genitalia* as figured, aedeagus Y-shaped.

Measurements: antenna 1.4 mm.; wing length 2.4 mm.; wing width 0.8 mm.

Female.—Unknown.

Holotype male, TAJIQUE, TORRANCE COUNTY, NEW MEXICO, June 28, 1947 (R. H. Beamer), deposited in the University of Kansas collection.

This species would key out to *T. quadripunctatus* in my key (Quate, 1955:158) but can be separated by the quadrate appearance of the basal flagellar segments, different shape of the male aedeagus and longer, more slender dististyle. It is most closely related to *nebraskensis* Quate (1955:163) but is separable from that species in that R_5 ends beyond the wing apex and the male



EXPLANATION OF FIGURES

Fig. 1, *a - j*, *Telmatoscopus latipenis* Quate, *a*, male genitalia, dorsal; *b*, male surstyle; *c*, base of male antenna; *d*, tip of male antenna; *e*, pupa, sternite four; *f*, pupa, sternite five; *g*, pupa, tergite four; *h*, pupa, tergite five; *i*, pupa, respiratory horn; *j*, wing. *k - o*, *Telmatoscopus subtilis* Quate. *k*, male genitalia, dorsal; *l*, male surstyle; *m*, base of male antenna; *n*, tip of male antenna; *o*, wing.

aedeagus has a longer basal stem and hence shorter arms than in *nebraskensis*.

TELMATOSCOPUS NEBRASKENSIS Quate. Quate, 1955:163.

WISCONSIN: Madison, Dane County, V-22-54 (R. H. Jones).

TELMATOSCOPUS PATIBULUS Quate. Quate, 1955:167.

MISSISSIPPI: Tishomingo, Tishomingo County, VI-2-56 (Snow).

TELMATOSCOPUS FURCATUS (Kincaid). Quate, 155:169.

WISCONSIN: Dane County, VI-11-53 (L. Limpel); Washburn County, VIII-8-50, light trap (R. H. Jones). KANSAS: Manhattan, Riley County, VI-8-32 (C. W. Sabrosky). COLORADO: Estes Park, Larimer County, VIII-11-52 (R. R. Dreisbach). OREGON: Hood River, Hood River County, VI-19-17 (F. R. Cole).

TELMATOSCOPUS SUPERBUS (Banks). Quate, 1955:183.

TENNESSEE: Tusculum College, Greene County, V-2-46, light trap. NEBRASKA: Lincoln, Lancaster County, VI-30-54, larva *ex* maple tree hole (Quate and E. W. Hamilton). KANSAS: Lawrence, Douglas County, light trap (A. R. Barr).

Telmatoscopus macdonaldi Quate, new species

(Figs. 2 *a-i*)

Male.—Species similar to *superbus;* head and prothorax without sensory organs; apparently vestiture light in color, wings with dark spots at apices of veins (pinned specimens unavailable); dististyle of male genitalia sigmoid-shaped. *Head:* eyes separated by distance equal to about two facets; interocular suture nearly straight; frons with hairs arranged as triangular patch on anterior part and narrow band extending posteriorly to suture; palpus about three-fifths as long as antenna, ratio of segments 6:12:11:15. Antenna with 16 segments, as figured.

Measurements: antenna 1.3 mm.; wing length 2.2 mm.; wing width 0.8 mm.

Female.—Similar to male. Eyes separated by four facets; wing membrane lightly infuscated. Genitalia as figured.

Measurements: antenna 1.3 mm.; wing length 2.5 mm.; wing width 1.0 mm.

Pupa.—Respiratory horn light brown, i.e., of body color, inner chamber of uniform width; row of pits interrupted near center. Details of ornamentation on abdomen as figured.

Holotype male, SANTA MONICA CANYON, LOS ANGELES COUNTY, CALIFORNIA, October 30, 1954, adult reared from pupa *ex* maple tree hole (W. A. McDonald), deposited in the California Academy of Sciences. Allotype female (CAS) and paratype female, same data as holotype.

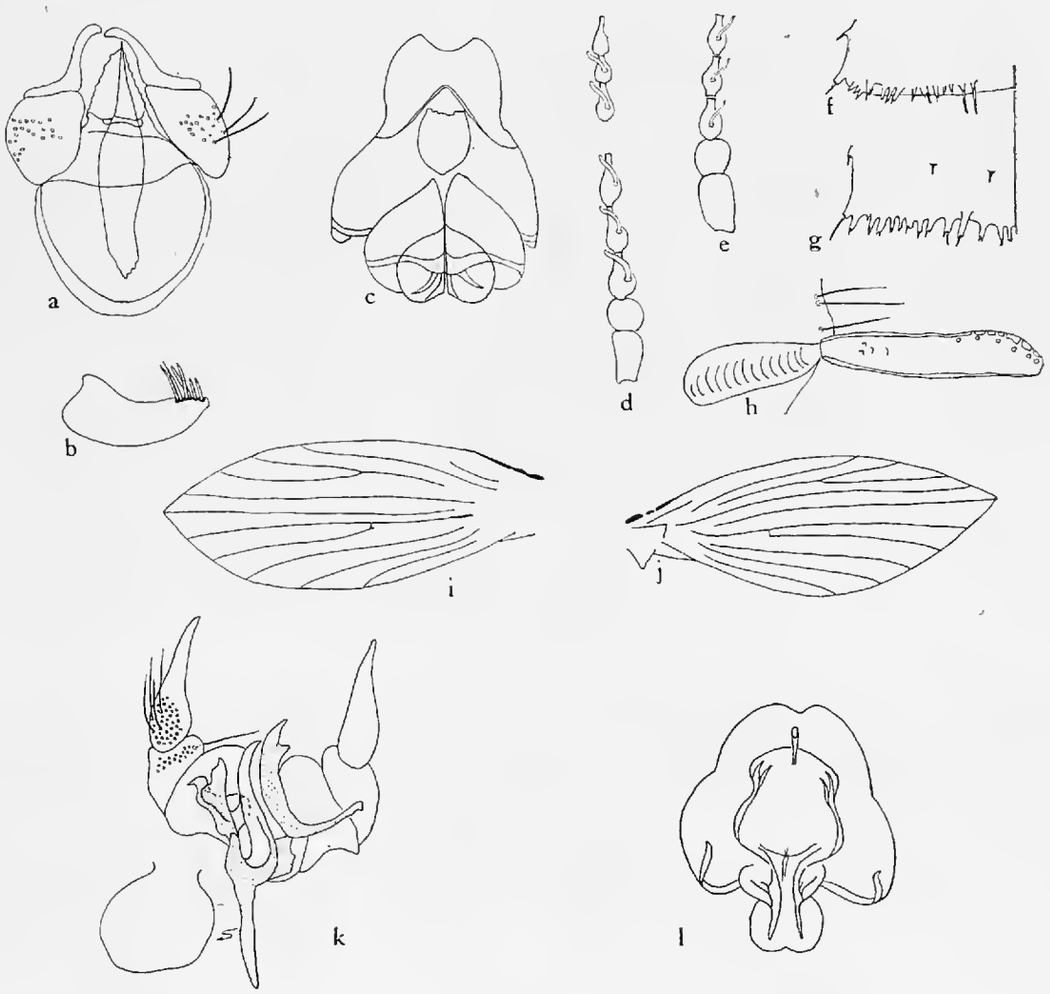
T. macdonaldi would key out to *superbus* in my key (Quate,

1955:158) but may be recognized by the male and female genitalia; the sigmoid dististyle of the male and the lack of tennis racquet-shaped structure on the face of the female subgenital plate (as in *superbus*) being the most obvious recognition characters. Otherwise, the two species are similar and hard to separate.

This species is named in honor of Dr. W. A. McDonald, who collected the types and has made other interesting psychodid collections in California.

PSYCHODA SETIGERA Tonnoir. Quate, 1955:202.

TENNESSEE: Decatur, Meigs County, V-16-56, oak tree hole (Snow).



EXPLANATION OF FIGURES

Fig. 2, *a* - *i*, *Telmatoscopus macdonaldi* Quate. *a*, male genitalia, dorsal; *b*, male surstyle; *c*, female genitalia; *d*, base and tip of male antenna; *e*, base of female antenna; *f*, pupa, sternite four; *g*, pupa, sternite five; *h*, pupa, respiratory horn; *i*, wing. *j* - *l*, *Threticus bicolor* (Banks). *j*, wing; *k*, male genitalia, dorsal; *l*, female genitalia.

PSYCHODA MINUTA Banks. Quate, 1955:203.

TEXAS: Kerrville, Kerr County, XI-53 (L. J. Bottimer).

PSYCHODA PUSILLA Tonnoir. Quate, 1955:206.

OREGON: Hood River, Hood River County, VII-9-17 (F. R. Cole). WASHINGTON: Endicott, Whitman County, VII-12-56; Oaksdale, Whitman County, VI-13-56; Pullman, Whitman County, VII-18-56; Anatone, Asotin County, VI-30-56. All specimens reared from cow dung, except one from pig dung.

PSYCHODA RAROTONGENSIS Satchell. Quate, 1955:208.

GEORGIA: Savannah, XI-3-55, "privy trap" (H. R. Dodge).

PSYCHODA TRINODULOSA Tonnoir. Quate, 1955:208

WISCONSIN: Madison, Dane County, IV-29-54, light trap (R. J. Dicke).

PHILOSEPEDON INTERDICTA (Dyar). Quate, 1955:227, 1959:449.

WISCONSIN: Madison, Dane County, XI-29-53, *ex* slime on dead oak tree.

THRETICUS JONESI (Quate). Quate, 1955:231; 1959:450.

MISSISSIPPI: Tishomingo, Tishomingo County, VI-2-56 (Snow). TENNESSEE: Sugar Tree, Decatur County, VII-7-54, tree hole (Snow).

THRETICUS BICOLOR (Banks). Quate, 1955:233; 1959:450.

NEBRASKA: Morse Bluff, Saunders County, VI-(5, 10, 11)-57 (Quate); same, VI-14-55 (W. F. Rapp, Jr.).

The illustration of the male genitalia by Quate (1955, fig. 82a) is incomplete, and a more accurate illustration is given here (fig. 2k). In the male specimen drawn previously a sclerotized rod adjacent to the main shaft of the aedeagus apparently was lost in the dissection, and the new figure shows the complex aedeagus with the full complement of parts.

The females of the Nebraska specimens differ from those in the eastern U.S. by the absence of a pair of horn-like structures distad of the spermatheca. A new figure (fig. 2l) of the female genitalia is given here based on the specimens from Nebraska.

The above specimens were collected in sedges growing in a moist, shady area at the base of a bluff where clear water seepage kept the ground wet and muddy. *Telmatoscopus furcatus* (Kincaid) was collected at the same place in association with *bicolor*. Immature stages of *furcatus* were strained from the

mud, but none definitely associable with adults of *bicolor* were found.

MARUINA LANCEOLATA (Kincaid). Quate, 1955:239.

COLORADO: Steamboat Springs, 12 miles S., Routt County, VII-24-55 (Quate).

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A NEW SPECIES OF ANEFLOMORPHA CASEY ASSOCIATED WITH CITRUS IN ARIZONA

(Coleoptera: Cerambycidae)

JOHN A. CHEMSAK

University of California, Berkeley

The genus *Aneflomorpha* Casey, as currently defined, comprises nineteen described species, sixteen from the United States and three from northern Mexico. The larvae are twig borers and girdlers in broad-leaved trees. Those of *A. subpubescens* (LeConte) attack and destroy young oak and chestnut seedlings and sprouts, and *A. lineare* (LeConte) girdles twigs of oak (Craighead, 1923). The adults are nocturnally active and are frequently attracted to light.

The following species, because of its occurrence on citrus in Arizona, may have some economic significance. The author is indebted to Dr. P. D. Gerhardt, University of Arizona, and Dr. E. G. Linsley, University of California, Berkeley, for the opportunity of describing this species, and to the latter also for the use of his manuscript key to the species of *Aneflomorpha*.

Aneflomorpha citrana Chemsak, new species

Male.—Form elongate, slender; integument uniformly dark brownish testaceous; pubescence moderately dense, fairly short, subrecumbent and suberect. *Head:* coarsely, densely, subconfluently punctate on vertex and between eyes, densely pubescent; antennae exceeding elytral apices by more than one segment, segments three to six spinose at apices, ciliate internally, spine of third segment longer than second segment, spines on segments four to six rapidly decreasing in length, sixth very short, segments three to nine carinate above, eleventh segment appendiculate, scape coarsely confluently punctate. *Pronotum:* longer than broad, sides broadly rounded, surface coarsely confluently punctate, faint traces of an irregular dorsal callus evident, moder-

ately densely clothed with rather long white subdepressed pubescence, sides with few longer erect hairs; prosternum slightly concave, coarsely, confluently punctate at about basal half, punctures subequal to pronotal ones, apical half with a distinct elevated transverse ridge, entire apical half transversely rugulose, pubescence moderate, short, subdepressed and suberect; prosternal process narrow, expanded at apex, front coxal cavities open behind by less than width of prosternal process; metasternum densely pubescent. *Elytra:* slightly less than three and one-half times longer than broad, sides subparallel, surface coarsely, irregularly subconfluently punctate at base, punctures subequal in size to those of pronotum, becoming finer apically; pubescence moderately dense, subdepressed, not obscuring the shining integument; apices emarginate, bidentate. *Legs:* slender, sparsely clothed with short subdepressed and longer suberect pubescence; femora coarsely, densely, shallowly punctate; tibiae carinate. *Abdomen:* sparsely, finely, shallowly punctate, moderately densely pubescent; fifth sternite broadly subtruncate at apex. Length, 11–14 mm.

Female.—Antennae extending over first three abdominal segments; abdomen with fifth sternite truncate at apex. Length, 12–15 mm.

Holotype male, allotype female and seven paratypes (five males, two females) TEMPE, MARICOPA COUNTY, ARIZONA, August 3–5, 1956 and August 18, 1959 "on citrus" (P. D. Gerhardt). Holotype and allotype deposited at the California Academy of Sciences, paratypes in collections of the University of Arizona and California Insect Survey.

This species is evidently related to *A. duncani* Linsley but differs by its smaller size and paler color. The elytra are shorter, antennal segments three to six spinose, and three to nine carinate. The color of *A. citrana* is somewhat variable in the type series, ranging from a brownish testaceous to dark brown. The other morphological characteristics are fairly constant, both quantitatively and qualitatively.

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1923. North American Ceramycid Larvae. Canada Dept. Agr. Bull. 27 (n.s.), 151 pp., 45pls.

ERRATA

Powell, Jerry A. 1960. Pan-Pac. Ent. 36(2):84; line 40, read VI-25-56 (A. A. Lee); "Coastal Area" instead of VI-25-26 (A. A. Lee); "Costal Area."

OTTO HERMAN SWEZEY

Entomologists the world over were saddened by news of the death of Dr. O. H. Swezey on November 3, 1959 at the age of 90. Dr. Swezey was born June 7, 1869 at Rockford, Illinois. He attended Lake Forest College, Illinois (B.A., 1896), Northwestern University (M.A., 1897) and Ohio State University (1902-1904), where he was a student of leafhoppers under Herbert Osborn. The greater part of his professional life (1904-1952)

was spent in the Hawaiian Islands as entomologist in the Experiment Station of the Hawaiian Sugar Planters. In 1944 he was granted an Honorary Degree of Doctor of Science by the University of Hawaii. From 1952 to the time of his death he lived in retirement in San Jose, California.

O. H. Swezey was a completely unique personality — modest to a fault and of unusually calm disposition. He was much interested in the teachings of the Baha'i faith. He was a vegetarian and abstained from the use of tobacco and alcoholic beverages. A patron of the arts, he rarely missed attending symphony concerts and other musical events.

Dr. Swezey's greatest interest in entomology was the insect fauna of the Hawaiian forests. His special talents were the close observation, patient rearing, and faithful reporting of the biology of insects. No fact was too small to attract his attention and every fact was instantly available thanks to a prodigious memory. He was an expert botanist and hence was able to contribute many hundreds of host plant records, most of which were brought together in his definitive work "Forest Entomology in Hawaii." Fortunately, this summary and approximately 230 other titles carry the bulk of Dr. Swezey's contributions over to posterity. The section, "Notes and Exhibitions" in each issue of the Proceedings of the Hawaiian Entomological Society provided an important outlet for the hundreds of detailed observations reported by Dr. Swezey at the monthly meetings from 1904 to 1952.

Although more of a biologist than taxonomist, Dr. Swezey's record of field collecting of native insects is most impressive. Only R. C. L. Perkins, who did the basic field work for the Fauna Hawaiiensis, and F. X. Williams approached Swezey's record in the Hawaiian Islands. Elsewhere, Dr. Swezey made extensive collections in Guam (1935-36) with R. L. Usinger, and Samoa (1940) with E. C. Zimmerman. His material is preserved in the collections of the Hawaiian Sugar Planters' Experiment Station and the B. P. Bishop Museum in Honolulu.

Dr. Swezey went to Hawaii in 1904 as an economic entomologist. His achievements, both as an individual and as head of the distinguished team of entomologists at the HSPA during the 1920's and '30's, are now legend. The sugar cane leafhopper was brought under control by the introduction of natural enemies, thus saving the sugar industry that appeared to be doomed.

Dr. Swezey played an important part in introducing other beneficial insects and summarized the case for the biological control of Lantana, a pioneer work on control of noxious weeds by insects.

Dr. Swezey continued on at the HSPA long after his official retirement, giving generously of his time and knowledge. In later years, although handicapped by partial blindness and deafness, he continued to rear insects and study their biology.

After his arrival in California Dr. Swezey lost no time in affiliating with the Pacific Coast Entomological Society. He and Mrs. Swezey attended three meetings in 1953 and, at the age of 83, he was elected to "Retired" membership in the Society on November 28, 1953. Typically, at the meeting of October 30, 1953 he reported on the rearing of a cutworm at his home in San Jose. From a single larva he reared 1051 parasites, an instance of polyembryony. Dr. Swezey was the principal speaker at the 235th meeting of the Society on March 6, 1954. His topic was "Some Aspects of the Endemic Insect Fauna of Hawaii." The last meeting he attended was the Field trip to Mt. Diablo, May 22, 1954.

Dr. Swezey is survived by Mrs. Swezey of San Jose, California and his son, Joseph, and two grandchildren in Hawaii.

—R. L. USINGER AND E. C. ZIMMERMAN

A NEW SPECIES OF CRASSOMICRODUS ASHMEAD

(Hymenoptera: Braconidae)

PAUL M. MARSH

University of California, Davis

Crassomicrodus muesebecki Marsh, new species

Female.—Length, 7 mm.; black except mandibles, all femora, anterior tibia, and basal two-thirds of middle and hind tibiae, which are ferruginous; body covered by long silvery hair. Head entirely black, transverse; clypeus prominent, more than twice as broad at apex as long; anterior tentorial pits deeply impressed; malar space equal to or slightly less than one-half the eye height; cheek and temple smooth, polished, frontal impressions immargined; ocellocular line nearly four times the diameter of an ocellus; antenna 30-segmented, nearly as long as body, scape large; mandibles bidentate. Thorax entirely black; notaulices very weakly defined; scutum and scutellum smooth and polished; prescutellar furrow bisected by one prominent median longitudinal carina and two lateral carinae; pronotum finely punctate; mesopleura smooth and polished, mesopleural furrow distinctly foveolate, long, curving upwards; propodeum sloping from base to apex, not rounded, rugulose.

Wings dark, veins dark brown; hind wing with five frenular hooks. Legs, all coxae and trochanters black, upper portion of trochanter lighter basally; all femora ferruginous; tibiae ferruginous, middle and posterior tibiae blackish basally (in some paratypes ferruginous area of posterior tibia replaced by white coloration); inner spur of posterior tibia equal to one-half basitarsal length; tarsus dark. Abdomen black; entirely smooth and polished; ovipositor 2 mm. long, strongly exserted, curved downward, sheaths black.

Male.—Essentially as in female.

Holotype female.—CALIFORNIA: FRESNO COUNTY, 7 MILES SOUTHWEST OF TRIMMER, June 2, 1951 (C. D. MacNeill). Cat. No. 64,876 U.S. National Museum.

Paratypes.—6 males, 7 females, all from California as follows. MADERA COUNTY: Bass Lake, 1 male, VI-6-38 (R. M. Bohart); NEVADA COUNTY: Rucker Lake, 1 female, VII-5-49 (E. I. Schlinger); PLUMAS COUNTY: Bucks Lake, 1 male, VI-23-49 (D. Cox); RIVERSIDE COUNTY: Idyllwild, 1 male, VI-19-51 (R. C. Bechtel); Keen Camp, 1 male, 3 females, VI-31-39 (B. Brookman, W. C. Bush, R. F. Smith), VI-9-39 (E. S. Ross); Ribbonwood, 2 females, V-21-40 (C. D. Michener); TUOLUMNE COUNTY: 1 male, 1 female, III-9-38 (N. W. Hardman); YOLO COUNTY: Rumsey, 1 male, V-30-56 (R. M. Bohart).

Type and four paratypes deposited in the U.S. National Museum, four paratypes in the California Insect Survey collection, three paratypes at the University of California at Davis, one paratype in the California Academy of Sciences, and one paratype in the author's collection.

This species differs from other *Crassomicrodus* by its strongly, rather than barely, exserted ovipositor. There is some variation in the color of the wings and posterior tibia in the specimens I have examined. In all the specimens from southern California the wings are hyaline, while those from central and northern California have the wings dark. Those specimens with hyaline wings apparently all have four frenular hooks and those with dark wings have five hooks. Also the color of the hind tibia is white (except at apex) in those specimens from southern California, rather than ferruginous as in the central and northern California specimens.

Dr. C. F. W. Muesebeck has kindly reviewed the manuscript and has aided my studies in many other ways. The species is named for him in recognition of his pioneer work on American Braconidae.

SYMMOCA SIGNATELLA H.-S. IN CALIFORNIA

(Lepidoptera: Gelechioidea)

Symmoca signatella Herrich-Schaeffer is a widespread species in Europe which has apparently recently been introduced into California. Meyrick (1895)[1] reported that the moth was introduced into the London and Paris areas during the late nineteenth century and that the larvae had been stated to feed on lichens. Recent collections I have examined indicate that it is now widespread in agricultural and urban areas of California. Dr. J. F. Gates Clarke of the U.S. National Museum, who kindly identified the species, states *(in litt.)* that the U.S.N.M. has specimens from Los Angeles, Riverside, and Yorba Linda (Orange County), the latter reared from lemon mummies. Ebeling (1959)[2] lists *S. signatella* as a minor pests of citrus, but it seems likely that it is a general scavenger as a larva and will be found in decaying vegetable matter associated with various plantings.

Data from material examined: Anaheim, Orange Co., III-29-43, r. f. arbor vitae trash (H. H. Keifer); Fresno, Fresno Co., V-30 to VI-3-56 (R. O. Schuster); La Mesa, San Diego Co., VI-3, 10-59, light trap (R. A. Mackie); Redwood City, San Mateo Co., IX-24, 30-59 (P. H. Arnaud, Jr.).

—JERRY A. POWELL, *University of California, Berkeley.*

A CORRECTION IN THE EYE NUMBER OF THE GENOTYPE TOMOLONUS REDUCTUS MILLS

(Collembola: Entomobryidae)

While examining samples of berlesed material for Collembola, specimens of a tomocerine were found which appeared to be *Tomolonus reductus* Mills. These specimens agreed with the original description of this species in every respect except for the number of eyes. It was stated that there were two eyes on each side, located at the anterior edge of an irregular black eyespot (Mills 1948)[3].

The specimens observed by the author possessed three eyes on each side, two on the anterior edge, the posterior one completely within the eyespot. It is sometimes very difficult to locate this third eye because of the pigmentation.

Recently an opportunity arose whereupon the cotypes were examined and it was found that these also possessed three eyes

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[1] Meyrick, E. 1895. Handbook of British Lepidoptera. MacMillan Co., London, 843 pp.

[2] Ebeling, W. 1959. Subtropical Fruit Pests. Univ. Calif. Div. Agr. Sci., 436 pp.

[3] Mills, Harlow B.—New North American Tomocerinae. Ann. Ent. Soc. Amer. 41(3):353-359.

on each side instead of two. Dr. Mills is in agreement with this.

The type locality of *T. reductus* is Hastings Natural History Reservation, Monterey County, California. To this date it is known in California from the following additional locations: Oakland, Alameda Co., 1953., Ione, Amador Co., 1956.—RICHARD F. WILKEY, *California Department of Agriculture, Sacramento.*

NOTE ON SYNONYMY OF AN AMERICAN AND JAPANESE SPECIES OF PSYCHODIDAE

(Diptera)

LAURENCE W. QUATE

Bishop Museum, Honolulu, Hawaii

At the suggestion of Prof. M. Tokunaga, Saikyo University, Kyoto, Japan, a comparison was made of the American species, *Telmatoscopus niger* (Banks), and the Japanese *Telmatoscopus spinitibialis* Tokunaga and Komyo. Prof. Tokunaga generously sent me a male and female paratopotype of *spinitibialis,* and the following conclusions are based on those specimens as well as the original description of that species.

A number of striking characters readily identify *T. niger.* The eye bridge is curved down medially above the antenna instead of being straight as is the usual case; the nodes of the first two flagellar segments of the antennae are fused, and the first flagellar segment is reduced and lacks an internode; the wing is rather narrow; the radial sector is pectinate; and the male and female genitalia are distinctive. In addition, the male has a large spine from the apex of the mid tibia, and the mid basitarsus is larger than the following tarsal segments. [Dr. Tokunaga and Miss Komyo had based the name of their species on the tarsal spine; but I had overlooked it in the redescription of *niger* (Quate, 1955:165).] Insofar as I can ascertain, there are no differences between *T. niger* and *spinitibialis.*

The synonymy of *T. niger* is as follows:

TELMATOSCOPUS NIGER (Banks)

Psychoda nigra Banks, 1894, Canad. Ent. 26:331 (type locality, New York).

Maruina nigra, Kertesz, 1902, Catalogus Dipt. 1:302.

Telmatoscopus niger, Quate, 1955, Univ. Calif. Publ. Ent. 10:165 (descr., illus.).

Psychoda snowhilli del Rosario, 1936, Philip. Jour. Sci. 59:140 (type locality, Maryland).

Telmatoscopus spinitibialis Tokunaga and Komyo, 1955, Philip. Jour. Sci. 84:217 (type locality, Honshu, Japan). *(New Synonymy.)*

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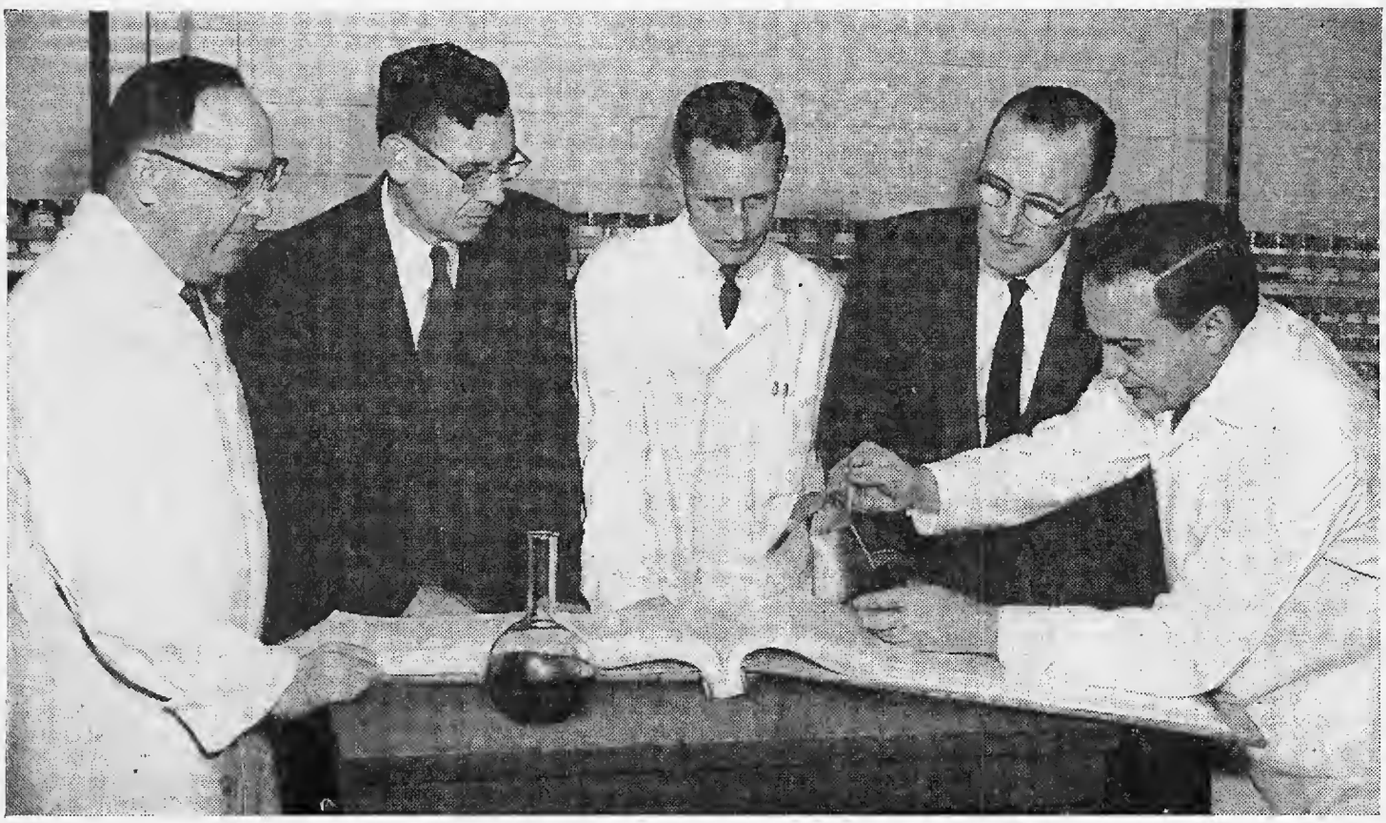

Discussing promising new insecticide compounds at Hercules' Agricultural Chemicals Laboratory are: George Buntin, discoverer of toxaphene; Dr. E. N. Woodbury, laboratory supervisor; Dr. Keith D. Ihde, research entomologist; Dr. Arthur D. Lohr, supervisor, Naval Stores research; and Dr. William R. Diveley, a discoverer of Delnav.

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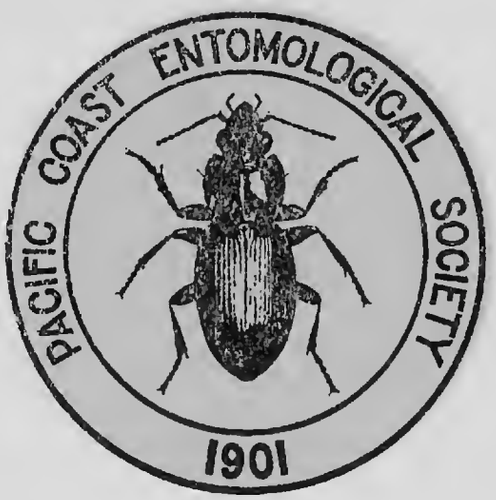
Vol. XXXVI OCTOBER, 1960 No. 4

THE PAN-PACIFIC ENTOMOLOGIST



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THE ACARIDAE: A RECAPITULATION

(Acarina: Sarcoptiformes)[1]

G. W. Krantz

Oregon State College, Corvallis

Although the mite family Acaridae is a comparatively small one as regards numbers of species, it is nevertheless one of the most successful groups of animals on earth. Through their unique methods of dispersal, omnivorous food habits and phenomenal reproductive rate, acarids have become well established throughout most of the world. Several species are found commonly in stored grain and grain products where they cause injury by their feeding and by creating, in many instances, difficult contamination problems. Preserved meats, cheeses, bulbs and dried fruits also are liable to infestation by acarids. The majority of species, however, are found living as saprophytes or fungivores in soil, litter, or in the nests of mammals or birds.

The Acaridae may be described as opaque, weakly sclerotized mites ranging in size from 400 to 2000 microns, and completely lacking in respiratory and complex sensory structures. The gnathosoma (fig. 1) is small and compact, with a pair of maxillary palpi closely appressed to the hypostome. The chelicerae are the most prominent gnathosomal feature, being heavy and coarsely chelate distally. The idiosoma is divided by a transverse apodemal suture into a propodosomal and hysterosomal area, each of which bears two pairs of legs in the nymphal and adult stages. The propodosoma has a weak anterior dorsal plate which is all but lost in many species and a more or less constant series of dorsal setae and sensory organs. The rostral setae (fig. 1, r.) are inserted at the anterior edge of the dorsal plate. They usually are quite strong and may or may not be weakly pectinate. The cervical setae (fig. 1, c.) may be found either at the anterior lateral corners of the dorsal plate or on the mediolateral borders of the plate. They generally are small and may be pectinate. The inner and outer propodosomal setae (fig. 1, i.p., o.p.) are inserted transversely across the posterior portion of the

[1] Invitational paper presented at the annual meetings of the Pacific Branch of the Entomological Society of America, June 24, 1959, at Sacramento, California. Technical paper No. 1281 of the Oregon Agricultural Experiment Station.

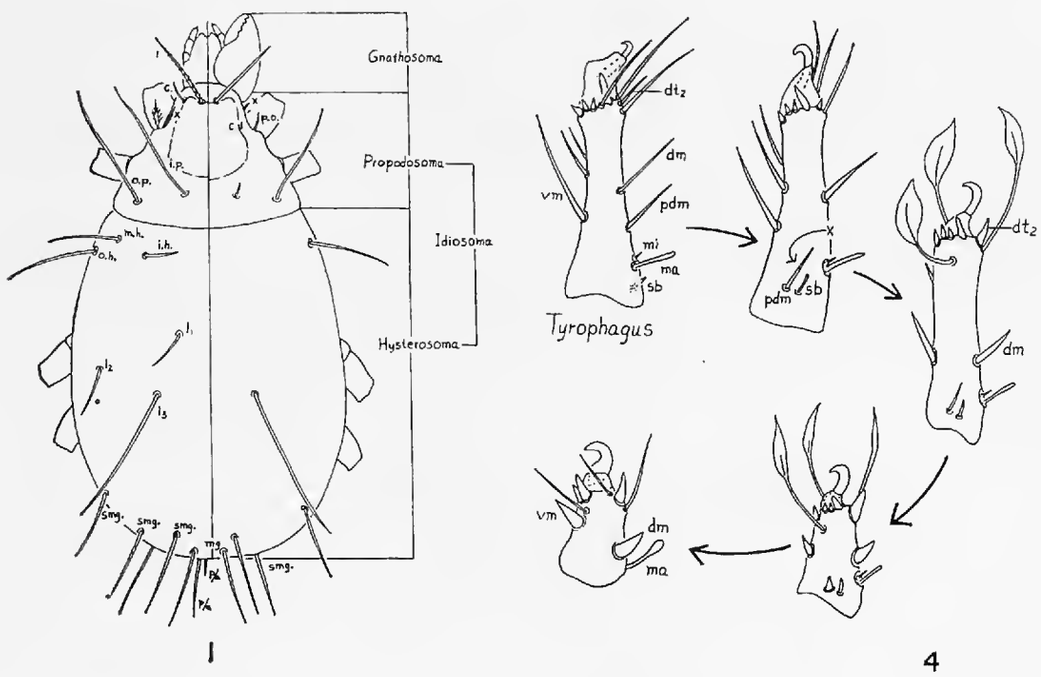
propodosoma. These setae are highly variable and, in some species, the inner pair may be reduced or absent. Grandjean's organ (fig. 1, x) is a tiny propodosomal structure that is thought to be sensory in function. The organ assumes a tree-like form in some acarids and lies in a body depression just anterior to coxae I, where it often is difficult to detect. In other species it is a seta-like projection which is easily seen. Posterior to Grandjean's organ is a pseudostigmatic spine (fig. 1, p.o.) which may be pectinate or smooth. The dorsum of the hysterosoma commonly bears ten pairs of setae, with reduction occurring in certain genera. Three pairs of humeral setae are found on the anterolateral portion of the hysterosoma (fig. 1, o.h., i.h., m.h.). The inner humeral setae always are the shortest of the three when all are present. Both the middle and inner pairs are completely lost in some species. The lumbar setae (fig. 1, l_1, l_2, l_3) occupy the middle area of the hysterosoma. Only the third lumbars are found in virtually all acarids. As many as seven pairs of setae may be inserted at the posterior margin of the hysterosoma. These are the marginal and all but one of the sub-marginal setae (fig. 1, mg., smg.). Although inserted ventrally, the post-anal setae (fig. 1, p/a) are considered by many authors to be a part of the marginal-submarginal setal complex.

Ventrally, epimera I are fused at the midline, while epimera II-IV are free medially (fig. 2a, op). The genital opening of the female lies between coxae III and IV while that of the male (fig. 2b) usually is found between coxae IV. Two pairs of genital discs flank the genital area in both sexes, and a copulatory sucker is located on either side of the male anal slit. The ventral setae are fairly constant and are considered to be of little importance taxonomically.

While most mites have six-segmented legs, acarids have only five. It is generally assumed that the trochanter has been lost and that the coxa is joined directly to the femur. Possibly, however, the true coxal segments have become fused with the venter, with only the epimera to mark their former positions. Thus the so-called coxa of acarids may, in reality, be the trochanter. Tarsus I (fig. 4) bears several setae, some of which are sensory in function. Nesbitt (1945) has emphasized the importance of these setae in determining phylogenetic development of acarid genera. Tarsus IV of the male bears two (occasionally

one) raised suckers (fig. 2c) on its dorsal surface, which serve to hold the female during copulation. All tarsi terminate in a sessile empodial claw which may be seated in a membranous caruncle. In the genus *Lardoglyphus*, true claws persist in the females, while the male of only one species, *L. zacheri* Oudemans, retains true claws on tarsi I and II.

Taxonomically the Acaridae has proven a confusing problem to the several acarologists who have studied them. Despite the efforts of such well-qualified persons as Berlese, Canestrini, Banks and Oudemans, the systematics of the Acaridae remained enigmatic until relatively recently. It is not surprising that errors occurred in the early works on this group. Lack of clear-cut taxonomic characters coupled with inadequate optical equipment resulted in a number of artificial and highly unstable systems of acarid classification. Rather than treating the Acaridae as a natural, integrated group, many early workers expressed relationships on a suprafamilial basis, creating families on the strength of what we now consider to be tribal or generic characters.



Explanation of Figures

Fig. 1. Diagrammatic representation of the dorsum of an acarid mite, showing extremes in body setation. Fig. 4. Variations in tarsi I of acarid mites, showing developmental trends in setation and segmental length. Vm-ventral median seta; sb—sub-basal seta; ma—macrosense seta; mi—microsense seta; pdm—postdorsal median seta; dm—dorsal median seta; dt_2—second dorsal terminal seta (Adapted from Nesbitt 1945).

The ensuing confusion in species separation led to numerous synonymies, many of which are yet to be resolved.

Realizing the inherent artificiality in the existing systematic concepts, Zakhvatkin (1937, 1940) presented a scheme of acarid classification in which the family Acaridae (then Tyroglyphidae) was extended so as to include several families of earlier authors. Zakhvatkin divided the acarids into two sub-families, both of which were further divided into tribes and genera. He separated his subfamilies through the relative positions of the cervical setae, size and condition of body and tarsal setae, size of the empodial claw, and the presence or absence of a caruncle. Tribal and generic characters were similar to those used later by Nesbitt (1945), with the position and modification of setae on tarsus I being of major importance in the separation of both tribes and genera. The resulting classification was, to quote Nesbitt, "the most satisfactory yet devised for demonstrating relationships in the family." The almost universal acceptance of Zakhvatkin's work by subsequent authors on the Acaridae tends to support Nesbitt's statement.

In 1955, Yunker proposed a classificaton of the supercohort Acaridiae, the group in which the Acaridae occurs. He observed that a natural separation of parasitic and non-parasitic forms could be justified on morphological grounds. Yunker divided the Acaridiae into the cohorts Acaridia (free-living forms), Psoroptidia (parasitic forms), and Ewingidia, a monogeneric intermediate form possessing morphological attributes of both the Acaridia and Psoroptidia. The presence of genital suckers in the Acaridia served to separate it from the remaining cohorts.

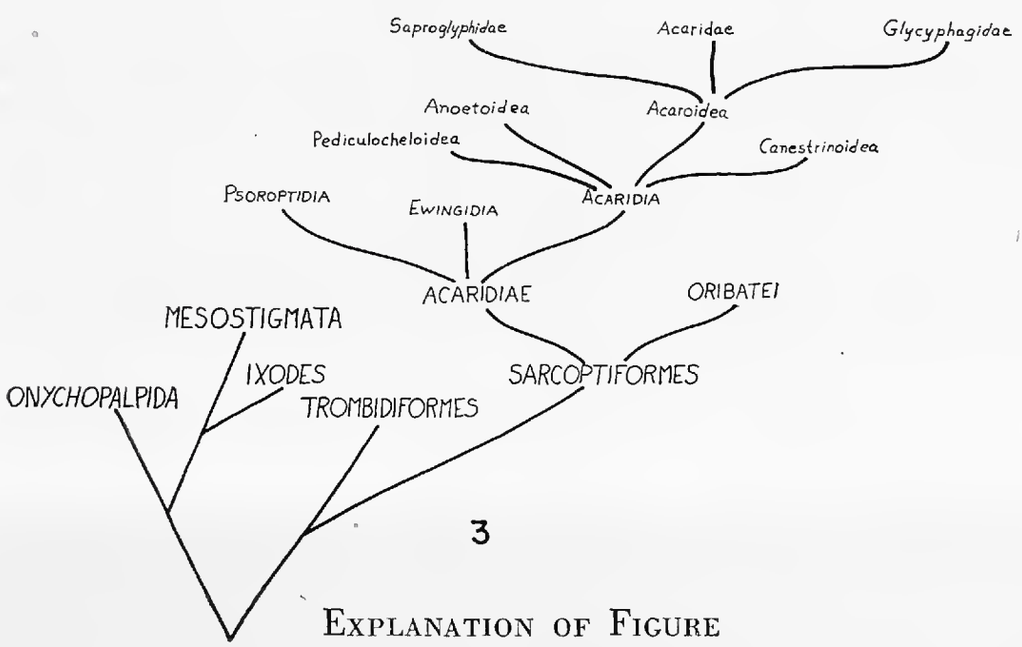
The Acaridia comprises four superfamilies (fig. 3), of which only the Acaroidea and the Anoetoidea possess the well-developed empodial claw so typical of members of the family Acaridae. The Anoetoidea differs from the Acaroidea, however, in usually having a transverse rather than a longitudinal genital slit, and in having highly modified palpi (Hughes 1958; Scheucher 1957).

While some authors prefer to think of the Saproglyphidae and Glycyphagidae as subfamilies in the family Acaridae (Türk and Türk 1957), these groups ordinarily are considered to have individual familial status. Unlike typical acarids which possess sessile claws, both saproglyphids and glycyphagids have distinct

pretarsi. In neither group do the males have anal or tarsal suckers as found on male acarids.

As presently conceived, the Acaridae consists of two subfamilies — the Acarinae Nesbitt and the Rhizoglyphinae Zakhvatkin. Structurally the Acarinae are of small size (400-700 microns) and are secondarily homeomorphic. The propodosomal setae (fig. 1) are well-developed and the legs are slender. The cervical setae are inserted on the anterolateral angles of the dorsal plate. Tarsus I is equal to or longer than the combined genu and tibia, and the tarsal setae are simple. The claws are quite weak but the caruncles are strong and distinct. The Rhizoglyphinae, on the other hand, are large mites (700-2000 microns) and are secondarily dimorphic, in that many of the body setae of the male are longer than those of the female. Some of the propodosomal setae may be reduced or absent (fig. 1). The cervical setae are inserted on the mediolateral borders of the dorsal plate. The legs are short and stout, with tarsus I rarely as long as the combined genu and tibia. Some of the tarsal setae are absent in rhizoglyphines, while others are modified into stout spines. The claws are robust, and the caruncles are poorly developed or absent.

As mentioned earlier, because of the absence of other major morphological features in the family, a great deal of emphasis has been placed on the setation and shape of tarsi I in the tribal and generic classification of acarids (fig. 4). It is impossible



EXPLANATION OF FIGURE

Fig. 3. Derivation of the Acaridae and related groups.

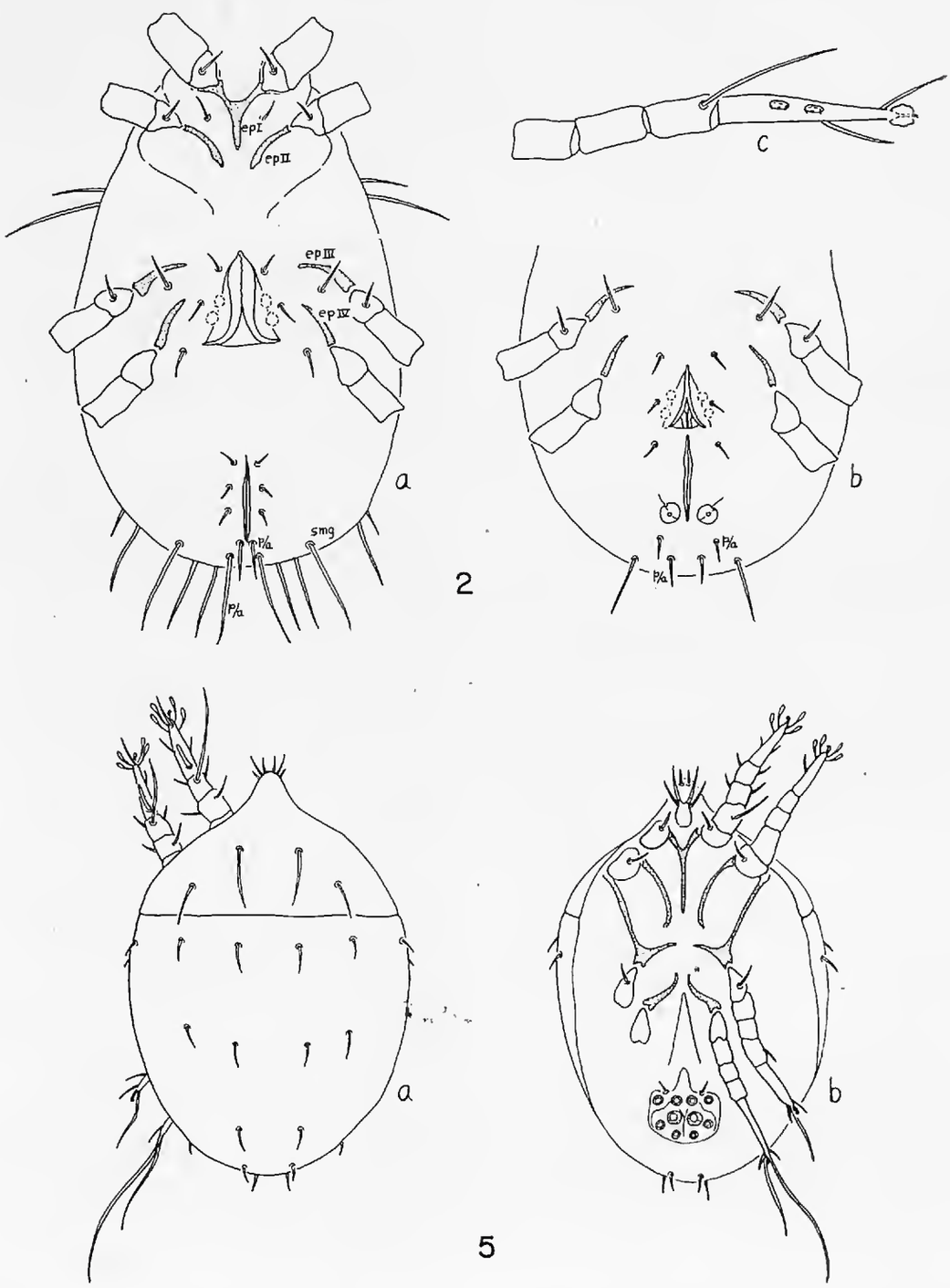
to say what the primitive condition of the tarsus is, but if we can assume the correctness of Oudemans' application of the theory of recapitulation to the Acaridae (1924), the genus *Tyrophagus*, subfamily Acarinae, appears to be the most primitive acarid group. Thus the condition of tarsus I of this genus might be considered primary for the family. Typically, then, tarsus I is equipped with 12 setae, five terminal spines, and an empodial claw and caruncle. In many species, various setae migrate to new positions on the tarsus and often change in shape or size. As these changes become more complex, the tarsal segment itself is seen to become shorter and stouter than in the original primitive condition. Correlated with these progressive alterations is a loss of some of the tarsal setae and an increase in the size of the empodial claw. By using this progression in conjunction with a correlated reduction or loss of body setae (fig. 1), Nesbitt (1945) has traced the relationships and phylogeny of acarid genera. He concludes, among other things, that the Rhizoglyphinae have evolved from the more primitive Acarinae.

Separation of the Acarinae and Rhizoglyphinae is possible on ecological as well as on morphological grounds. Acarids collected from low moisture substrates such as dried fruit or stored grain will almost invariably prove to be members of the subfamily Acarinae, while those acarids found in rotting bulbs, mold or any other high moisture habitat usually will be rhizoglyphines.

While acarids lack apparent defensive structures or the speed necessary to elude the many predators associated with them, still they persist in what oftentimes amounts to astronomical numbers, primarily by out-producing their enemies. Development from egg to adult in some Acaridae may take as little as eight days under conditions of optimum temperature and moisture, and females have been observed to lay over 100 eggs during their lifetimes (Garman 1937).

The acarid life cycle consists of the egg, larval, nymphal and adult stages ordinarily found in other mite groups. The eggs are large and heavily yolked, and are extruded by the female in a haphazard fashion as she crawls over the substrate on which she is feeding. The hatching larva is hexapod rather than octopod as in the succeeding stages. The larva soon becomes quiescent and molts to the first nymphal, or protonymphal, stage. The

protonymph feeds actively for a short time and, after a period of quiescence, transforms to the second nymph. The second nymph may be distinguished from the protonymph by a distinct size differential, as well as by differences in setal patterns. The second nymph resembles the adult in certain respects but sexual



Explanation of Figures

Fig. 2 a. Diagrammatic representation of the venter of female acarid mite. b. Diagrammatic representation of the venter of a male acarid mite. c. Leg IV of a male acarid mite, showing dorsal tarsal suckers. Fig. 5 a. Dorsum of a typical acarid hypopus. b. Venter of a typical acarid hypopus.

characters usually are not clearly defined until the adult molt is attained.

Quite often an extra nymphal stage occurs between the first and second nymphal instars. This form is referred to as the hypopus, or hypopal stage (fig. 5). Because of its time of occurrence in the nymphal sequence, the hypopus is commonly thought of as the second nymphal stage, or deutonymph. When the hypopal stage occurs, the typical second nymphal instar appears at the hypopal molt and is called the third nymph, or tritonymph. Morphologically, there is no observable difference between the typical second instar and the post-hypopal third instar.

The acarid hypopus is peculiar in that it differs so radically from the other acarid instars. It is round or oval in shape, usually darker in color than the preceding or succeeding stages, and is distinctly flattened dorsoventrally. As with the other nymphal forms, eight legs are present but they may be very short. The tarsi often are decorated at their distal ends with a number of elaborate setae. Mouthparts are absent, and the gnathosoma is represented by a tiny anteroventral body projection which may be the developing palpi. A plate of disc-like suckers is located on the ventral side of the hypopus, between or behind the fourth pair of legs. It is by means of these suckers that the hypopus adheres to passing insects, birds or rodents and is carried from one area to another.

Although the hypopal stage has been studied by scores of investigators, the reason or reasons for its sudden and erratic appearance has yet to be defined or proven. According to Michael (1901), eight different theories had been advanced as of the year 1884 concerning the origin of the hypopus. Various workers thought of the hypopus as an itch mite, a separate family of adult Acarina, an immature stage of the predatory genus *Gamasus*, an external parasite, or the male, or male and female, mites of the genus *Tyroglyphus*. In his presidential address before the British Microscopical Society in 1894, Michael described the observations of one worker, who decided that the hypopus was "a ferocious creature which attacked other mites from below, ate its way in, and then devoured its host, leaving only the skin." As pointed out by Michael, the absence of mouthparts in hypopi did not seem to trouble the investigator. Haller (1880) suggested that the hypopus is a protective covering which is produced

when the immediate food supply is exhausted and travel to a new location is necessary. Megnin (1873, 1874) believed the hypopus to be a heteromorphous adventitious nymph which develops only when adverse environmental conditions forces its dissemination. Michael confirmed Megnin's observations on the origin of the hypopus but found that formation of the hypopal stage is not necessarily dependent on environmental conditions. Other experimenters have attributed hypopus formation to moldy or dirty food media (Sokolov 1935; Scheucher 1957), to some unknown "innere Faktoren" (Türk and Türk 1957), or to the presence of two distinct types of nymphs in an average population, one of which will transform to hypopi regardless of environmental conditions, and one which passes into the hypopal stage only when deprived of suitable food (Schulze 1924). Türk and Türk (1957) and Scheucher (1957) feel that lack of moisture in the habitat is a factor which is of primary importance only in that the lack of moisture in the food medium prevents feeding, which in turn leads to hypopal formation.

It can be seen, therefore, that the hypopus question is still open to debate. Until an explanation can be found for this phenomenon, it may be assumed that the hypopus is a form primarily adapted for dissemination and for resistance to environmental inconstancies.

The hypopal stage is by no means limited to the Acaridae. The Saproglyphidae and Glycyphagidae in the Acaroidea, and the Anoetidae in the Anoetoidea have hypopal forms, as do certain of the feather mites in the superfamily Analgesoidea. Further biological studies probably will reveal that hypopi occur also in other Acaridae.

The purpose of this paper has been to summarize some of the more important taxonomic and biological aspects of the Acaridae. It should be realized that, because of the introductory nature of this discussion, many of the incidental phenomena relating to the family have not been included. Much has already been learned, but the Acaridae still offer a major challenge in the field of acarological research.

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HETEROGONY IN ANDRICUS CRYSTALLINUS BASSETT

(Hymenoptera: Cynipidae)

RICHARD L. DOUTT

University of California, Albany

Heterogony is suspected to exist in certain California species in the genera *Loxaulus* and *Antron* (Weld, 1957), and was proved to occur in *Dryocosmus* (Doutt, 1959), and *Callirhytis* (Lyon, 1959). Recent studies now include the genus *Andricus* among those exhibiting an alternation of generations.

Fallen leaves of the deciduous blue oak, *Quercus Douglasii* H. & A., bearing galls of *Andricus crystallinus* Bassett were collected on Mt. Diablo, Contra Costa Co., California on February 4, 1959. The fact that many of the galls showed emergence holes indicated a strong possibility that an alternating generation must exist for no leaves are on the trees in February and it seemed logical that the emerging females would not hibernate but instead would oviposit in some part of the dormant tree. Adult female *Andricus crystallinus* began emerging in the laboratory on February 5 and were caged on small dormant seedlings of *Q. Douglasii* on February 6. Oviposition occurred immediately in the tight leaf buds. The seedlings were then kept under daylight fluorescent lamps at a constant temperature of 78° F. and a relative humidity of 65%. Within five days the buds had opened and the leaves were rapidly expanding. On February 16 (ten days after oviposition) small, green, conical, monothalamous galls with laterally projecting cottony fibers (Figure 1) were evident on the leaves. On February 23 (17 days after oviposition) emergence of both male and female *Andricus* occurred. These adults of the bisexual generation, morphologically distinct from the unisexual or agamic generation of *A. crystallinus*, oviposited in the fully expanded leaves of the blue oak. It is from these eggs that the unisexual generation is formed in the pinkish, crystalline galls (Figure 2) which are so characteristic of this species in the summer months. In this experimental study the unisexual galls required 130 days to reach their full development on the leaves.

Since the bisexual generation has not been previously recognized, a brief description of the morphological and biological characteristics of these insects is appropriate.

ANDRICUS CRYSTALLINUS Bassett, bisexual generation.

Female.—Body entirely black, legs except coxae golden brown, coxae

black. Antennae dark brown except basal four segments which are golden. Maxillary and labial palpi pallid. Wings hyaline with slight infuscation near break in median vein, areolet small, veins smoky brown. Head viewed dorsally nearly as wide as thorax, but frons very short. Surface minutely punctate with scattered short hairs. Eyes and ocelli jet black. Antennae with 14 segments. Mesoscutum smooth, shining, parapsidal sutures well developed, no median suture. Scutellum dull, rugose, clothed with scattered hairs. Mesopleura smooth, shiny. Abdomen polished, few scattered hairs near petiole, larger than head and thorax combined, segments all visible dorsally, segment II forming less than one half of the abdomen, ventral spine slender, ovipositor brown. Tarsal claws toothed.

Male.—Color as in female except all antennal segments dark brown, abdomen near apex tends to be more brown than black as in female. Compound eyes large, reaching three-fourths way down head. Frons wider than female. Third antennal segments distinctly longer than fourth; (this is not so apparent in the female). Antennae with 15 segments. Abdomen smaller than thorax. Areolet present but small. Legs more slender in male than female.

The female of the bisexual generation is readily distinguished by color and size from the unisexual or agamic female which is basically reddish amber with black areas on portions of thorax, head, and abdomen, and of larger size. The mesoscutum of the agamic female is minutely punctate, dull, clothed with numerous white hairs. Segment II of abdomen is quite large, forming nearly 2/3 of the abdomen. Wings tend to be slightly infuscated near base.

Gall.—The galls in which the bisexual generation of *Andricus crystallinus* develops are found mostly on the upper surface of leaves, singly or in small groups. The color is green with straw colored apex. The gall has many long cottony, white hairs which project laterally and are longer than the greatest dimension of the gall. The gall is conical in shape, and distinctly canted to one side rather than being erect (Figure 1). The length is approximately 2.5 mm. with the base 1.0 mm. tapering to the tip. The position of the gall is indicated on the opposite (usually lower) side of the leaf by a pale colored elliptical swelling. Emergence takes place from uppermost side of the slanted, conical gall. The gall has a single chamber.

Host.—The insects described herein were reared on *Quercus Douglasii,* but since the unisexual generation has been taken on other white oaks including *Q. dumosa,* and *Q. garryana* it is likely that the bisexual form may be found on them also.

Plesiotypes.—The specimens used in the above description

Explanation of Figures

Figure 1. Typical gall produced by the bisexual generation of *Andricus crystallinus* Bassett. Gall measures 2.5 mm. in length and 1.0 mm. at base.

Figure 2. Cluster of galls produced by the unisexual generation of *A. crystallinus*. Dimension of this gall cluster approximately 15 mm. wide by 12 mm. high. Photographs by F. E. Skinner.

were reared in the laboratory at Albany, California, from agamic females obtained in galls collected at Mt. Diablo State Park, February 4, 1959. The series consisted of females and males. These specimens are housed in the collection of the Department of Biological Control, University of California, Albany.

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A GOOSEBERRY CAMBIUM MINER

(Lepidoptera: Opostegidae)

In May 1956, a pest new to western North America was found doing serious injury in a commercial gooseberry patch near Forest Grove, Oregon. The larvae were identified by the U. S. National Museum as *Opostega* sp. near *nonstrigella* Chamb. The larvae of the moth were making linear feeding mines in the cambium of the gooseberry shoots. One or both ends of the mines recurved in a half circle so that each mine made a pattern of two parallel lines from four to ten inches long. Injured gooseberry plantings infested by the miner have been found generally in the Willamette Valley of Oregon.

The original description of *O. nonstrigella* by Chambers[1] gave gave no host or type locality. Grossenbacher[2] described the injury and gave life history notes from the Hudson Valley of New York. He thought a fungus was involved in the injurious effects but could not confirm the relation. In 1919, Caesar[3] reported it as injuring gooseberries from Burlington, Ontario.—R. G. Rosenstiel, *Department of Entomology, Oregon State College, Corvallis.*

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[1] Chambers, V. T. 1881. New species of Tineina. Cin. Soc. Nat. Hist. Jour. 3(4):289-296.

[2] Grossenbacher, J. G. 1910. Medullary spots: a contribution to the life history of some cambium miners. N. Y. Agr. Exp. Sta. Tech. Bul. 15. Geneva.

[3] Caesar, Lawson. 1919. Insects as agents in the dissemination of plant diseases. 49 Ann. Rep. Ent. Soc. Ont. 1918:60-66.

TAXONOMIC AND DISTRIBUTIONAL NOTES ON SOME WESTERN SPIDER WASPS

(Hymenoptera: Pompilidae)

MARIUS S. WASBAUER

California Department of Agriculture, Sacramento.

The following study is based on material which I was allowed to examine through the kindness of the following individuals and the institutions which they represent: Mr. Jerry A. Powell, California Insect Survey, University of California, Berkeley (C.I.S.); Dr. E. S. Ross, California Academy of Sciences, San Francisco (C.A.S.); Mr. H. H. Keifer, Bureau of Entomology, California Department of Agriculture, Sacramento (C.D.A.). Material from my own collection (M.W.) was also employed.

Dipogon (Dipogon) leechi Wasbauer, new species

Female.—Length 5.6 mm. Forewing 4.5 mm. Head and body entirely dull, clothed with a rather long, dense, appressed pubescence, silvery with vague golden reflections on head, golden on pronotum, mesonotum and scutellum, elsewhere silver-gray, particularly long on abdomen. Appressed hairs of pronotum separated by an average of .3 their length. Integumental color black, antennae testaceous, first three segments infumated dorsally; mandibles distad of middle, front tibiae below and all tarsi testaceous; trochanters each with a narrow, apical ivory band on inner side. Integument minutely granulose, nearly impunctate. *Head:* slightly broader than long, facial distance .92 the transfacial distance; compound eyes somewhat convergent above, upper interocular distance .85 the lower interocular distance; ocelli in a compact, nearly right triangle, posterior ocelli nearer to each other than to compound eyes, postocellar distance .84 the ocello-ocular distance. Clypeus slightly convex, apical half with a number of irregularly spaced punctures, each giving rise to a long, apically directed, amber colored hair, apex trunctate. *Thorax:* posterior margin of pronotum broadly angulate; propodeum with a small depressed area on either side of the weakly impressed median longitudinal sulcus; wings nearly hyaline, forewing faintly infuscate through marginal and third submarginal cells, not infuscate at apex or over basal vein, microtrichiae not longer or more dense in infuscate areas than elsewhere, nervulus beyond basal vein by .15 its length, first recurrent vein meeting second cubital cell at its basal third, cubital vein meeting wing margin, second cubital cell nearly 1.4 the length of the third. *Abdomen:* first tergite with a few slender, erect hairs anteriorly.

Male. Unknown.

Holotype female, MILL VALLEY, MARIN COUNTY, CALIFORNIA, August 9, 1948 (Hugh B. Leech). The type is in the collection of the California Academy of Sciences.

A single specimen from Amortejada Bay, Isla San Jose, Gulf of California, Mexico, collected March 23, 1953 by P. H.

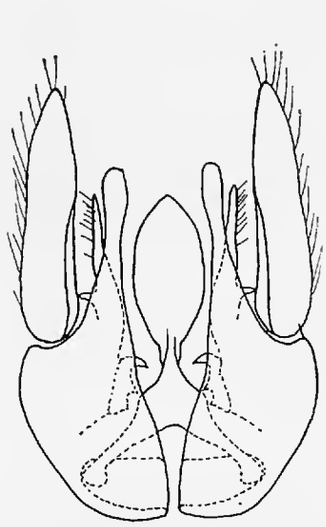
Arnaud (Sefton Orca Expedition) may be referable to *leechi*. It closely resembles the type but differs in the following details: appressed pubescence of face longer, more dense, forewings somewhat more strongly infuscate, posterior margin of pronotum more nearly arcuate, ivory bands on apices of trochanters lacking.

Dipogon leechi is probably most closely related to *D. brevis brevis* (Cresson) but differs primarily in the dull, strongly reticulate integument, long, rather sparse appressed hairs on the frons and vertex, by long, closely set, appressed hairs on the propodeum and first metasomal tergum and the scarcely infuscate forewing.

Dipogon (Dipogon) diablo Wasbauer, new species

Female.—Length 3.9 mm. Forewing 3.6 mm. Head, thoracic dorsum and abdomen dull, minutely granulo-reticulate, sides of thorax sub-shining; pubescence sparse over most of body, silvery with faint golden reflections on head, pronotum, and mesonotum, elsewhere silvery; appressed pubescence of head and pronotum no more dense than on remainder of body. Integumental color brown, the following areas suffused with blackish: head above antennae, fronto-clypeal line, first three and ultimate antennal segments, humeri, posterolateral margins of mesonotum, scutellum, postscutellum, metanotum, mesepisternum ventrally, coxae, femora and tibiae dorsally, and abdomen. *Head:* somewhat broader than long, facial distance .92 the transfacial; compound eyes noticeably convergent above, upper interocular distance .83 the lower interocular distance; ocellar triangle with the front angle slightly greater than a right angle; posterior ocelli nearer the compound eyes than to each other, postocellar distance 1.3 the ocello-ocular distance. Clypeus slightly convex, with a preapical row of larger punctures and a number of long, slender, apically directed hairs, apex subtruncate. *Thorax:* posterior margin of pronotum arcuate, but with a slight median notch; propodeum evenly convex posteriorly, without a median longitudinal sulcus; wings slightly infuscate over basal vein, a large diffuse, infuscate area apically, including marginal cell except apical third, apical half of first submarginal cell, first and second submarginal cells and third discoidal cell anteriorly; microtrichiae somewhat stronger in infuscate areas than between and basad of them; nervulus beyond basal vein by .6 its length; first recurrent vein meeting second cubital cell somewhat beyond its basal third, cubital vein reaching the wing margin, second cubital cell about 1.6 the length of the third. *Abdomen:* first tergite without erect hairs anteriorly.

Male.—Length 3.6 mm. Forewing 3.9 mm. Head and thoracic dorsum dull, minutely punctulate, the punctures contiguous, remainder of body subshining. Integumental color black, clypeus, antennae basally, mandibles apically, palpi, pronotum, forelegs and middle femora orange-colored, middle tibiae and tarsi and hind legs piceous. *Head:* lower face and clypeus with numerous long, decumbent, whitish hairs, vertex and occiput laterally and ventrally with a number of shorter, erect, proclinate hairs; ocellar triangle broad, the front angle greater than a right angle; lateral ocelli nearer to



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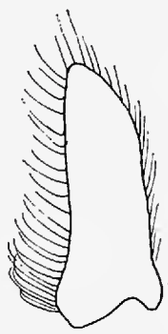

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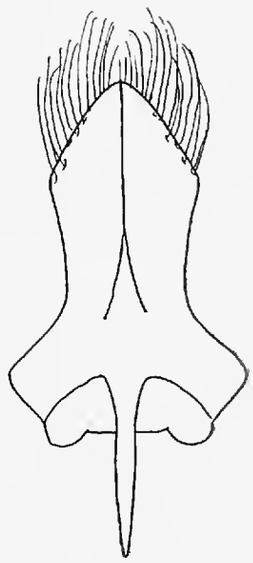

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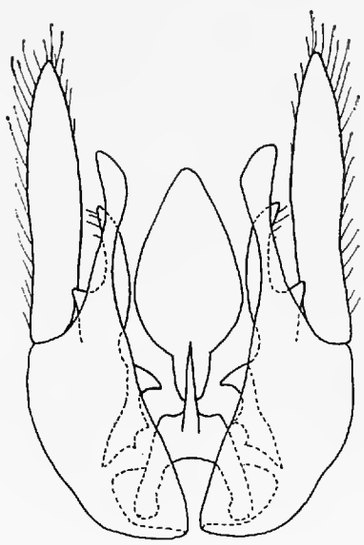

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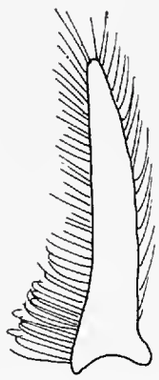

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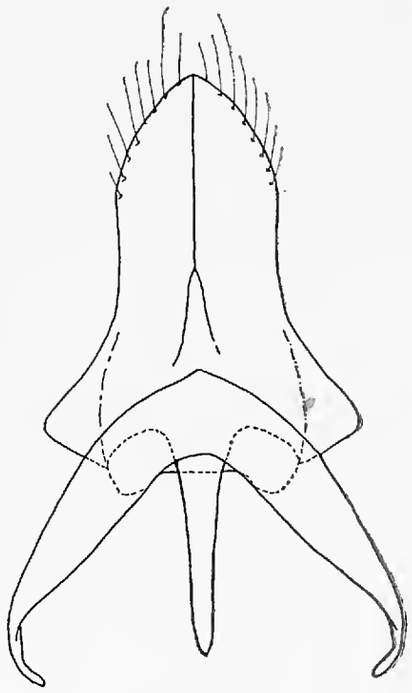

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Explanation of Figures

Figs. 1-3. *Dipogon* (*Dipogon*) *diablo* Wasbauer, allotype male. Fig. 1. Male genitalia, dorsal view. Fig. 2. Right paramere, exterior view. Fig. 3. Subgenital plate, ventral view (sternite VIII removed). Figs. 4–6. *Dipogon* (*Deuteragenia*) *calipterus nubifer* (Cresson), neallotype male. Fig. 4. Male genitalia, dorsal view. Fig. 5. Right paramere, exterior view. Fig. 6. Subgenital plate, ventral view.

compound eyes than to each other, postocellar distance 1.6 the ocello-ocular distance; front rather broad, middle interocular distance .63 transfacial distance; disc of clypeus evenly, not strongly convex, apex simple, subtruncate. *Thorax:* posterior margin of pronotum arcuate; scutellum convex, strongly raised above level of mesonotum; propodeum in profile with the slope nearly even from front to rear; forewing with a barely discernable infuscate spot over basal vein, a larger faint infuscation including proximal third of first submarginal cell, posterior half of marginal cell, second and third cubital cells, apical half of second discoidal cell, and a faint infuscation at apex of wing; nervulus beyond basal vein by .43 its length; hindwing with mediella between submediella and cubitella .93 the length of intercubitella. *Abdomen:* genitalia and subgenital plate as in figs. 1, 2, and 3.

Holotype female and allotype male, DANVILLE, CONTRA COSTA COUNTY, CALIFORNIA (F. X. Williams). Holotype August 12, 1949, allotype August 9, 1950. The types are in the collection of the California Academy of Sciences.

Dipogon diablo is the second known North American species belonging to the *graenicheri* group of Townes (U.S. Nat. Mus. Bull. 209, 1957, p. 138) and the female differs from *graenicheri* as follows: integumental color of abdomen entirely black, thorax variously suffused with blackish, thoracic dorsum and abdomen entirely dull, microtrichiae of forewing scarcely larger and denser in infuscate areas than elsewhere, infuscation diffuse, not well marked.

DIPOGON (DEUTERAGENIA) CALIPTERUS NUBIFER (Cresson)

Male.—Integumental color black, antennae ventrally, mandibles except at extreme base, palpi, posterolateral borders of pronotum, forelegs except coxa and trochanter, orange. Fore coxa suffused with orange posteriorly. Wings marked as in female. Genitalia and subgenital plate as in figs. 4, 5 and 6.

Neallotype male, El Toro, Orange County, California, September 1, 1959, ex. McPhail trap (C. Johnson) deposited at the California Academy of Sciences.

The male differs from *calipterus calipterus* (Say) in having orange markings on the pronotum. A male from El Cajon, San Diego County, California, August 10, 1959, collected by Klopfer (C.D.A.), differs from the neallotype only in having the orange pronotal markings more extensive.

Both males and females of this subspecies are attracted to baits and probably also to honeydew secretions. The majority of specimens before me have come from McPhail traps used in fruit fly detection.

Distribution—MEXICO. Vera Cruz: Orizaba, ♀, (Townes, 1957, U. S.

Nat. Mus. Bul. 209:125). California. Orange County: Garden Grove, ♀, (Townes, *ibid.*). El Toro, ♂, (Neallotype); same locality, ♀, X-13-1959, McPhail trap on orange tree (C. Johnson, C.D.A.). Atwood, ♀, X-1959, McPhail trap on orange tree (C. Johnson, C.D.A.). Modjeska, ♂, X-6-1959, McPhail trap on peach tree (C. Johnson, C.D.A.). Trabuco Canyon, ♂, X-27-1959, McPhail trap on orange tree (C. Johnson, C.D.A.). Yorba Linda, ♂, IX-18-1959, McPhail trap (C. Johnson, C.D.A.); same data, ♀, X-5-1959; same data, ♂, X-26-1959, McPhail trap on grapefruit tree. San Diego County: El Cajon, ♂, VII-10-1959, walnut twig (Klopfer, C.D.A.). Pala, ♂, X-1-1959, McPhail trap on sycamore (C. Johnson, C.D.A.). Rainbow Valley, ♂, X-16-1959, McPhail trap on orange tree (C. Johnson, C.D.A.); same data, X-23-1959. Sacramento County: Sacramento, ♀, IV-10-1959, on willow (G. Buxton, C.D.A.).

Aporus (Aporus) luxus (Banks)

In Bradley's excellent treatment of the subfamily Pompilinae (Trans. Amer. Ent. Soc., 70:23–157, 1944), *Aporus assimilis* (Banks) is considered a subspecies of *Aporus luxus* (Banks). The key provided for the separation of these subspecies involves the presence or absence of erect hairs on the front femora of the females. I have recently examined large series of *Aporus* in the collections of the California Academy of Sciences and the California Insect Survey and all females of *luxus (sensu lat.)* examined have a varying amount of erect hair on the femur. However, Bradley's subspecies concept appears to be valid and the material before me is about 75% separable on the basis of the following criteria:

Erect hair on front femur of female fine and very sparse, longer hairs on the outer side less than .25 the thickness of the femur in dorsal view; pubescence of antennal fossa silvery in certain lights..... ..... *luxus luxus* (Banks)

Erect hair on front femur of female stouter and more dense, longer hairs on outer side .25 to .40 the thickness of the femur in dorsal view; pubescence of antennal fossa not silvery, at most brownish to aurescent..... *luxus assimilis* (Banks)

I am unable to find constant differences in the males of the two subspecies and these must therefore be allocated by association.

Aporus luxus luxus (Banks)

This subspecies is characteristic of the Transition and Upper Sonoran life zones of southern California north to Marin County. The distribution is as follows:

California. Alameda County: Hills back of Oakland, ♀, X-3-1929 (E. C. Zimmerman, C.A.S.). Tesla, ♀, X-15-1948 (J. E. Gillaspy, C.I.S.). Contra Costa County: Mount Diablo, ♀, V-7-1939 (J. W. MacSwain,

C.I.S.). Orinda Cross Roads, ♀, IX-14-1953, flowers *Sambucus* sp. (M. Wasbauer, M.W.). Los Angeles County: Crystal Lake, 2 ♀♀, VI-29-1950 (P. D. Hurd, Jr., P. H. Timberlake, C.I.S.). Tanbark Flat, ♀, VII-13-1952 (J. W. MacSwain, C.I.S.). Marin County: Mill Valley, ♀, IX-1947 (E. S. Ross, C.A.S.). Monterey County: Carmel, ♀, X-5-1930 (L. S. Slevin, C.A.S.); same locality, ♀, VIII-25-1922, L. S. Slevin, C.A.S.); same locality, 2 ♀♀, X-2-1941 (L. S. Slevin, C.A.S.). Monterey, ♀, I-26-1930 (L. S. Slevin, C.A.S.); Pacific Grove, 2 ♀♀, X-29-1954 (M. Wasbauer, M.W.); same locality, ♀, X-13-1924, (L. S. Slevin, C.A.S.); same locality, ♀, IX-(14-16)-1920 (F. E. Blaisdell, C.A.S.). Paraiso Springs, ♀, XI-1-1930 (L. S. Slevin, C.A.S.). Plumas County: Meadow Valley, 4,000-7,000 ft., ♀, VI-8-1924 (E. C. Van Dyke, C.A.S.). Riverside County: Riverside, ♀, VI-10-1934 (A. J. Basinger, C.A.S.). Vandevanter Flat, San Jacinto Mts., ♀, VI-16-1940 (H. T. Reynolds, C.I.S.). Temecula, ♀, IV-11-1950 (P. D. Hurd, C.I.S.). Banning, ♀, VII-16-1950 (J. W. MacSwain, C.I.S.). San Bernardino County: Mill Creek Canyon, ♀, IX-24-1923 (E. P. Van Duzee, C.A.S.). San Diego County: Coronado Beach, ♀, 1890 (F. E. Blaisdell, C.A.S.). San Diego, ♀, X-24-1946 (W. W. Jones, C.A.S.). San Francisco County: San Francisco, 2 ♀♀, VII-(11-12)-1922 (F. X. Williams, C.A.S.); same locality, ♀, VI-28-1920 (F. X. Williams, C.A.S.); same locality, ♀, IX-1935 (E. S. Ross, C.A.S.); same locality, ♀, XI-12-1922 (C. L. Fox, C.A.S.); same locality, ♀, VI-1920, (F. X. Williams, C.A.S.). San Mateo County: Rockaway Beach, ♀, XI-12-1946 (W. E. Ferguson, C.I.S.). Nine mi. S. San Gregorio, ♀, XI-12-1946 (W. E. Ferguson, C.I.S.). Santa Clara County: Alum Rock Park, ♀, X-29-1951 (R. Williams, M.W.). San Antonio Valley, ♀, IX-14-1948 (P. D. Hurd, C.I.S.). Stevens Creek, ♀, V-28-1952 (D. Burdick, M.W.). Tuolumne County: Near Mather, ♀, VIII-13-1930 (E. C. Zimmerman, C.A.S.). Oakland Camp, ♀, X-2-1954 (M. Wasbauer, M.W.).

Lower California: 10 mi. N. San Ignacio IX-30-1941 (C.A.S.).

Aporus luxus assimilis (Banks)

This subspecies is found in the Upper Sonoran to Canadian life zones and is widespread in the Western States. The distribution is as follows:

British Columbia: Vernon, 2 ♀♀, VII-(4-7)-1947 (H. B. Leech, C.A.S.); same locality, ♀, VII-16-1947 (H. B. Leech, C.A.S.).

California. Alameda County: Berkeley, ♀, IV-21-1920 (E. C. Van Dyke, C.A.S.). El Dorado County: Pyramid Ranger Station, ♀, VIII-1-1949 (J. W. MacSwain, C.I.S.). Fresno County: Huntington Lake, 7,000 ft., ♀, VII-1927 (E. P. Van Duzee, C.A.S.). Mt. Kaiser, 9,000 ft., ♀, (F. C. Clark, C.A.S.). Humboldt County: Big Lagoon, 2 ♀♀, VII-11-1937 (E. P. Van Duzee, C.A.S.). Trinidad, 2 ♀♀, VI-6-1925 (J. O. Martin, C.A.S.). Inyo County: Antelope Springs, ♀, VII-11-1953, on *Chrysothamnus* sp. (J. W. MacSwain, C.I.S.). Big Pine Creek, 8,000-11,000 ft., ♀, VII-1-1929 (I. McCracken, C.A.S.). Lake County: Warner Lake, ♀, (C.A.S.). Lassen County: Hallelujah Jct., ♀, VII-12-54 (J. A. Powell, C.A.S.); same locality, ♀, VII-4-1949 (P. D. Hurd, C.I.S.). Near Butte Lake, Lassen Nat. Park, ♀, IX-13-1948 (C. D. MacNeill, C.I.S.). Marin County: Tomales Bay, ♀, VIII-14-1938 (E. C. Van Dyke, C.A.S.). Monterey County: Pacific Grove,

♀, X-29-1954 (M. Wasbauer, M.W.). Paraiso Springs, ♀, VII-15-1954 (O. and L. Bryant, C.A.S.). Nevada County: 7 miles E. Hobart Mills, ♀, VIII-26-1948 on *Chrysothamnus* sp. (J. W. MacSwain, C.I.S.). Placer County: Lake Forest, ♀, VII-14-1949 (E. G. Linsley, C.I.S.). Plumas County: 4 miles W. Quincy, ♀, VII-15-1949 (P. D. Hurd, C.I.S.). Meadow Valley, 4,000-5,000 ft., ♀, VII-2-1924 (E. C. Van Dyke, C.A.S.). San Bernardino County: Lake Arrowhead, ♀, VII-25-1932 (R. P. Allen, C.A.S.). San Francisco County: San Francisco, ♀, IV-28-1923 (F. X. Williams, C.A.S.); same locality, ♀, V-1925 (F. X. Williams, C.A.S.); same locality, ♀, VI-1920 (F. X. Williams, C.A.S.); same locality, ♀, VII-4-1922 (F. X. Williams, C.A.S.). Sierra County: Gold Lake, 2 ♀♀, VII-27-1921 and VIII-2-1921 (C. L. Fox, C.A.S.).

Idaho. Latah County: Moscow, ♀, VII-24-1925 (C. L. Fox, C.A.S.).

Oregon. Klamath County: Klamath Falls, ♀, VII-20-1922 (E. C. Van Dyke, C.A.S.). Clackamas County: Mt. Hood, near Gov't Camp, ♀, VIII-16-1939 (E. S. Ross, C.A.S.).

Utah. Cache County: Logan, ♀, VIII-12-1953 (E. S. Ross, C.A.S.).

Washington. Mt. Rainier National Park: Sunrise, ♀, VII-11-1934 (O. Bryant, C.A.S.). Pierce County: Ft. Lewis, 2 ♀♀, IX-14-1951 (R. O. Schuster, C.I.S.). Walla Walla County: Walla Walla, 2 ♀♀, VI-1936 (G. E. Bohart, C.I.S.). Whitman County: Pullman, ♀, VII-13-1925 (C. L. Fox, C.A.S.).

Localities where specimens intermediate between *luxus* and *assimilis* have been found are as follows: San Francisco, California, VII-11-1922 (F. X. Williams, C.A.S.); same data, VI-1920. Santa Cruz, California, VI-3-1919 (E. P. Van Duzee, C.A.S.). Near Gov't Camp, Mt. Hood, Oregon, VII-20-1937 (E. C. Van Dyke, C.A.S.). San Quintin, Lower California, V-9-1938 (W. E. Simonds, C.A.S.). Cabo San Lucas, Lower Califronia, III-16-1953 (P. H. Arnaud, C.A.S.).

Tastiotenia festiva Evans

Female, Rodeo, Hidalgo County, New Mexico, VIII-19-1958 (F. X. Williams, C.A.S.), on *Euphorbia*. This specimen differs from material collected at Borrego, San Diego County, California, the type locality, in the more deeply infuscated wingtips and the mesepisterna entirely black and the extensive black on the dorsal surface of the propodeum, extending to the basal portion of the mesocoxa. In addition, the middle and hind tibial spurs and all the tarsi are dark brown, nearly black.

Pompilus (Perissopompilus) phoenix Evans

Male, Mt. Diablo, Contra Costa County, California, VI-30-1952 (F. X. Williams, C.A.S.). This record is of interest since it represents the most northerly locality for *Pompilus phoenix*. The region is principally upper Sonoran in its faunal affinities, and may represent the northern periphery of the range of this species.

NEW SYNONYMY IN THE BUPRESTIDAE
(Coleoptera)

G. H. NELSON[1] AND W. F. BARR[2]

HIPPOMELAS, subgenus NANULARIA

Hippomelas Laporte and Gory, 1837, Hist. Nat. Icon. Ins. Coleop. Monog. Buprestidae, 1:92.
Nanularia Casey, 1909, Proc. Washington Acad. Sci., 11(2):172.
Ampheremus Fall, 1917, Ent. News, 28:68. *New synonymy*

A comparative study of the structure of a long series of the diminutive species *cylindricollis*, upon which the genus *Ampheremus* was based, has been made with examples of *Hippomelas (Nanularia) californica* (Horn), *H.(N.) brunneata* Knull and *H.(N.) cupreofusca* (Casey). This study has shown that the characters originally utilized by Fall in separating *Ampheremus* from *Nanularia, i.e.* cleft between the meso- and metasterna, structure of the maxillary palpi and the nature of the lateral margins of the pronotum are not of generic significance. Furthermore, no other structural features could be found that would justify the retention of *Ampheremus* as a distinct genus. Consequently, *Ampheremus* is here placed in synonymy with *Hippomelas* subgenus *Nanularia.*

HIPPOMELAS (NANULARIA) CYLINDRICOLLIS (Fall)

Ampheremus cylindricollis Fall, 1917, Ent. News, 28:69.
Hippomelas (Nanularia) inyoensis Van Dyke, 1942, Proc. California Acad. Sci., (4)24(3):112. *New synonymy*

The types of Fall's *cylindricollis* and Van Dyke's *inyoensis* have been studied by both writers. In spite of the fact that the former was collected at Palm Springs, California, and the latter approximately 200 miles north in an ecologically different area in the Owen's Valley, Inyo County, California, the two individuals are almost identical in structure, form and color. On the basis of this study *H. inyoensis* Van Dyke must be regarded as a synonym of *H. cylindricollis* (Fall).

[1]Department of Anatomy, College of Medical Evangelists, Loma Linda, California.
[2]University of Idaho, Moscow, Idaho.

AMBLYSEIUS SIMILOIDES, A NEW PREDACIOUS MITE FROM CALIFORNIA

(Acarina: Phytoseiidae)

T. C. BUCHELOS AND A. EARL PRITCHARD
University of California, Berkeley

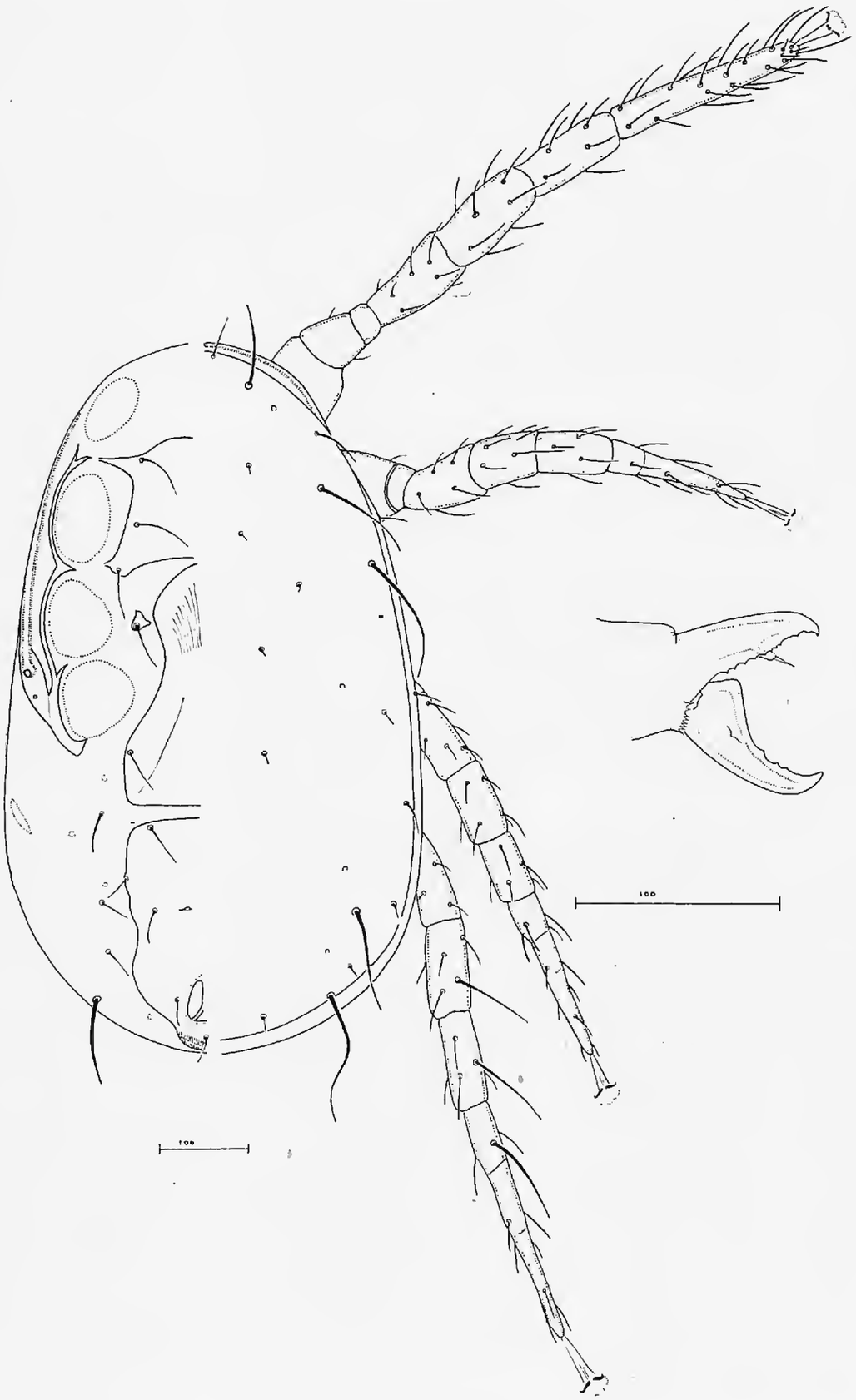
Amblyseius similis (Koch) is a name currently applied to a phytoseiid mite that is common in Europe. This name also has been applied to a similar mite that is common in California (Chant, 1960), but this species is certainly distinct from the description of *A. similis* given by Dosse (1958) from Germany. A name is needed in connection with the publication of biological studies of the California species, and it is here described.

Amblyseius similoides Buchelos and Pritchard, new species

Amblyseius similoides resembles *A. similis* in that the first and fourth lateral setae are long, with the second lateral seta shorter than the third; the fifth lateral seta is shorter than the sixth; and there are four pairs of dorsocentral setae in addition to the vertical setae. However, in *A. similoides* the spermatheca bears a very slender cervix in contrast to the broadly cup-shaped cervix of *A. similis*.

Female (Fig. 1).—Chelicera with chelae moderately developed, the movable digit with several fine teeth and the fixed digit multidentate. Dorsal shield smooth, with five pairs of pores; vertical setae moderately developed and second lateral similar in length, the third lateral longer, and the first and fourth laterals still longer: fifth, seventh, and eighth laterals very small, the sixth lateral definitely longer; ninth lateral very long, smooth; four pairs of dorsocentrals and anterior mediolaterals all very small; posterior mediolaterals long. Peritremes reaching vertical setae. Ventri-anal plate slender, the pre-anal portion longer than broad and similar in width to epigynial plate; three pairs of widely separated pre-anal setae and a pair of transverse pores between caudal pair; three pairs of para-anal setae; two pairs of slender metapodal platelets, the anterior pair much smaller. Sternal plate broader than long, the metasternal platelets separate. Spermatheca (Fig. 2) with cervix longer than broad at base, narrowing to the sharply bent atrium. Genu IV with a stout, pointed macroseta and six short setae; tibia IV with a stout, pointed macroseta and five short setae; basitarsus IV with a stout, pointed macroseta and three short setae. Lenth of idiosoma 432μ; greatest width of body 270μ.

Male (Fig. 3)—Spermatodactyl with shaft slender, the distal portion abruptly bent, bearing a slight protuberance at the bend, and tapering somewhat to a slightly widened apex. Dorsal shield with chaetotaxy similar to female. Ventri-anal plate with three pairs of widely separated setae and a



EXPLANATION OF FIGURES

Fig. 1, dorsal and ventral aspects of female of *Amblyseius similoides*, with enlargement of chelae.

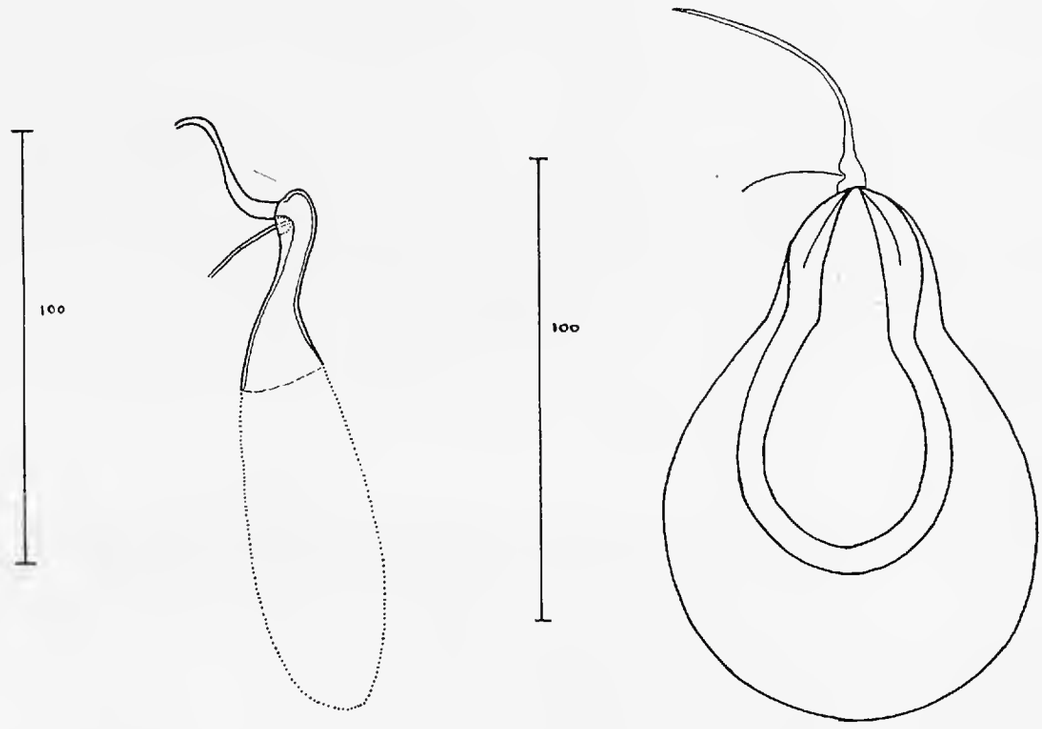


Fig. 2, left: spermatheca of *Amblyseius similoides;* right: spermatheca of *A. similis* (after Dosse).

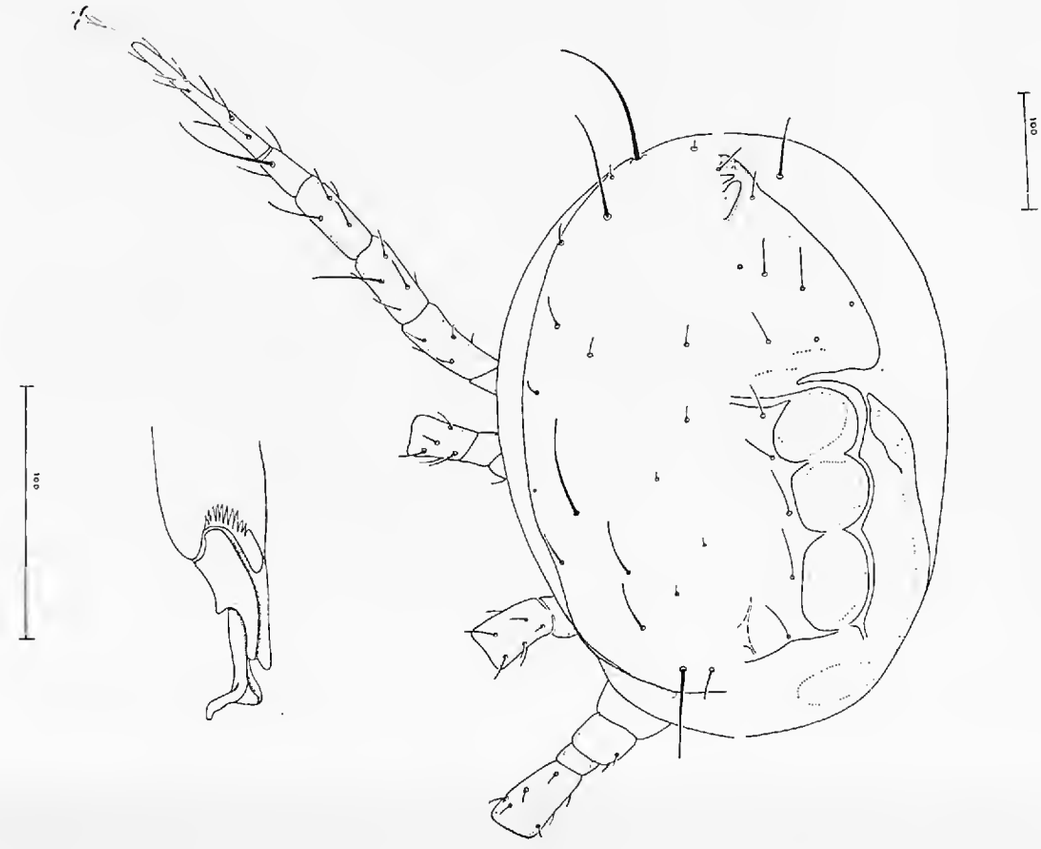


Fig. 3, dorsal and ventral aspects of male of *Amblyseius similoides,* with enlargement of spermatodactyl.

pair of pores between and just posterior to caudomedian pair of setae. Length of idiosoma 302μ; greatest width of body 194μ.

Holotype female, REDWOOD CITY, SAN MATEO COUNTY, CALIFORNIA, September 2, 1957 (R. O. Schuster), on walnut; type No. 2728 in the U.S. National Museum.

Paratypes.—Forty-five females, 27 males, Redwood City, California, September 2 , 1957 (R. O. Schuster), on walnut.

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BUTTERFLIES OF NORTH DAKOTA, by D. Lovell Puckering and Richard L. Post. North Dakota Agricultural College, Fargo, North Dakota. 56 pages (not numbered consecutively), text figs. Paper, $1.50. Published May 23, 1960.

This booklet treats the 91 species of Papilionoidea known for the area with a key and gives a short diagnosis, foodplant information, and distributional data for each. The work is primarily that of Mr. Puckering, a graduate student at North Dakota Agricultural College, and is based on activities of the North Dakota Insect Survey, supplemented by local private collections.

Although they include an annoying number of misspellings, the keys appear to be very useful, since they include black and white photographs of both upper and lower wing surfaces of each species figured on the same page with the couplet concerned. The authors were fortunate in securing the cooperation of a number of specialists, and they have used the numerical and nomenclatorial systems of the perennially delayed dos Passos Checklist. Therefore, the most recent name combinations are used, but evidently several new combinations are thus proposed in a taxonomic publication of limited distribution.

In general very little data are available about the distribution of insects in North Dakota, and this publication offers detailed information on the butterflies of the area, together with a short essay on the major physiographic elements affecting distributional patterns. Some interesting aspects of the transition or overlap zone between eastern and western entities in several species groups (*e.g.*, the *Papilio glaucus-rutulus* complex) are brought out. In addition, range extensions for a number of species are given.

The book will be of value to collectors in the northern midwest area, to students of butterfly systematics, and to persons interested in insect distribution in North Dakota and the relationship of the fauna of that area to other parts of North America.—JERRY A. POWELL, *University of California, Berkeley.*

DISTRIBUTION OF APHODIINAE IN OREGON

(Coleoptera: Scarabaeidae)

MANOHAR LAL JERATH
Oregon State College, Corvallis

The present report gives distribution records for the species of the subfamily Aphodiinae which have been found to occur in Oregon. Five species of Aegialiini, twenty-nine species of Aphodiini and three species of Psammodiini are included in this study. The species in each tribe are listed alphabetically and Leng catalog numbers, where available, are given after the author's name, in parentheses. Four species of *Aegialia* and twelve species of *Aphodius* are recorded from Oregon for the first time.

This work is based on a study of adults collected in Oregon and now in the collections of M. H. Hatch, University of Washington, Seattle, Washington; Joe Schuh, Klamath Falls, Oregon; L. G. Gentner, Medford, Oregon; Department of Entomology, Oregon State College, Corvallis, Oregon. Specimens which had not been determined by authorities in the group or which could not be determined with certainty by the writer were submitted to O. L. Cartwright of the U. S. National Museum for identification. Localities are listed alphabetically with the present location of specimens in various collections indicated by symbols as follows: H (M. H. Hatch), S (Joe Schuh) and G (L. G. Gentner). Unless designated, localities given in the following list refer to specimens in the Oregon State College collection.

TRIBE AEGIALIINI

Five species of the genus *Aegialia* have been found in Oregon. Four species, *Aegialia lacustris* LeConte, *A. latispina* LeConte, *A. conferta* Horn, *A. punctata* Brown and one subspecies, *A. crassa insularis* Brown are here reported for the first time. All the species of this tribe occurring in Oregon are represented in the Oregon State College collection.

AEGIALIA BLANCHARDI Horn (13100)

Common species in the Oregon coastal sand dune area throughout the year, Bandon, Cannon Beach, Ft. Clatsop, Dayton (also H), Kiger Island near Corvallis, Florence (also H), Gearhart, Sunset Beach, 6 m. N. of Gearhart, Hauser, Heceta Beach, Newport, Pacific City (also H), Oceanlake, Waldport (also S).

AEGIALIA CONFERTA Horn (13102 a)

Rare species. Kiger Island near Corvallis, Dayton, Forest Grove.

AEGIALIA CRASSA CRASSA LeConte (13105)

Rare species. Cannon Beach, Hauser (also H), Newport.

AEGIALIA CRASSA INSULARIS Brown (13105 a)

Rare species. Collected only at Neskowin.

AEGIALIA LACUSTRIS LeConte (13099)

This species, which is not very common, has only been collected in the sandy areas under the willows at Kiger Island near Corvallis and along a creek, 12 miles west of Adel.

AEGIALIA LATISPINA LeConte (13103)

Rare species. Kiger Island near Corvallis.

AEGIALIA PUNCTATA Brown (13102 b)

This species was collected in the sand dunes bordering Fossil Lake, during May 1957, where it was fairly abundant.

TRIBE APHODIINI

Twenty-nine species of the genus *Aphodius* have been taken in Oregon. The following 12 species are here recorded for the first time: *Aphodius alternatus* Horn, *A. consociatus* Horn, *A. denticulatus* Haldeman, *A. luxatus* Horn, *A. neotomae* Fall, *A. nevadensis* Horn, *A. phaeopterus* LeConte, *A. rectus biformis* Motschulsky, *A. sparsus* LeConte, *A. subaeneus* LeConte, *Aphodius* sp. 1 and *Aphodius* sp. 2.

APHODIUS ALEUTUS Eschscholtz (13122)

A very abundant species in deer droppings at high altitudes during summer. Crater Lake (H), Dayton (H), Hubbard (H), Mary's Peak near Corvallis (also H), Pamelia Lake, about 3,000 ft., Wallowa Lake (H).

APHODIUS ALTERNATUS Horn (13140)

Rare species. Cornelius, Corvallis, Forest Grove, Seaside, Steen Mts. above Fish Lake (H).

APHODIUS CASEYI Saylor

Listed from Oregon in the fifth supplement of Leng's catalog (Blackwelder and Blackwelder, 1948). The writer has never found this species in any of the material examined.

APHODIUS COLORADENSIS Horn (13179)

Occurs at high altitudes. Specimens in Hatch collection from Bone Springs and Tollgate Road (Blue Mts.).

APHODIUS CONGREGATUS Mannerheim (13121)

Leng (1920) lists the distribution from California to Alaska. The writer has not seen any specimens from Oregon.

APHODIUS CONSOCIATUS Horn (13138)

Bear Springs, Wasco Co. (H), Cornelius, Corvallis, Cabbage Hill east of Pendleton, Dreu Reservoir, Lake Co. (H), Forest Grove (H), Monzoita (H), Mottet Ranger Station (H), Seaside.

APHODIUS CRIBRATULUS Schmidt (13144)

Rare species, Corvallis, McMinnville (H), Peavine Ridge near McMinnville (H).

APHODIUS sp. near DECIPIENS Horn (13150)

Rare species. Meacham (H).

APHODIUS DENTICULATUS Haldeman (13112)

Fairly common species at high altitudes. Durkee (H), Forest Grove (H), Gold Center Camp, Blue Mts. (H), Medicine Hat (S), McMinnville (H), Suckers Creek Canyon (H), 30 m. south of Vale.

APHODIUS DILATICOLLIS Saylor

Rare species only known from Eugene and McMinnville. In Hatch collection.

APHODIUS DISTINCTUS (Mueller) (13184)

Common species in cow droppings. Ashland (also G), Baker (H), Cascadia, Cayuse, Corvallis (also H, S), Durkee, Freewater, Hood River, Klamath Falls (S), Kiger Island near Corvallis (S), McMinnville (also H), North Howell Prarier (S), Scappose, Talent (also G), Weston, Woodburn.

APHODIUS FIMETARIUS (Linnaeus) (13119)

A very abundant species in cow dung throughout Oregon. In a few localities specimens were collected from horse manure.

APHODIUS GRANARIUS (Linnaeus) (13131)

Adults of this species are fairly abundant in cow dung in Oregon. Larvae usually found in soil and may be feeding on roots of vegetation. Arlington (H), Blitzen Valley, Harney Co., Blooming, Bone Springs, Blue Mts. (H), Brogan, Cornelius, Corvallis, Dairy (H), Durkee (H), Eugene (also H), Forest Grove, Golden (H), Klamath Falls (G), McMinnville (H), Ochoco National Forest (H), Owyhee Canyon, Pendleton, Portland (S), Redmond, Salem, Talent (also G), Weston.

APHODIUS HAMATUS Say (13109)

Adults occur commonly at high altitudes in dung. Larvae

known to injure turf in pastures in Ruby Valley, Nevada. Oregon localities: Clackamas Lake (H), Devils Garden, Modoc National Forest, Gold Center Camp, Blue Mts. (H), 15 miles west of Klamath Falls, Lake Creek (H), Lakeview (H), Steen Mts., Swin (also S), Tollgate (H).

APHODIUS INUTILIS Horn (13187)

Leng (1920) lists this species from Oregon, but the writer has not seen any specimens.

APHODIUS LUXATUS Horn (13181)

Rare species. Forest Grove (H), McMinnville (H), Scio.

APHODIUS sp. near MILITARIS LeConte

Rare species, only known from McMinnville (H).

APHODIUS NEOTOMAE Fall (13125)

Rare species, occurring in wood rat nests. Three specimens collected at Corvallis.

APHODIUS NEVADENSIS Horn (13142)

Rare species, one specimen from Tumalo. From Hatch collection, now in U. S. National Museum.

APHODIUS OPACUS LeConte (13146)

Not very abundant, found usually in deer droppings at high altitudes. Bone Springs, Blue Mts. (H), Bald Mts. (H), Cornucopio (H), Gold Center Camp, Blue Mts. (H), Mary's Peak near Corvallis, McDonald Forest near Corvallis, Medford, Summit Prairie, Wallowa Lake (H), Yamhill Co. (H).

APHODIUS PARDALIS LeConte (13185)

Larvae of this species are injurious to golf turf (Ritcher & Morrison, 1955), fairly abundant when found. Albany, Corvallis (also S), Eugene, McMinnville (H), Scio (S).

APHODIUS PECTORALIS LeConte (13126)

Common species in deer droppings in wooded areas. Cannon Beach (H), Corvallis (H), Dayton (H), Gronite (H), eight miles north of Gold Beach on Rogue River, Mary's Peak near Corvallis, McDonald Forest near Corvallis, Peavine Ridge near McMinnville (H).

APHODIUS PHAEOPTERUS LeConte (13154)

Occurs at high altitudes. From Lewis Peak and Tollgate (Blue Mts.). In Hatch collection.

APHODIUS RECTUS BIFORMIS Reitter

Found in cow droppings. Willamette Valley localities Port-

land, McMinnville (H), Corvallis. Recently introduced, according to Hatch.

APHODIUS SPARSUS LeConte (13205)

A common species in wood rat nests, Corvallis, McMinnville (H).

APHODIUS SUBAENEUS LeConte (13139)

This species occurs at high altitudes. Known from Steen Mts. above Fish Lake (H).

APHODIUS VITTATUS Say (13132)

A very abundant species in cow dung all over the state.

APHODIUS species 1.

One specimen collected on snow at Mary's Peak near Corvallis by Frank Hasbrouck during June, 1955. Specimen now in U. S. N. M. (According to Cartwright, in a personal communication, it is a new species.)

APHODIUS species 2.

One specimen collected in deer droppings at Mary's Peak near Corvallis by Ritcher and Jerath on August 9, 1955, and now at U. S. N. M. (According to Cartwright, in a personal communication, it is a new species.)

TRIBE PSAMMODIINI

Two species of the genus *Psammodius* and one species of *Pleurophorus* are recorded in the literature as occurring in Oregon.

PSAMMODIUS OREGONENSIS Cartwright

A very common species in the Oregon coastal sand dunes, found in large numbers.

PSAMMODIUS CAELATUS (LeConte) (13245)

Not a very common species. Bandon (also U. S. N. M., p. 447), Hauser, Newport, Taft (U. S. N. M.) and Woods (S).

PLEUROPHORUS CAESUS (Creutzer) (13255)

Not usually common but Hinman and Larson (1935: p. 149) collected 131 specimens in flight traps during 1931 and 1932 in the Willamette Valley: Bakers Creeks (H), Forest Grove (H, S), Grants Pass (H), McMinnville (H), Portland (S), St. Helens (S).

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ZOOLOGICAL NOMENCLATURE: NOTICE OF PROPOSED USE OF PLENARY POWERS IN CERTAIN CASES (A.[N.S.]45)

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. 17, Parts 9/11 to be published on 16 September 1960.

(3) Validation of the generic name of *Macronema* Pictet, 1836 (Insecta, Trichoptera) Z.N.(S.)706
(7) Suppression of the family name NIRMIDES [Leach, 1815] (Insecta, Mallophaga) Z.N.(S.)1400
(8) Designation of a neotype for the nominal species *Pediculus dentatus* Scopoli, 1763 (Insecta, Mallophaga) Z.N. (S.)1394
(10) Suppression of the generic name *Liotheum* Nitzsch, 1818 (Insecta, Mallophaga) Z.N.(S.)1399
(11) Suppression of the specific name *pellarini (Aedipoda)* Le Guillou, 1841 (Insecta, Orthoptera) Z.N.(S.)1436

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 16 December 1960. Each comment should bear the reference number of the case in question. Comment received early enough will be published in the *Bulletin of Zoological Nomenclature.* Those received too late for publication will, if received before 16 December 1960, be brought to the attention of the Commission at the time of commencement of voting.

All communications should be addressed to: Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London, S.W. 7, England.—W. E. CHINA, *Assistant Secretary, International Commission on Zoological Nomenclature.*

OBSERVATIONS ON THE BIOLOGY OF CHILOXANTHUS STELLATUS (CURTIS) AND C. ARCTICUS (SAHLBERG)

(Hemiptera: Saldidae)

ROBERT L. USINGER
University of California, Berkeley

The genus *Chiloxanthus* is Holarctic in distribution. *C. stellatus* is recorded in the Drake and Hoberlandt catalogue (1950) from Northern Europe, Siberia, Alaska, and Canada. *C. arcticus* is listed in the catalogue as a synonym of *pilosus* (Fallen) from Europe, Siberia, and North Africa. According to Linnavuori (1953), "*Ch. arcticus* is, however, a good species . . . *Ch. arcticus* is best distinguished from *Ch. pilosus* by the light, short, smooth hair-covering of the upper surface, while *Ch. pilosus* always has a long, dense, black and upstanding hair-covering . . . Also the living habits and the distribution are dissimilar. *Ch. pilosus* is halobiontic, being common on salty seashores of North and Central Europe, and known also from the salty biotopes near Halle in Germany . . . *Ch. arcticus*, being a high boreal insect, occurs only on the shores of the Arctic Sea both in Europe and Siberia. It is not confined to salty water, but may extend far into the tundra, too."

In the summer of 1955 an opportunity was presented to study Saldidae at various places along the Arctic Coastal Plain while primarily engaged in other studies with headquarters at the Arctic Research Laboratory at Point Barrow, Alaska. Thanks are due to the authorities of the Arctic Institute of North America and the Office of Naval Research for support of this work.

CHILOXANTHUS STELLATUS (Curtis)

This species was found only in the vicinity of Point Barrow but must be widespread in the tundra at high altitudes, (Weber, 1950). It occurs only on the well drained parts of high polygons and was never found, with diligent searching, in such saldid habitats as mud flats, low areas in the sphagnum, or along the ocean beaches or lake shores. On July 18 and 26 nymphs and adults were common; nymphs were in the first and second instars. At the same locality P. D. Hurd collected adults from June 30 to August 7 in 1952 and 1953 and last instar nymphs from June 17 to July 21, 1953.

Britton (1958) describes the tundra landscape including "high" and "low" polygons and "ditch-like troughs" between as

follows: "All substrate materials, with the possible exception of those underlying the deeper lakes, are perennially frozen to depths of several hundred feet below a surface zone that thaws each warm season. This zone, called the active layer, develops most rapidly, extending to depths of several feet, in well-drained sands and gravels. The poorly drained ditchlike troughs which conspicuously pattern the ground thaw very slowly, to depths of only a few inches each season."

It is evident that *Chiloxanthus stellatus* occupies the "active layer" described above and that it thus avoids the chilling effects of the permafrost for perhaps eight weeks each year. The length of nymphal instars is not known but the species is large and the season is short. With nymphs of all stages occurring during the summer and adults and last instar nymphs found "early" in the summer, it seems certain that adults and nymphs overwinter in a semi-frozen state, protected only by the thin layer of a few inches of tundra vegetation.

Chiloxanthus arcticus (Sahlberg)

I am indebted to Linnavuori for comparing my Alaskan material with specimens from Finland and Siberia. *C. arcticus* was collected only on mud flats along the shores of the Kuk River inland from Wainwright. The distance from Pt. Barrow is about 100 miles in a southwest direction. The saldids were found July 30, 1955 on the hard packed open mud flats where the fresh water of the Omalik River empties into the broad Kuk Inlet. Collecting was difficult because there was a strong wind and the bugs found shelter in mud cracks. There were many more nymphs than adults, and the nymphs were in stages two to five. *C. arcticus* was never found on salt water beaches or inland on the tundra.

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FIRST NORTH AMERICAN HOST RECORD OF THE ADVENTIVE WASP, CHRYSIS FUSCIPENNIS BRULLE

(Hymenoptera: Chrysididae)

GERALD I. STAGE

University of California, Berkeley

While making investigations on the parasites and associates of *Osmia clarescens* Cockerell (Megachilidae: Apoidea) utilizing empty mud nests of *Sceliphron caementarium* (Drury), a number of cells containing larvae of a chrysidid wasp were discovered. The adults which emerged in the laboratory were subsequently identified with the kind assistance of Karl V. Krombein as *Chrysis (Chrysis) fuscipennis* Brullé. This adventive wasp was first recorded in North America by Krombein (1956) when three females and one male were collected in Washington, D.C. Its Old World distribution encompasses the regions of Indo-Malaya, Syria, Palestine, Egypt, Asia Minor, China and Australia (Bingham, 1903, p. 468). The only other record from this continent concerns a single female taken in a house at Galt, Sacramento County, California (Harper, 1959).

The *Sceliphron* nests which contained the chrysidids were collected January 31, 1959, from under the roof, eaves, and along the upper walls in several old buildings at a ranch two miles northwest of Turlock, Stanislaus County, California. It was then noted that perhaps a dozen of the closed mud cells had a single conical puncture (about 1.5–2 mm. in diameter at the surface, narrowing to about .5 mm. internally) near the middle of the exposed side. Internal examination of the cells in the laboratory showed a one hundred per cent correlation between the presence of the chrysidid parasitoid and the punctures on the outside of the cells. A brown plug could be seen sealing the constricted inner third of the puncture and extending internally over the cell wall to form a thin circular convex flange about two millimeters in diameter. It appears to be formed from a dried liquid (probably of secretory origin) placed there upon withdrawal of the chrysidid's long ovipositor.

The relationship between *Sceliphron* and *Chalybion californicum* (Saussure) has long been known, and the cells taken over by *Chalybion* can in all cases be recognized on close examination (Rau, 1928, pp. 443–444). In the parasitized cells the original mud cap was apparently undisturbed, which would not

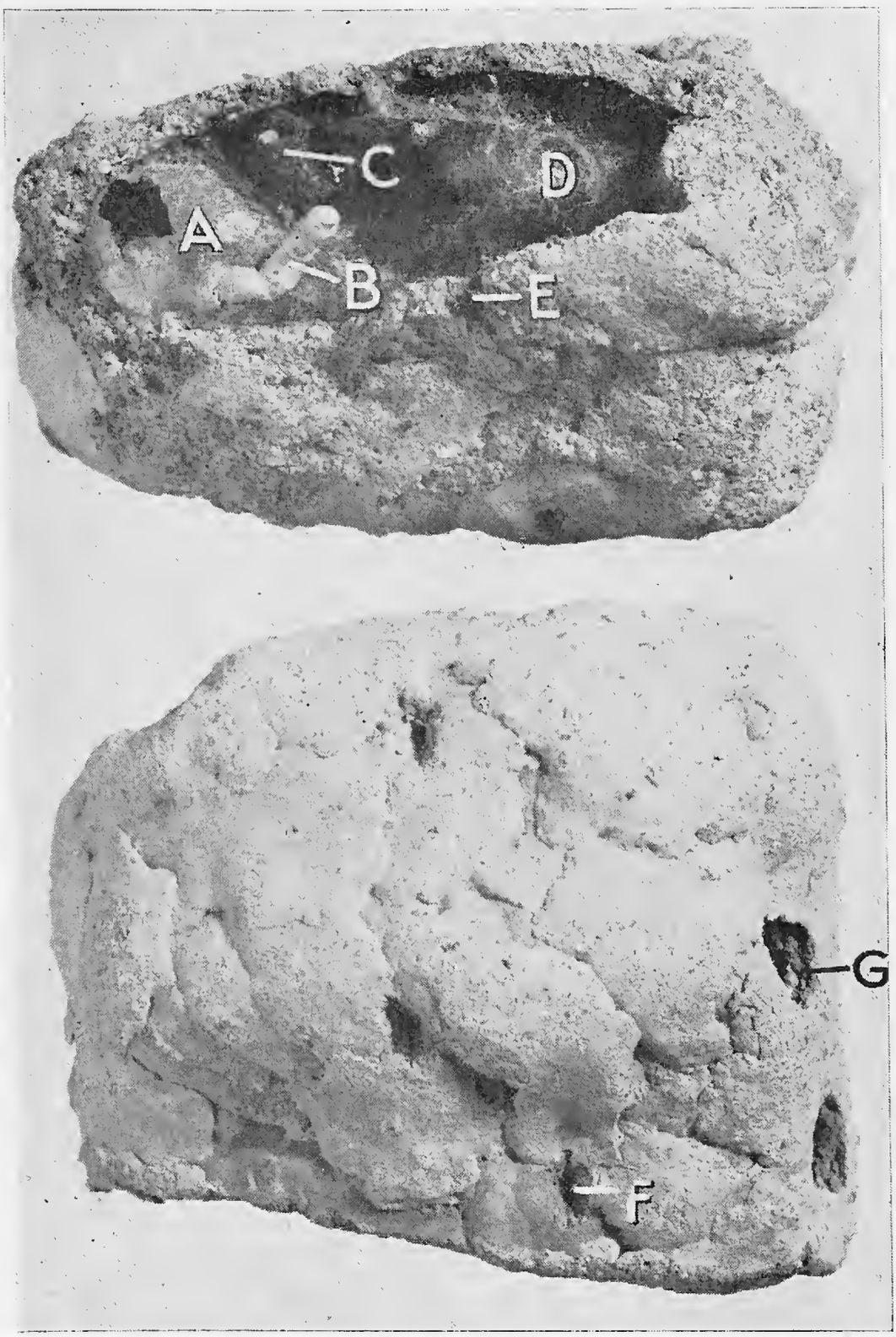
be the case if the cells had been previously appropriated by *Chalybion*. In a high percentage of cases, however, the unparasitized cells from the same locality yielded *Chalybion*, but this does not necessarily indicate that this wasp is not parasitized by the chrysidid.

In the parasitized cells the only host remains were the specialized meconial portion (*i.e.*, the chuck and chuck chamber of Shafer, 1949, pp. 30–31), and the anterior portion of the cocoon. Using the criteria set forth by Rau (1915), it was determined that all the identifiable cocoons were those of *Sceliphron*, thereby confirming the conclusion formed on the basis of the condition of the cell caps.

When first examined, the chrysidid larvae were mature and had already constructed cocoons. These pale yellow, parchment-like, semi-transparent cocoons were constructed of fine silk, and conformed closely to the lower third or fourth of the mud cells. In two instances the sphecid chuck chambers were in their normal position in the lower end of the cell with the chrysidid cocoon formed closely in contact above. In the remaining examples, the chuck chamber had been moved from its normal position and was variously placed near the center of the cell with the chrysidid cocoon then constructed below it. The creamy white meconium of the chrysidid was placed on the exposed top of the cocoon. It was extremely variable in shape, ranging from botuliform to globular. The nearly intact top half of the sphecid cocoon filled the top of the cell.

The cocoons were kept in the laboratory at room temperature, and the chrysidids (nine males and one female) emerged between April 6 and May 5, 1959. The sphecids, kept under the same conditions, all emerged between April 5 and April 23, 1959. All but two of the cells containing chrysidids were opened for observation in January. The parasitoids from these remaining two emerged through holes chewed through the mud caps at the top of the cells. All the chrysidid larvae, except those removed for preservation, successfully completed their development.

It seems apparent from these observations that *Chrysis fuscipennis* Brullé is a parasitoid on *Sceliphron caementarium* (Drury), attacking the mature larvae overwintering within their cocoons. Oviposition is accomplished by making punctures in the mud walls of the sphecid cells, which are then sealed upon withdrawal



Explanation of Figure

Nests of *Sceliphron caementarium* (Drury) parasitized by *Chrysis fuscipennis* Brullé. A. *Chrysis* cocoon. B. *Chrysis* meconium. C. *Sceliphron* chuck chamber. D. Remains of *Sceliphron* cocoon. E. Oviposition punctures of chrysidid (x-section). F. Oviposition punctures of chrysidid (external view). G. *Chrysis* emergence holes.

of the ovipositor. The chrysidid overwinters as a larva and emerges in the spring by chewing through the mud cap on the cell.

One of the previous Old World host records for *Chrysis fuscipennis* concerns a vespid, *Eumenes conica* (Fabricius), in India (Bingham, 1899). In this case the chrysidid gained access to the cell through the unsealed entrance in a brief absence of the provisioning vespid. Bingham's later examination of the nest showed two different semi-transparent eggs, the larger stuck on the cell wall while the other was on the single provisioned caterpillar. Bingham (1903, p. 468) also cites *Eumenes petiolata* Fabricius and *E. flavopicta* Blanch as hosts of this parasitoid in India.

It may be of interest to note that at this same Turlock ranch a determined effort was made to collect every *Sceliphron* nest that could be located in September of 1956. No evidence of *C. fuscipennis* was apparent at that time upon careful examination of all the approximately one hundred and fifty cells obtained. Also the author and Roy R. Snelling had collected Aculeate Hymenoptera intensively in the general Turlock area during the preceeding five years (occasionally examining *Sceliphron* nests) without ever turning up this species of parasitoid. This may indicate that the advent of the chrysidid into the Turlock area occurred after 1956.

The author wishes to express his appreciation for the helpful criticism and generous assistance of C. Don MacNeill, California Academy of Sciences, and Jerry A. Powell, University of California, Berkeley, in the preparation of this article.

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TWO NEW SPECIES OF CATOCHINE GALL MIDGES, WITH A NEW KEY TO GENERA OF THE CATOCHINI

(Diptera: Cecidomyiidae)

A. EARL PRITCHARD
University of California, Berkeley

Gall midges belonging to the tribe Catochini are considered rare. Many of the known adults have been taken only in cold weather off snow. It is of considerable interest to learn that two species occur in the western United States, and both of these are described as new.

A female of *Anocha spinosa* (Felt), collected at Itasca Park, Minnesota, January 7, 1954, flying at -20° F. over snow, was forwarded to me by Dr. C. E. Mickel. A study of this and two other specimens recorded from Minnesota showed that the wing membrane possesses macrotrichia. Therefore, my key to genera of the tribe Catochini (1947) was erroneous, and a new key is presented. The genus *Catarete* Edwards is not included in this key because the antennal sensoria have not been described. The wing of *Catarete* is distinctive in that vein R_5 is very close to the costa and terminates before the apex of the wing.

KEY TO THE GENERA OF CATOCHINI

1. R_1 reaching costa before end of wing; flagellum without forked sensoria 2
– R_1 reaching costa at apex of wing; flagellum with forked sensoria 4
2. Flagellar segments each with a pair of budlike sensoria 3
– Flagellar segments with only sensory setae and rods ..... *Anocha* Pritchard
3. Medial fork with branches even; costa extending nearly to M_1 ..... *Neocatocha* Edwards
– Medial fork with branches very uneven, the upper branch sigmoid; costa ending just beyond R_5 ..... *Tritozyga* Loew
4. Wing membrane without macrotrichia or nearly so ..... *Eucatocha* Edwards
– Wing membrane with fairly dense macrotrichia ..... *Catocha* Haliday

Eucatocha betsyae Pritchard, new species

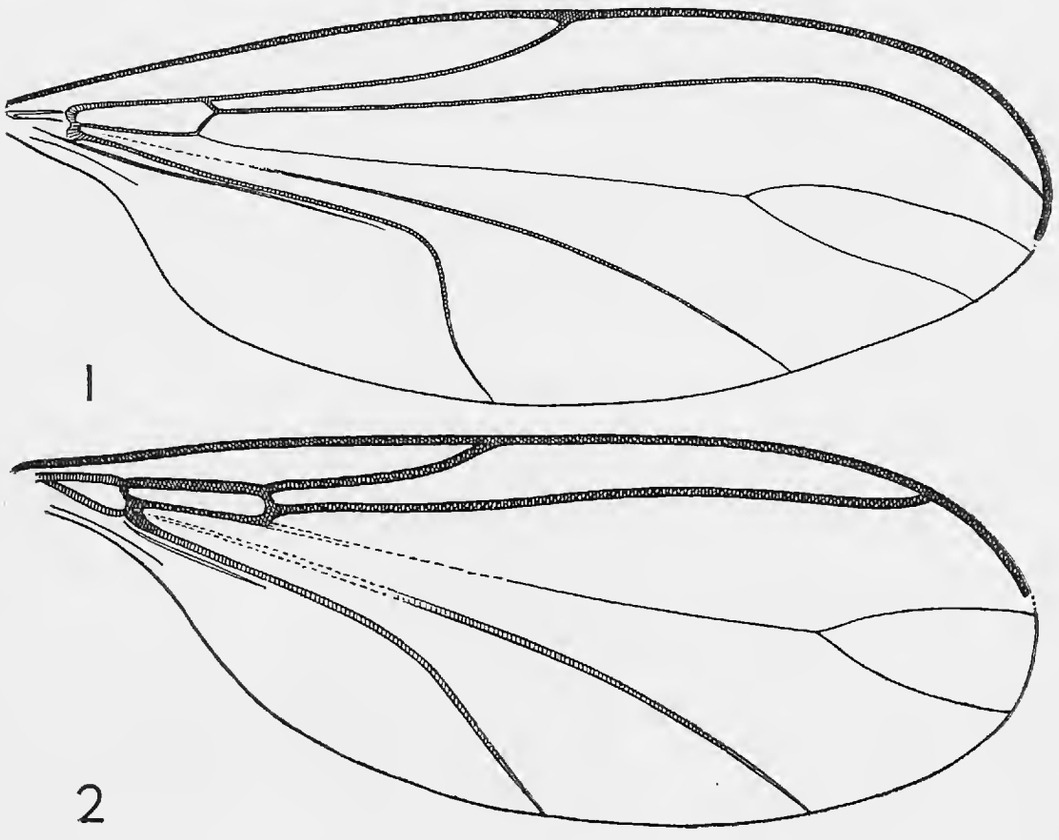
(Figure 1)

Eucatocha betsyae differs from *E. barberi* (Felt), the only

other species in the genus, in that the cubitus is sharply bent and sigmoid. The female of *Eucatocha* is here described for the first time.

Female.—Eyes with dorsolateral bridge about four facets wide. Antenna with 2+9 segments; first flagellar segment very long, the ninth very small, the other flagellar segments each with a distal neck, about three-fourths as long as the enlargement and the enlargement beyond the whorl of tactile setae set with long sensory setae and four sensoria each bearing 4 to 7 long, tapering branches. Palpus with four segments, the first with blunt sensory setae on inside. Wing (fig. 1) membrane with only a few macrotrichia at tip; R_5 strongly curved distally and reaching tip of wing; medial fork plain, moderately long; Cu sharply bent and sigmoid. Claw with 4 or 5 short medio-lateral teeth; empodium short, with three pairs of hairs. Ovipositor with lamellae articulated to tenth tergite; spermathecae two, rather large, rounded. Length of wing, 5.3 mm.

Holotype female, STRAWBERRY, TUOLUMNE COUNTY, CALIFORNIA, December 27-31, 1958 (Betsy Schneider and Earl Pritchard); in the Pritchard collection at the University of California, Berkeley. Paratypes: Four females, same data as holotype; one female, Sagehen Creek (11 miles north of Truckee), Nevada Co., California, December 4, 1954 (E. M. Brock).



EXPLANATION OF FIGURE

Fig. 1. Wing of *Eucatocha betsyae.*

Fig. 2. Wing of *Anocha celesteana.*

This species is named in honor of Mrs. Betsy Schneider. The specimens were found flying in the afternoon, over snow, at temperatures around freezing.

Anocha celesteana Pritchard, new species

(Figure 2)

Anocha celesteana differs from *A. spinosa* (Felt), the only other species in the genus, in that the eye bridge is devoid of facets laterally and the cubitus is simply and evenly curved.

Female.—Eye with lateral bridge widely devoid of facets. Antenna with 2+8 segments; flagellar segments elliptical with very short distal necks, each with the distal sensory setae blunt. Palpus with four segments. Wing (fig. 2) with C extending to break just before M_1; R_1 not reaching middle of wing; R_5 slightly sigmoid, widely separated from costal margin and reaching it well before end of wing; M_{1+2} weak and its branches short and weak; M_{3+4} strong but free; Cu evenly rounded. Claws slightly curved, with very small mediolateral teeth; empodium rudimentary. Spermathecae deeply pigmented. Length of wing, 2 mm.

Holotype female, Cheyenne, Wyoming, September 24, 1947 (D. G. Denning); in the Pritchard collection at the University of California, Berkeley.

This species is named in honor of Mrs. Celeste Green.

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PARATRIATOMA FROM THE MAINLAND OF MEXICO

(Hemiptera: Reduviidae)

Raymond E. Ryckman and Lee E. Olsen[1]

College of Medical Evangelists, Loma Linda, California

The monotypic genus *Paratriatoma* consists of the nominate species, *hirsuta* Barber (1938). This species was described from the Grand Canyon of the Colorado River. Subsequent to 1938 this kissing-bug has been reported in the Colorado and Mojave Deserts of California, southern Nevada and central Arizona by Wood (1941), Usinger (1944) and Ryckman (1953). On ecological grounds this species should be expected to occur in the desert regions of northern Sonora.

[1]This investigation was supported in part by a grant (E-173) from the National Institutes of Health, U.S. Public Health Service.

On April 11, 1960, the authors, assisted by A. E. Ryckman and J. V. Ryckman, examined several *Neotoma* lodges on Highway No. 2, 81 miles west of Sonoyta, Sonora, Mexico. Two of the lodges studied contained *Paratriatoma hirsuta*. Nest No. 1 contained five, fifth instar nymphs; and from nest No. 2 the following were collected: nine, fifth instar nymphs and twenty-one adults. The two nests combined contained seventeen adult males; four adult females; ten male and four female fifth instar nymphs. In addition to the above bugs, four adult males and one fifth instar female nymph of *Triatoma rubida* (Uhler) were collected from nest No. 2. It would appear that the spring emergence from fifth instars to adults was well underway on April 11 when these collections were made.

The nests of *Neotoma* in this area were usually found to be associated with mesquite and ironwood trees. These wood-rats inhabited relatively extensive underground burrows beneath their stick lodges. The *Paratriatoma hirsuta* nymphs collected from nest No. 1 were one and one-half feet below the surface of the ground and approximately three feet from the entrance to the underground burrow. The nymphs were in a mass of cactus spines in the burrow.

This is a southern extension of the known range of *Paratriatoma hirsuta* by approximately 150 miles and the first report of this genus on the mainland of Mexico.

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RHIZOMARIA PICEAE HARTIG NEW TO AMERICA

(Homoptera: Aphidae)

F. C. HOTTES
Grand Junction, Colorado

Because the species discussed herewith has been placed in almost as many genera as times it has been mentioned in aphid literature the generic name first used with it is retained in this brief note.

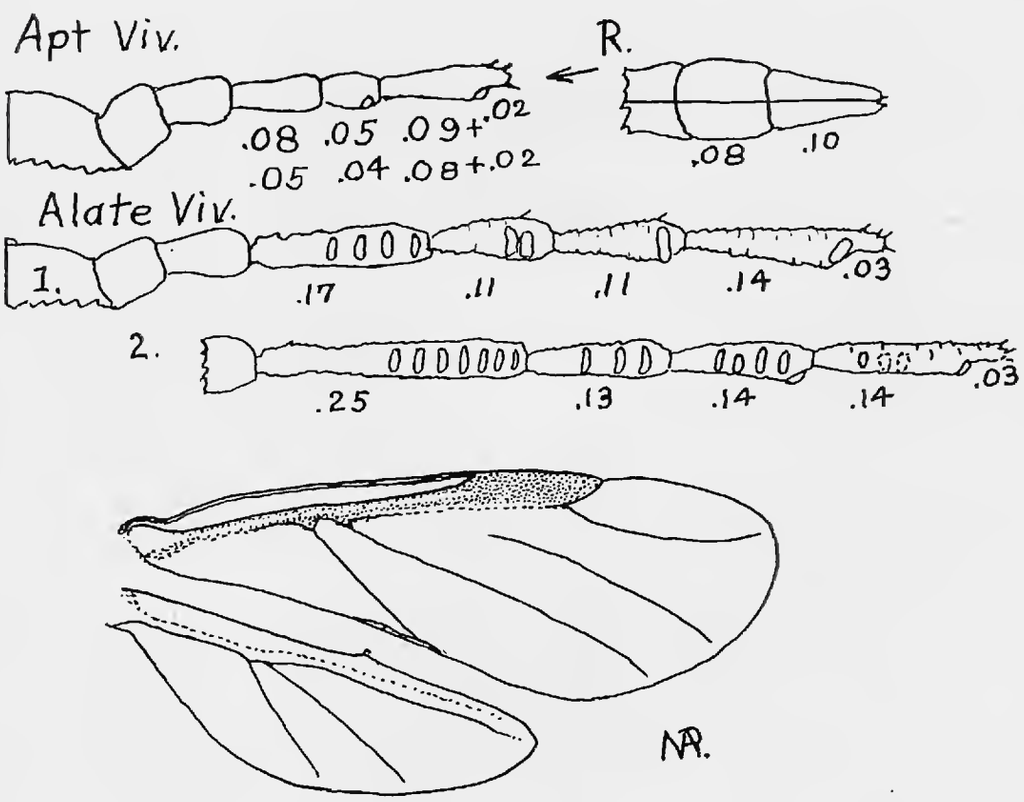
In 1953 while weeding under a blue spruce tree, my hoe brought up a small rootlet surrounded by a mass of flocculent matter. I could not associate this material with aphids although I suspected them, nor could I identify the root, or locate more flocculent matter. In June of 1959 I bought several small trees of *Picea pungens* from a local nursery, they in turn having purchased them from a nursery in Delta, Colorado where the plants had been grown from seed. The trees were in gallon cans. Upon removing the trees from the cans I at once noted the same flocculent matter I had seen in 1953 and was able to associate it with aphids. From this material I have been able to rear many apterous viviparous females and two alate specimens. The two alate specimens differ from each other and may not belong to the same species.

I could not associate the specimens with species known to me, or identify them from descriptions in the literature. Material was sent D. Hille Ris Lambers who determined it as the species described by Hartig in 1857 as *Rhizomaria piceae*. A search of the literature was then made. Baker (1920) placed *Rhizomaria* as a synonym of *Pemphigus* Hartig. Only one reference to *piceae* under this genus was found, and this species does not appear to belong to this genus because of the rather large wax glands on the thorax of the alata and the apparent absence of cornicles in this form. Use of Baker's keys fails to place this species in *Pemphigus* but more nearly in the genus *Prociphilus* Koch.

I strongly suspect that we need further information concerning this species before we can correctly place it generically and for this reason treat it in the genus proposed for it by Hartig.

The genus *Rhizomaria* was proposed by Hartig in 1857, not 1856 as reported by Börner (1952), for the species *piceae* described at the same time. Hartig's description of the genus is very brief, and is based upon the structure of the sensoria. His description of *piceae* is not good, and is in error in his reference

to "two staff-shaped honey tubes" on the males which he did not have. Tullgren (1909) placed *piceae* in the genus *Pemphigus* and cited a paper I have not seen by Jacobi (1905) who placed it in *Rhizomaria.* Theobald (1929) provisionally placed *piceae* in the genus *Pachypappella* Baker. Börner (1932) placed *piceae* in the genus *Pachypappa* Koch and looked upon it as a synonym of *Pachypappa vesicallis* Koch. Börner (1952) and Börner and Heinze (1957) did likewise. Baker (1920) placed *Pachypappa* as a synonym of *Pemphigus.*



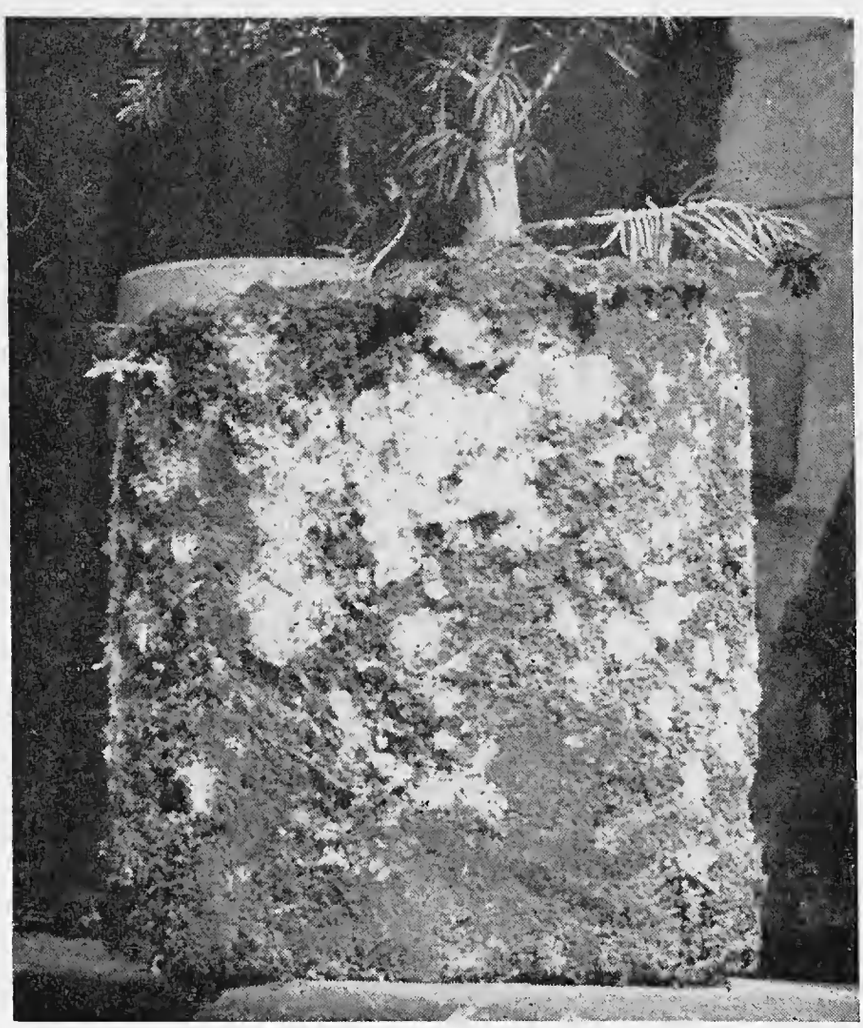
EXPLANATION OF FIGURES

Rhizomaria piceae Hartig: apterous viviparous female, antenna and rostrum; viviparous female, antenna forms, wings.

The apterous forms of this species are extremely small and pale in color except for two dusky areas on the head separated by a clear median line. Cornicles have not been noted. Apterous specimens produce an abundance of flocculent material far in excess of that which would be expected from their numbers. This material arises from the posterior region of the dorsum of the abdomen and takes the form of flat ribbon-like material which extends some distance beyond the abdomen. It is white and at times bluish. Specimens taken in December had a distinctly

different secretion from those taken in the summer. The secretion was not at all flocculent, nor ribbon-like but rather thread-like and surrounded the specimens much like a cocoon.

It was decided not to plant the trees but rather to use them for rearing additional specimens. Several methods were tried for rearing, which permitted frequent observation with a minimum amount of disturbance to the roots. It was found that the aphids



EXPLANATION OF FIGURE

Rhizomaria piceae Hartig: flocculent material on roots of *Picea pungens.*

did not tolerate a soil which retained water. Therefore adequate drainage had to be provided and care used in the application of water. The method of rearing which gave best results was as follows. The trees were removed from the cans and the sides of the root mass covered with a band of aluminum foil. The bottom of the soil mass was left uncovered. The tree was then planted in peat moss in a large clay pot. To observe the aphids one had only to remove the tree from the pot and unwind the aluminum band.

Aphids on trees planted directly in peat moss did not follow the roots into the moss, the moss first having to be removed, a process which took time, when the aphids were observed.

The paper in which Hartig published his descriptions appears to be extremely difficult to locate. It is interesting to note that this paper is not listed in Index Litteraturae Entomologicae by Horn and Schenkling. Perhaps this is due to the fact that Hartig's paper is without a title and in the form of a letter which begins "My esteemed Friend," and ends "Your devoted friend, Theodor Hartig."

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NOTES ON THE OCCURRENCE OF FOUR ADVENTIVE EARWIGS IN ARIZONA

(Dermaptera)[1]

W. L. Nutting

University of Arizona, Tucson

Schlinger *et al.* (1959) have recently reported on the firm establishment of the predaceous earwig, *Labidura riparia* (Pallas), in agricultural desert valleys of southern California. Since this insect had previously been known from Florida irregularly westward only into Texas, it seems pertinent to document its occur-

[1] Arizona Agricultural Experiment Station Technical Paper No. 539.

rence in Arizona. The records are taken from 26 specimens which have been routinely deposited in the collection of this department by several different entomologists. No attempt has been made to work out details of the biology or distribution of this earwig in Arizona.

The distribution is, as might be expected, near the centers of major irrigated farming areas in the south: Yuma, April to November, 1952, 1954 to 1957; Phoenix, March 1958; Chandler, September 1959; Casa Grande, April 1958; Tucson, April 1955, 1958, September 1959. The first Arizona specimen was taken at Yuma on July 24, 1952, by D. M. Tuttle, Entomologist at the University of Arizona Agricultural Experiment Station, Yuma. It is interesting to note, and perhaps not merely coincidental, that this record is but 55 miles farther east and four months earlier than the first published Californian collection. As in California also, no further records are available until 1954. In spite of the rather intensive and continuing survey which is carried on in the agricultural areas of southern Arizona, it is surprising that almost no specimens of this conspicuous insect were taken to the eastward until 1958. Although the evidence is purely circumstantial, it does point to Calexico and Yuma as possible foci of introduction with subsequent spread through commerce northward and eastward. Isolated collections from Puerto Peñasco and Guaymas, Sonora, Mexico, in 1959 may be worth noting, but will probably generate little more than speculation concerning their relation to the California and Arizona populations of this insect.

Gurney (1950) and Schlinger *et al. (op. cit.)* have mentioned the African earwig *Euborellia cincticollis* (Gerst.) as another relatively recent (1946) adventive in California along the lower Colorado River. From the Arizona records in our collection, a rather similar case might be made for this insect as well. It was first taken at Yuma, on September 24, 1949, and again in 1950 and 1955. Subsequent collections are as follows: Florence, 1951, 1955; Mesa, 1952, 1955, 1956; Hassayampa and Arlington, 1955; Tucson, 1958; and Chandler, 1959. Hubbell and Wallace (1955) have also reported on collections of *E. cincticollis* from Tempe in 1951 and 1952. Although no detailed observations have been made on this earwig, some of the specimens were swept from alfalfa by G. D. Butler of the Department of Entomology, and others were taken in houses, motels and at lights.

Hubbell and Wallace *(op. cit.)* further mentioned collections of the closely related, but apterous, *Euborellia annulipes* (Lucas) from Tempe and Scottsdale in 1951. The following records of this Tropicopolitan earwig from our collection show that it had become rather widely established here much earlier: Tucson, 1922; Buckeye, 1932; Yuma and Mesa, 1939; Nogales, 1947; and Sells, 1954. It is now extremely common in residential and irrigated areas in the warmer parts of the state. Indeed, Hebard cited records from Texas as early as 1904 (1917); Sinaloa, 1916 (1922); and Baja California, Mexico, 1921 (1923); California, 1885 (1917) and from Phoenix, Arizona, during or before 1917 —no date given (1917).

The European earwig, *Forficula auricularia* (Linnaeus), has long been known from many cities on both the Atlantic and Pacific coasts, but has apparently not hitherto been recorded from Arizona. Although it may have reached Arizona much earlier, our collection contains only three adult specimens taken at Phoenix in March, 1958. The seeming lack of records and the very recent notice of this conspicuous and troublesome earwig certainly do not attest to a firm establishment here as yet. However, these specimens perhaps presage the spread of yet another adventive earwig, at least in the irrigated areas of the state.

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A SYSTEMATIC STUDY OF NORTH AMERICAN PRIONONYX

(Hymenoptera: Sphecidae)

F. D. PARKER

University of California, Davis

Since the general work of Fernald (1907) on Sphecini, the only systematic paper dealing with North American *Prionony*x was that of R. M. Bohart (1958). The latter described one new species and presented a key to the genus in which the females of *P. thomae* (Fabricius) and *pubidorsum* (Costa) were separated for the first time. A further study under Bohart's direction has revealed additional characters of value and has made it necessary to remove one species from synonymy.

The conformation of the clypeus was used by Bohart to separate the females of *thomae* and *pubidorsum*. Although this is a valid method, it was found that the palpi offered much better characters. In *thomae* the maxillary palpus is more than twice as long as the labial palpus, whereas in *pubidorsum* the two palpi are about equal in length (figs. 7, 8).

Closer examination of *pubidorsum* specimens from many parts of North America revealed the presence of two specific entities. One of these, *canadensis* Provancher (1889), was placed in synonymy by Fernald (1907). *P. canadensis* differs in the male by having narrow fossulae on antennal segments V-VII instead of on segments V-VIII as shown in figs. 1 and 2. The females can be distinguished by the silvery pubescence of the prothoracic lobes, which is marginal in *canadensis* and covers more than one-half of the lobe in *pubidorsum*. The known range of *canadensis* is northern California, Idaho, Nevada, Oregon, Utah, and Washington. *P. pubidorsum* is a more southern species, occuring in Arizona, California, Nevada, New Mexico, Texas, and south through Mexico into South America. There is some overlapping of the two species in California and Nevada.

Antennae of male *Prionony*x have good taxonomic charecters, which are illustrated in figs. 1–6. The shallow depressions or fossulae occur on segments V-VIII except in *canadensis* which has none on VIII, and in *ferruginea* (Fox) which has none. They are narrow in *canadensis*, *pubidorsum*, and *subatrata* Bohart, but broad in *atrata* (Lepeletier), *thomae* and *fervens* (Linnaeus). In *subatrata* the fossula on segment VIII is abbreviated.

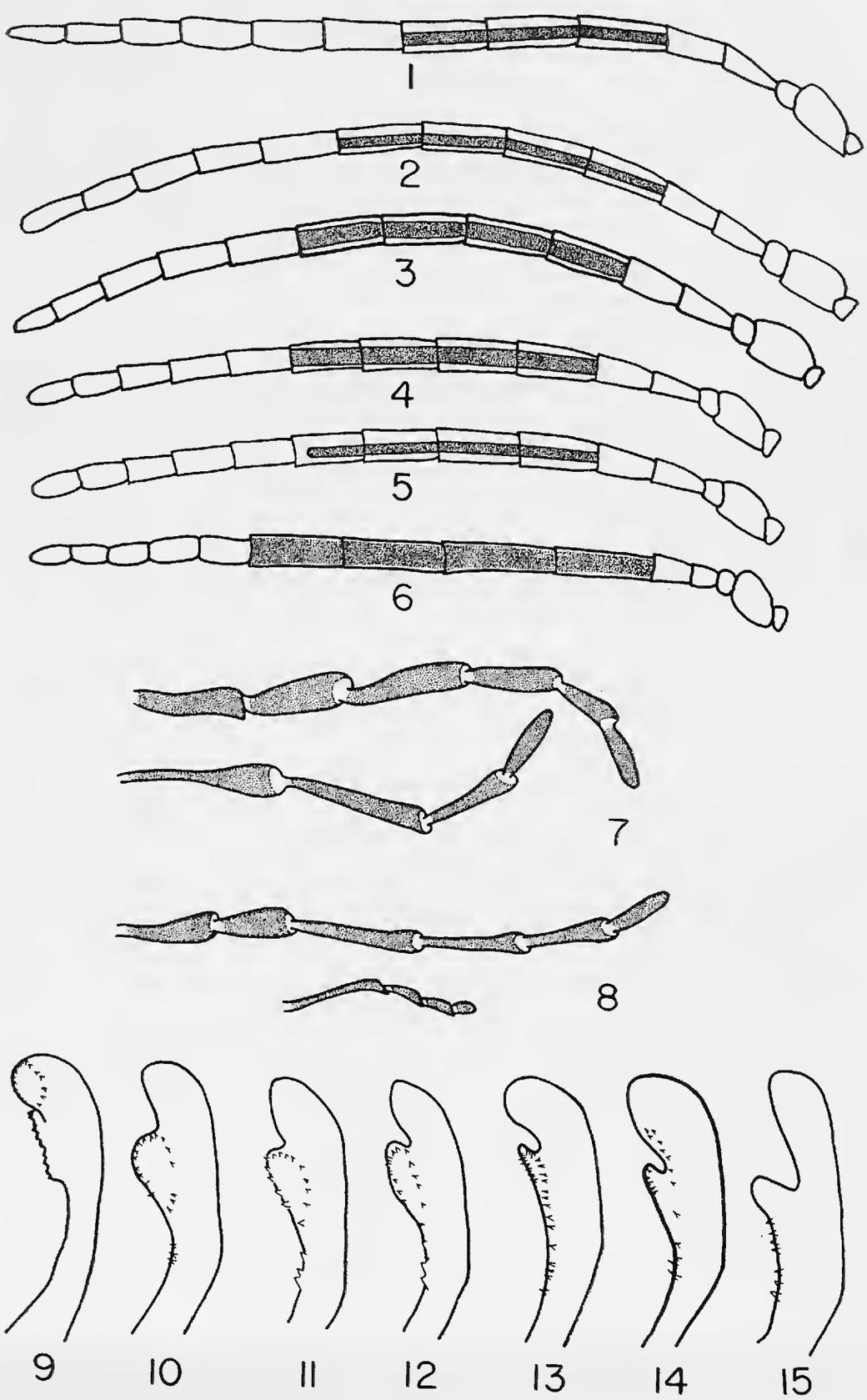
In the male genitalia the aedeagus provides the best diagnostic characters, particularly in the size and shape of the subapical lobe. The aedeagi of the seven species of our area are illustrated in figs. 9–15.

Key to the Species of North American Prionony x

1. Antennae 13-segmented, some flagellar segments with conspicuous flattened areas (fossulae) except in *ferruginea;* abdomen without sting (males) 2
– Antennae 12-segmented, flagellar segments without fossulae; abdomen with a sting ordinarily visible (females) 8
2. Abdomen black or brownish black 3
– Abdomen variously marked with red 4
3. Antennal segment VI with a broad fossula extending entire length of segment; scutum dull, individual punctures obscured by shagreening; scutellum dull ..... *atrata* (Lepeletier)
– Antennal segment VI with a narrow fossula not reaching distal end of segment; scutum partly polished, many individual punctures distinct; summit of scutellum shiny ..... *subatrata* Bohart
4. Antennal segment I much longer than third; scutum shiny in part and with numerous distinct punctures; free clypeal edge convex medially ..... *ferruginea* (Fox)
– Antennal segment I shorter than third; scutum completely shagreened or striate; free clypeal edge concave medially 5
5. Sternite VI with a broadly U-shaped median emargination 6
– Sternite VI entire medially 7
6. Antennal segments V–VIII with fossulae ..... *pubidorsum* (Costa)
– Antennal segments V–VII with fossulae ..... *canadensis* Provancher
7. Wings lightly brown-stained; scutellum low ..... *thomae* (Fabricius)
– Wings dark brown violaceous; scutellum gibbous ..... *fervens* (Linnaeus)
8. Wings lightly brown-stained at most; abdomen usually bright red 9
– Wings dark brown violaceous; abdomen black or dark red 12
9. Clypeal free edge entire medially; leg bristles pale; wings clear ..... *ferruginea* (Fox)
– Clypeal free edge notched medially; leg bristles black; wings somewhat stained 10
10. Maxillary palpus more than twice as long as labial palpus ..... *thomae* (Fabricius)
– Maxillary palpus about equal in length to labial palpus 11

Explanation of Figures

Figs. 1–6, antennae of male *Prionony x:* 1, *canadensis;* 2, *pubidorsum;* 3, *fervens;* 4, *atrata;* 5, *subatrata;* 6, *thomae. Figs.* 7–8, maxillary and labial palpi of female *Prionony x:* 7, *pubidorsum;* 8, *thomae.* Figs. 9–15, distal part of *Prionony x* male aedeagus, lateral view: 9, *ferruginea;* 10, *thomae;* 11, *pubidorsum;* 12, *canadensis;* 13, *subatrata;* 14, *atrata;* 15, *fervens.*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11. Prothoracic lobe with posterior marginal pubescence only; never more than one-half covered.....*canadensis* Provancher
– Prothoracic lobe with pubescence more than one-half covered.....*pubidorsum* (Costa)
12. Clypeal bristles partly pale; scutum covered with strong longitudinal striae.....*fervens* (Linnaeus)
– Clypeal bristles black; scutum not strongly striate.....13
13. Clypeus with silvery to golden appressed pubescence; scutum completely shagreened dull; scutellum not especially raised or shiny .....*atrata* (Lepeletier)
– Clypeus with black, appressed pubescence; scutum somewhat smooth and distinctly punctured toward middle; scutellum gibbous, shiny .....*subatrata* Bohart

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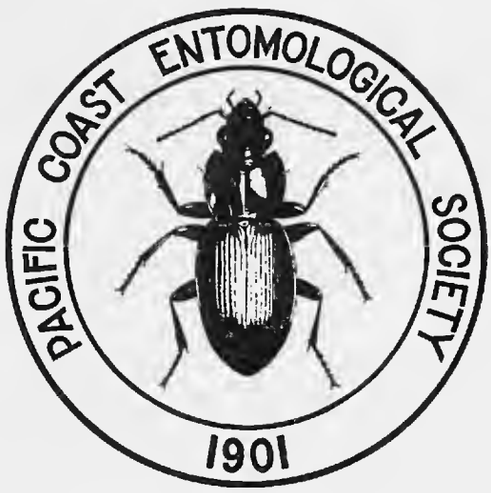
* New names in bold face, synonyms and homonyms in italics.



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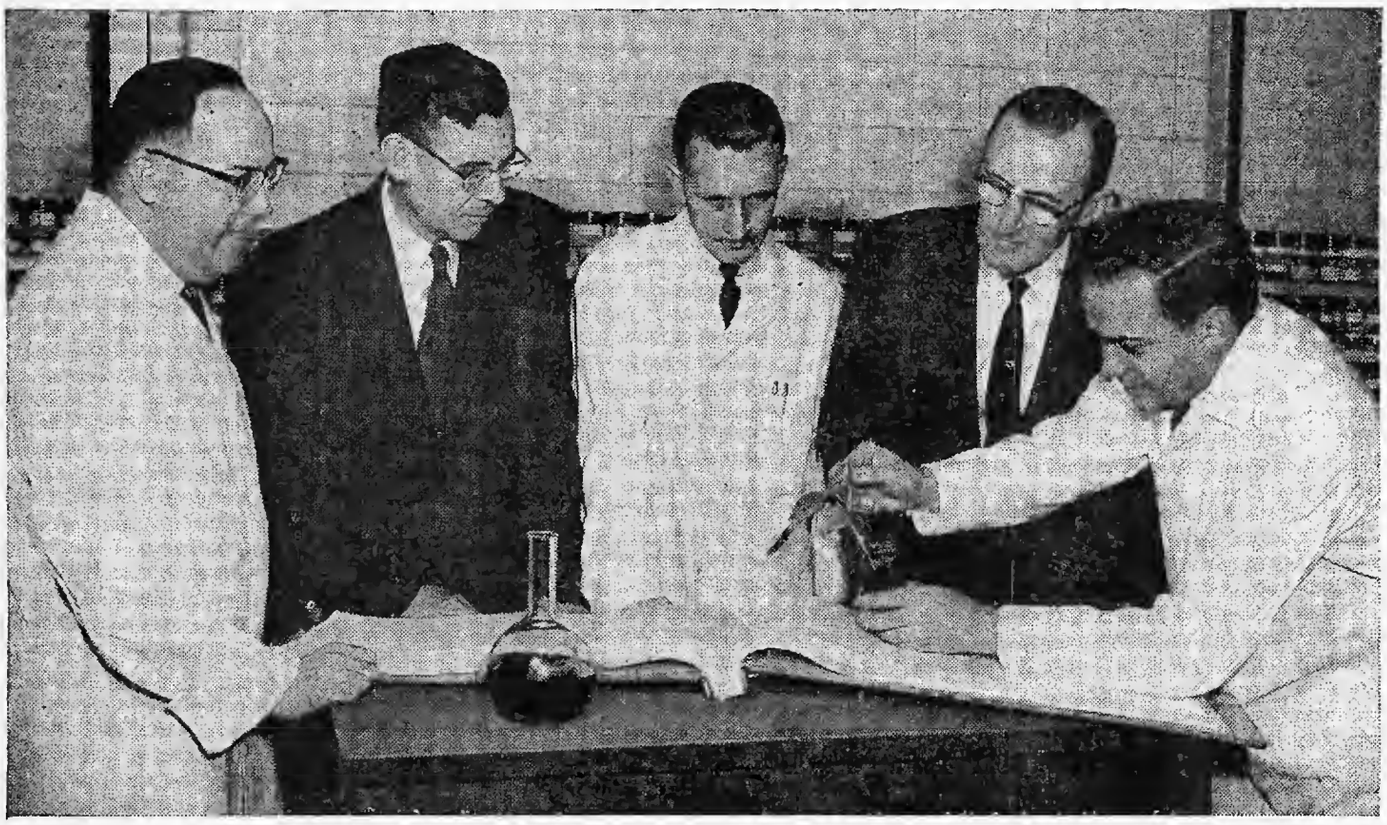
PATRONIZE

OUR

ADVERTISERS



Discussing promising new insecticide compounds at Hercules' Agricultural Chemicals Laboratory are: George Buntin, discoverer of toxaphene; Dr. E. N. Woodbury, laboratory supervisor; Dr. Keith D. Ihde, research entomologist; Dr. Arthur D. Lohr, supervisor, Naval Stores research; and Dr. William R. Diveley, a discoverer of Delnav.

Hercules Research:

KEY TO TOXAPHENE'S OUTSTANDING RECORD OF SERVICE

Toxaphene has had a remarkable history. In a fast-moving industry, this versatile insecticide maintains its leadership after more than 12 years of service to agriculture. New uses are being found for toxaphene each year as it continues its dynamic growth.

Continuous research is carried on by Hercules Powder Company to find new chemicals for agriculture, and to find better ways to utilize the tools now available. Many of the people doing this work were engaged in the original development of toxaphene. Besides laboratory research, Hercules has placed great emphasis upon field testing and large-scale demonstrations. From such applied research in cotton insect control, for example, has come information to help farmers get better yields while lowering their production costs.

TOXAPHENE

Agricultural Chemicals Division, Naval Stores Department
HERCULES POWDER COMPANY
INCORPORATED
Wilmington, Delaware

NX60-1

WINNING COMBINATION IN EVERY DROP

No insecticide has yet approached malathion's combination of powerful, wide-range insect control and low toxicity to man and animals.

One drop of malathion is all it takes to kill 300,000 aphids . . . yet *you* don't need a respirator or special protective clothing to handle it safely.

For fruit and vegetables, malathion offers control of most major insect pests. It can be used close to harvest *without* residue problems . . . up to 1 day on some crops, three days on most crops.

For fruit, malathion offers powerful insect control with safety for finish of sensitive apple varieties.

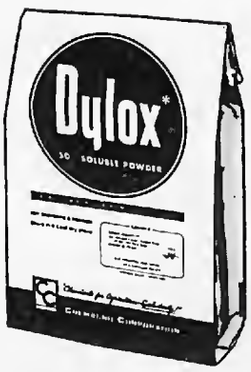
Write for MALATHION GROWER'S GUIDE PE-5039: American Cyanamid Company, Agricultural Division, 30 Rockefeller Plaza, New York 20, N. Y.

CYANAMID

MALATHION
INSECTICIDES

CYANAMID SERVES THE MAN WHO MAKES A BUSINESS OF AGRICULTURE

SYSTOX Spray Concentrate. The original systemic insecticide for control of aphids, mites and leafhoppers on a wide variety of crops.



DYLOX 50% Soluble Powder. A highly effective control for a variety of insects on alfalfa, cabbage, cotton and sugar beets.

CO-RAL 25% Wettable Powder. A revolutionary spray control for cattle grubs, screwworms, lice, ticks and horn flies on livestock.

DIPTEREX Sugar Bait Fly Killer. Approved for use around dairy animals, poultry, stock, animal hospitals, picnic areas, garbage areas, latrines.

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CORPORATION

Kansas City, Missouri

CO-RAL Livestock Duster. A .5% dust in a pocket-size squeeze bottle for the spot treatment of screw-worms and ear ticks on livestock.

DYRENE 50% Wettable Powder. An outstanding foliage fungicide for fungus disease control on tomatoes, potatoes and celery.

Manufacturer of

"Chemicals for Agriculture—Exclusively!"

DEF Cotton Defoliant. Revolutionary action produces better than 90% defoliation in as little as 5 to 7 days.

HERBICIDES. A wide variety of formulations for eradicating all common types of brush and weeds in all major crops.

PARATHION. Ethyl parathion 98.5% or methyl parathion 80%. High quality technical parathions for manufacturing purposes.

GUTHION 25% Wettable Powder or Spray Concentrate. For the control of virtually all major insects on cotton and deciduous fruit.

kills all citrus mites

Fast kill and long-lasting residual activity against *all* citrus mites is possible with KELTHANE. This non-phosphate miticide can be used during fall and winter for a thorough clean-up of mites in your groves.

Slow-killing miticides let mites migrate, after spraying, to other trees or to rapidly developing new growth. This allows them to build up and injure tender, new foliage. Mites don't have a chance with KELTHANE.

KELTHANE kills *all* citrus mites. It is compatible with most citrus pesticides and does not harm beneficial insects.

Chemicals for Agriculture

ROHM & HAAS COMPANY

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