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ORDER FROM CALIFORNIA ACADEMY OF SCIENCES, SAN FRANCISCO 18, CALIFORNIA.
SOME REMARKS ON THE INFLUENCE OF INSECTS ON HUMAN WELFARE*

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The ways in which insects affect human welfare are so numerous and diverse that no approach to completeness of treatment can be made in a brief paper. In the present instance, however, completeness is not needed, nor in fact is even a comprehensive sampling. A consideration of certain aspects of the subject will suffice, for the object of the paper is to advance the thesis that the time has come for entomologists to present to the public on whose support the progress of entomological research almost entirely depends a more balanced interpretation of insect and human relations than that usually current.

The subject of insects and human welfare is not new and certain aspects of it have been developed at length in a great variety of books, technical bulletins, magazine articles, newspaper stories and even reports over the radio. The relationships that have been most frequently stressed, perhaps naturally enough, have been those in which insects appear as enemies of man. It is not my desire to minimize the damage inflicted on man by those insects which are agricultural or forest pests, transmitters of disease, or are in other ways inimical to man's well being. Such damages, however, and the insects responsible for them, should be viewed in proper perspective. In no other way can the real importance of insects as a whole be understood correctly and evaluated properly.

It has long been apparent to biologists, whenever insect and human relations are viewed in their entirety, that the insect species which are injurious or antagonistic to human welfare actually constitute only a small proportion of the total of insect

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*Presidential address read before the Pacific Coast Entomological Society, January 4, 1947.
life and that the great majority of insects are either directly or indirectly beneficial to man or enjoy a neutral status. Dr. Frank Lutz (8) has estimated that not more than one-half of one per cent of all the insects in the United States are actually pests. Calling attention to Lutz’s estimate, Paul Knight (7) states that “those who care to extend the argument can show that a far greater percentage are of direct value, but that would prolong a question that is scarceley debatable.” Nevertheless the beneficial aspects of insect activities have not been brought clearly to the attention of people generally.

It is still too common practice on the part of entomologists, and in particular of economic entomologists, since they must perforce focus their attention on destructive species, to ignore or to minimize the numerous benefits conferred on man by insects. For example, Graham, in “Principles of Forest Entomology,” (6) recognizes the beneficial role of numerous forest insects, but dismisses them with a paragraph of brief consideration in the final chapter. An occasional text, such as “Destructive and Useful Insects,” by Metcalf and Flint (9) devotes a full chapter to the benefits that man derives from insects, and a very few treat the subject at more length, but in the majority of texts the treatment is quite inadequate.

All too often, especially in articles designed for popular consumption, we encounter extravagant statements and overdrawn pictures concerning the so-called warfare between man and the insects as if the two were engaged in a relentless struggle to the death. The “insect menace” has become a catch phrase. To be sure, most of these fantastic pictures are found in articles written by persons lacking entomological training. Not a few, however, have been prepared by entomologists who should know better and nearly all are based on information and ideas that have been supplied by entomologists. An unfortunate consequence of this state of affairs is that many, if not most, laymen have developed the belief that nearly all insects are injurious and should ruthlessly be exterminated.

A few decades ago excessive emphasis on the destructive activities of insects perhaps was justified. The increasing number of insect pests required that public attention be directed to these enemies of agriculture. Without this emphasis it might not have been possible to arouse the public sentiment and the legislative
backing that were essential for the support of needed research on
pest control. At that time also a factual basis for an adequate
appreciation of the beneficial aspects of insect life had not yet
been sufficiently developed. For that matter, there is real need at
the present time for extensive and detailed exploration of the
beneficial activities of insects. In particular there is a need for
quantitative studies. The knowledge we now possess is mostly of
a qualitative nature.

The goal of an aroused public interest in the study of injurious
insects has long since largely been achieved and adequate support
for research in economic entomology usually is available. We
now urgently need to round out the picture, to educate the lay
public to a realization of the vast amount of good that is done
by insects as a whole, to the end that balanced judgment shall
determine the general attitude toward insect-human relations and
that all branches of entomological research shall be recognized
as meriting adequate support.

There is at present a measure of real danger that the lay
public, animated by the conviction that insects constitute an
enemy group, may attempt to carry the matter of insect control,
or rather, suppression, too far. For the first time in the history
of man's conflict with insects the materials at his disposal make
the unwise dream of insect extermination seem possible of attain-
ment, at least in localized areas; or if this state of affairs has not
yet been attained, at least it seems to be not far away. If, there-
fore, man is to be spared costly experiences in which his actions
bring down upon him more harm than good, it is essential that
there be developed in the public mind an appreciation of the
beneficial activities of insects that will serve to balance the already
well developed appreciation of their injurious activities.

The economic entomologist has a special responsibility in this
connection because of his frequent contacts with a segment of
the public which has a special reason for distrust of insects.
Moreover, to ensure the proper development of economic ento-
omology in the years that lie ahead, it is essential that the economic
entomologist recognize and accept this responsibility as many of
them individually already have done. It is becoming increasingly
evident that the carrying out of proper measures for the control
of injurious insects is not simply a matter of applying a suffi-
ciently lethal insecticide. Rather it requires that each species
be regarded in the light of the entire complex ecological picture of which it is a part and that control measures be selected accordingly. It often happens that insects that are injurious under one set of conditions or circumstances are of no consequence or are beneficial under others. A correct appraisal of the economic status of many an insect, therefore, can not be made by the farmer but only by a well trained economic entomologist who has a broad knowledge of general insect ecology. A great deal of time and money is now wasted in so-called "insurance spraying" which might be saved or better used in some other type of control. The farmer should be educated to expect the economic entomologist to have the broad type of training suggested above and to look confidently to the economic entomologist for immediate advice and guidance in meeting his problems of pest control. This desirable relationship cannot materialize so long as the current point of view continues to prevail.

It may be that the danger that I have envisioned is more apparent than real. Human affairs move with sufficient slowness that the unwisdom of attempts at the wholesale extermination of insects may be made sufficiently clear through repercussions from early attempts that efforts in this direction will be abandoned and will be replaced by actions based on a saner philosophy. Certainly the usage of DDT to date has revealed that such powerful insecticides, valuable as they are, cannot be used indiscriminately with impunity. Nevertheless much is to be gained by a concerted program of public education that is aimed at balanced enlightenment in place of the present program of merely seeking support for more and ever more destruction of insect life.

In the light of the reasoning thus far advanced it seems worthwhile to review certain of the interrelations between man and insects in which the insects play a beneficial role.

As a general rule little attention is paid to the factors concerned in the control of the plant population of the earth and the place that insects hold among these factors. Because of man's dependence on plants it is customary to label as injurious any creature aside from man and his domestic animals that feeds on plant life. Yet obviously this is not the case. An organism is really injurious only when it becomes sufficiently abundant that its activities are genuinely detrimental to the welfare of other
organisms. This happens in the case of only a very small proportion of insects. Moreover, it is possible for a plant as well as an insect or other animal to get out of balance with the rest of life; to become, in fact, a pest. A few plants in recent decades have so far escaped from normal population controls as to become veritable scourges, and so far, the only significant progress in bringing them back under control has been accomplished through the use of insects that feed on them.

The most notable example is the prickly-pear cactus in Australia which according to some authorities by 1935 occupied some 60,000,000 acres of Australian soil to the extent that it was practically worthless for agriculture. Cactus feeding insects introduced from the Americas have brought the cactus under control. Most of the work of control has been wrought by a single species, the moth Cactoblastis cactorum, whose caterpillar mines the joints of the cactus. Allan P. Dodd(4) says the introduction of this insect between 1925 and 1927 “brought a complete change in the outlook within a few years. Its progress has been spectacular, its achievements border on the miraculous. Great tracts of country, utterly useless on account of the dense growth of the weed, have been brought into production. The prickly pear territory has been transformed from a wilderness to a scene of prosperous endeavor.”

Probably not many plants possess the qualifications for becoming pests of the magnitude of the cactus but we have no way of judging beforehand. There are other weed plants besides cactus which, though perhaps less objectionable, have nevertheless become major pests in countries into which they have been introduced. Such are lantana in Hawaii and Australia, blackberry and gorse in New Zealand, and St. John’s Wort in California. Success has been only partially attained to date in controlling these weeds but the measure of success that has been attained has been accomplished largely through the use of insects.

In the countries to which they are native these plants are not pests. They fit normally into the flora of those regions in mutual adjustment with other organisms. The factors that determine their normal population levels, as is true of plants everywhere, undoubtedly are several but among these are the insects that feed upon them. Dr. Brues has pointed out in “Insect Dietary” that insects are a major factor in determining population
levels in plant life. We perhaps cannot even guess accurately what the consequences would be if insects were to be totally removed from the realm of plant life but we can be sure that it would be some sort of chaos and that man would be numbered among the victims of such a disastrous happening.

We are accustomed to looking upon insects that attack trees as injurious and requiring control, and certainly often, though not always, this view is the correct one. Yet it is equally certain that the majority of insects to be found in a forest are not detrimental to the forest and that many, if not the majority, actually benefit the forest in one way or another. F. C. Craighead (2) in "An Annotated List of the Important North American Forest Insects" lists less than 200 kinds of really destructive species distributed over many families, yet W. J. Chamberlin (1) records 575 species of bark and timber beetles in but two families. The great majority of these are forest species but the great majority are not destructive.

Chamberlin (l.c.) says, "When Micracis, Carphoborus, Pityophthorus, Pityokeines, Lymantor, Hypothenemus, or any of the other similar species attack the lower limbs of trees and kill them, they are but hastening natural pruning which results in a clean bole and a better grade of lumber."

Doane, Van Dyke, Chamberlin, and Burke (3) say that "In every heavily stocked young forest there are thousands of trees that must die and pass out of the picture before the forest reaches maturity. . . . . Nature takes care of this . . . . . . need through suppression of slower-growing trees; and at times insects and disease may serve a useful purpose in removing trees from overcrowded stands, thereby releasing the space to the surviving trees which will then grow more rapidly and into better wood material."

It is obvious, therefore, that without the beneficial services of numerous forest insects our forests would never have attained to their present magnificence, their productivity would be far less than it now is, lumber would be inferior, they would be less suitable as homes for valuable wild life and their esthetic and recreational values would be far less than they now are. They would, moreover, be filled with a tangled maze of dead branches and small trees that would constitute a fire hazard far greater than any now known, or what is more probable, they would be swept by destructive fires of such extent and with such frequency
as never to attain the status of forest maturity as we now know it.

To consider another phase of the general problem, many insects inhabit the soil, often in tremendous numbers. In one case in Illinois their numbers were estimated at no less than 65 millions per acre. Some of the soil insects, namely wireworms, white grubs, certain aphids and mealybugs, and a miscellany of others, feed on the underground parts of plants, damaging them more or less, and at times attain the status of pests. The majority, on the other hand, make a definite, important, and perhaps essential, contribution to the development of the soil itself and to the maintenance of soil fertility.

Paul Knight(7) in this connection says, "(1) Soil organisms cause a continual interchange of soil particles by bringing to the surface particles of subsoil. The gradual enrichment of these subsoil particles increases the thickness of the rich top layer. (2) The burrows of soil organisms allow better drainage and aeration. (3) The dead bodies of animals such as insects and worms add a large amount of organic material to the earth. (4) The excreta of insects compares favorably in fertilizing value with the digestive wastes of other animals. Though the digestive waste of one insect is infinitesimal, the aggregate mass of all insect excreta probably exceeds that of the larger animals and is an important factor in soil fertility."

W. M. Wheeler(10), referring specifically to the soil building activities of ants says "Thus the ants act on the soil like the earthworms, and this action is by no means inconsiderable, although as yet no one has studied it in detail."

In the discussion of both of the preceding two topics—forest insects and soil inhabiting insects—mention has been made of the effectiveness of insects as scavengers. Their value in this connection can more easily be underestimated than overestimated for they are second in importance only to the bacteria and fungi as agents of decay.

We deplore decay whenever it affects any type of material or product that we wish to preserve for a time. We deplore the existence of Penicillium fungi that destroy a part of the oranges or lemons that we buy in the markets, we strive to prevent the growth of the several rot disease fungi that destroy the foundation timbers of our homes and other buildings; we abhor the maggots that swarm through the carcass of a dead animal or a mass of
garbage that has not been properly disposed of, but at the same time we recognize the general usefulness of decay. We know that decay is the necessary counterpart to life and without decay life would soon become impossible on the earth.

Folsom and Wardle (5) say that insects "As scavengers are of inestimable benefit, consuming as they do in incalculable quantity all kinds of dead and decaying animal and vegetable matter. This function of insects is most noticeable in the tropics, where the ants, in particular, eradicate tons of decomposing matter that man lazily neglects."

The importance of decay and the necessity for it lies in the fact that certain chemical elements, in particular nitrogen, phosphorus, and potassium, obtained from the soil by plants and needed alike by plants and animals are present in usable form only in relatively small amounts in most soils. The available supply must be returned to the soil on the death of the organisms living on or in the soil if life is to be continued in anything like its normal luxuriance. Without the beneficial agency of the bacteria, fungi, insects, and other organisms of decay but especially these three, developing plant life would gradually but surely tie up in plant tissues almost all of the existing supply of critically needed mineral elements.

For the purpose at hand it is unnecessary to develop in detail additional aspects of the general topic. Simple mention or very brief treatment of some of these will suffice. All, in one way or another, are fairly well known to entomologists though not to the general public, or at least not sufficiently known.

The importance of insects as animal foods is apparent when we realize that considerably more than half of the food supply of common land birds, fresh water fishes, many reptiles, and many small mammals consists of insects and without the insects these animals would be unable to maintain themselves. It is customary to consider such animals as constituting checks on the increase of insects, and no doubt at times and perhaps continuously to a limited extent they do constitute such checks, but there is much evidence to indicate that more often the vertebrates in question, and in particular the birds, are merely living off of the surplus of insect life and are not a significant factor in regulating insect abundance.

The dependence of flowering plants on insects as pollen
carriers has received wide attention. It is estimated that about 85% of flowering plants require insect pollination in whole or in part. Metcalf and Flint (9) estimate that the annual yield of agricultural crop plants in the U.S. that depend on pollen transfer by insects has a value in excess of two billions of dollars. In this field as in others, however, the picture that has commonly been drawn is an unbalanced one. Most discussions of the subject have been in terms of the honey bee and bumble bees. Admitting the tremendous importance of these insects, it must yet be recognized that there are thousands of species of plants for which the honey bee and bumble have no meaning. Great numbers of other insect species: solitary bees, flies, beetles, moths and butterflies, and even, occasionally, such small creatures as thrips, function as pollinators of these plants and in numerous instances play an absolutely essential role. Without them a considerable proportion of our garden flowers and shrubs could not exist, nor could there be the wealth of color and variety in the wild plants that clothe our valleys and hillsides in proper season. Insects, therefore, make a contribution to the esthetic and recreational resources of man that is not inconsiderable.

Much of the vegetation that adds beauty to the desert areas of the earth consists of insect pollinated plants. Such also is the case with the chaparral and other growths that hold back the run off on hillsides and gentler slopes over vast acreages and so protect the lowlands from destructive floods.

In summation, it is perhaps impossible to visualize adequately the totality of beneficial effects which insects exert directly or indirectly on human welfare, but the benefits are incalculably great. It is not too much to say that insects determine the character of man's world to a far greater extent than he does himself and that if they were suddenly to disappear completely the world would be changed so extensively that it is extremely doubtful that man would be able to maintain any sort of organized society whatever.

I repeat, therefore, that the time has come for entomologists generally, and for economic entomologists in particular, to present to a public that is manifesting increasing interest in insect life, a more rounded and better balanced picture of insect life. It is time to appeal for interest and support on the basis of this more complete picture and man's place in it, recognizing that
all forms of life are interwoven in an integrated whole which needs to be understood before it can safely be changed in any radical manner, and that in arriving at this more intelligent basis for orienting ourselves to the insects there is no place for categorical condemnation or praise. On the contrary, each species or closely knit group deserves to be considered independently and judged on its individual merits.

REFERENCES


(4) Dodd, Allan P. 1940. The Biological Campaign Against Prickly Pears. Commonwealth Prickly-Pear Board. Brisbane, Queensland, Australia.


DESCRIPTION OF THE LARVA OF PLEOCOMA HIRTICOLLIS VANDYKEI LINSLEY
(Coleoptera, Scarabaeidae)

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Much has been written about the adults of the peculiar genus Pleocoma and their habits, but little has been published about their larval stage. Osten-Sacken in 1874 described a Pleocoma larva found deep in the earth by Mr. Behrens of San Francisco. The only other reference to the morphology of larvae of the genus is by Böving and Craighead (1930-31) in their key to families and subfamilies of the Scarabaeoidea.

Early in 1946, while visiting at the University of California, in Berkeley, the writer was shown 8 Pleocoma larvae collected February 26 by R. F. Smith and J. W. MacSwain from a spot near Patterson Pass where Pleocoma hirticollis vandykei Linsley had been found abundant previously (Smith and Potts, 1945). A second trip to the same spot, March 8, 1946, by Smith, MacSwain, several of Linsley’s graduate students, and the writer, yielded over 40 additional larvae. They were found from 1 to 3 inches deep in the pasture soil feeding on grass roots.

Besides the larva of Pleocoma hirticollis vandykei Linsley, described in this paper, the larvae of Pleocoma australis Fall, Pleocoma badia Fall, Pleocoma fimbriata Le Conte and a larva of an unknown species from Sacramento, California, have been examined by the writer, through the courtesy of Dr. Linsley and the U. S. National Museum. All of these agree in the following essential characters: antenna 3-segmented; epipharynx with tormae not united mesally; haptomerum with a group of heli; chaetoparia well-developed; plegmatia present; hypopharynx without oncyli; terga of abdominal segments 3 to 7, inclusive, with 4 dorsal annulets; spiracles with concavities of respiratory plates facing ventrally; legs 4-segmented; mesothoracic and metathoracic legs with stridulating organs; anal opening Y-shaped, not surrounded by fleshy lobes.

The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the Director.
Like the adults, *Pleocoma* larvae resemble geotrupids in several important morphological features. Of all the Scarabaeidae, only larvae of *Pleocoma* and those of geotrupids have 3-segmented antennae. Too, the stridulating organs found on the legs of *Pleocoma* larvae are very similar to those of *Geotrupes* and *Odontaeus*. In contrast, however, the epipharynx, the tergal annules of the abdominal segments, and the last abdominal segment of *Pleocoma* are entirely different from homologous structures of known geotrupid larvae and, in fact, resemble in many ways structures characteristic of melolonthine larvae. Because of these important differences, the writer would prefer placing the genus *Pleocoma* in a subfamily close to, but distinct from, the Geotrupinae, as Leng (1920) has done, rather than class *Pleocoma* with the geotrupids (Paulian, 1941).

**Third-stage Larva of *Pleocoma hirticollis vandykei* Linsley**

Description based upon a study of 9 third-stage larvae and a cast skin of a larva found associated with a dead male in its pupal cell. Male identified by Linsley.

*Larva* (Fig. 1) typically scarabaeiform with whitish body and light yellow-brown head. Length of mature larva ranging from about 45 to 50 mm.

*Cranium* (Fig. 4) narrower than prothorax. Surface shining and generally smooth with a series of fine longitudinal striae on each side of the epicranial suture (ES). Maximum width of cranium ranging from 6.5 to 9 mm. with a mean of 8 mm. Frontal sutures (FS) whitish and sinuate, forming less than a right angle at their juncture with the epicranial suture. Frons (F) bearing on each side an irregular, transverse row of 5 to 10 posterior frontal setae (PFS), one large seta (AA) in each anterior angle (rarely with an additional small seta), a single large exterior frontal seta (EFS) (often with 1 or 2 small setae), and a single large anterior frontal seta (AF) (plus 2 to 4 small setae). Epicranium (E) with 2 large dorsoepicranial setae on each side of the epicranial suture. Ocelli absent.

*Clypeus* (Fig. 4) trapezoidal with slightly concave lateral margins; divided transversely into a large, rather heavily sclerotized postclypeus (PSC) and a very small, membraneous preclypeus (PC). Postclypeus on each side with a transverse patch
of setae consisting of 3 large setae and several small setae, anteriorly with an irregular series of low longitudinal rugosities.

Labrum (L, Fig. 4) slightly wider than long, symmetrical and apically trilobed. Surface bearing numerous long setae and, except for the apical membraneous lobes, rather heavily sclerotized and coarsely reticulate.

Antenna (A, Fig. 4) almost as long as cranium, fairly slender, 3-jointed, and borne on a cylindrical basal piece fused to the epicranium. First segment as long as second and third segments together; third segment very small, about one-third as long and half as wide as second segment. First and second segments bearing numerous setae. End of second antennal segment, below juncture with apical segment, with a small oval sensory spot. Apical segment without sensory spots; apex with 2 to 4 olfactory pegs.
Mandibles (Figs. 2, 3, 6 and 7) shorter than cranium, approximately symmetrical, subtriangular in outline, each with a strong, blade-like scissorial area (SA) and a rather small, molar area (MO). Scissorial area blackish with a slightly concave or nearly straight cutting edge. Molar areas also blackish, those of left and right mandibles similar in size but somewhat asymmetrical. Molar area of right mandible (Fig. 6) with a transverse apical lobe and a curved median lobe, the latter surrounding a small, longitudinal proximal lobe. At the base of each molar area is a dense brush of setae or brustia (BR). On the dorsal surface of each mandible, laterad of each molar area, is a patch of 27 to 30 setae, the dorsomolar setae (DMS). Dorsodorsal mandibular region and lateral face of mandible much wrinkled, not separated by a scrobis. Lateral face with a single, large, median seta. Ventral surface of each mandible transversely wrinkled between the inner proximal part of the scissorial area and the molar area. Laterad of the molar area and extending to the vicinity of the small ventral mandibular process (VP) is a large patch of 29 to 33 setae. The region mesad of the ventral mandibular process bears a number of pores and sometimes 1 to 3 setae.

Maxilla (Figs. 5 and 8) consisting of a cardo, stipes, galea, lacinia and a maxillary palpus. Cardo (CAR) subquadrate in outline and extending from the base of the maxilla to the proximal edge of the stipes. Cardo divided longitudinally into 2 oblong sclerites, the dorsal one bearing a few scattered setae. Stipes (ST) bounded posteriorly by the cardo and anteriorly by the maxillary palpus and galea. Dorsally, along the inner edge of the stipes, is a row of 10 to 16 conical, stridulating teeth (SD). Ventrally, the stipes bears a number of long needle-like setae; and a narrow, transverse, irregular double row of similar setae adjoins the maxillary palpus. Galea and lacinia distinctly separate but lying close together. Galea (G) with a single apical uncus (UN), bordered dorsally by 4 stout setae and ventrally by 2 stout setae; remainder of surface with a sparse covering of slender setae. Lacinia (LA), with a terminal uncus having 1 or 2 ventral tooth-like lobes. Inner edge of lacinia bearing 2 rows of long stout setae, the dorsal row extending from the uncus to the proximal margin of the lacinia. Dorsad and ventrad of the rows of stout seta the lacinia is sparsely covered with slender setae. Maxillary palpus 4-jointed, the first 3 joints bordered an-
PLEOCOMA HIRTICOLLIS VANDYKEI LINSLEY

Fig. 2. Left mandible, dorsal view. Fig. 3. Molar region of left mandible, ental view. Fig. 4. Head, cephalic view. Fig. 5. Right maxilla and labrum, ventral view. Fig. 6. Molar region of right mandible, ental view. Fig. 7. Left mandible, ventral view.

teriorly by a semi-circle of setae. Apical joint with a lateral, sensorial groove and a number of distal, sensory pegs.

*Labium* (Figs. 5 and 9) composed ventrally of a subtrapezoidal postmentum (PMP), the subdivided prementum (PRM₁ and PRM₂) and a pair of labial palpi (LP). Postmentum bare except for a few setae near each lateral margin. Proximal sclerite of prementum subquadrate in outline, wider than long, set with a transverse row of setae interrupted mesally. Apical sclerite of prementum set with numerous setae, of which the largest are those adjacent to the bases of the labial palpi. Dorsal surface of apical sclerite of prementum, called the glossa (GL), with a dense covering of long slender setae, anteriorly and on each side. Central posterior portion of glossa sparsely set with short, stout, conical setae. Labial palpi 2-segmented.

*Hypopharynx* Fig. 9, (HP) located posterior to the glossa and dorsad of the proximal sclerite of the prementum. Hypopharynx, on each side with a caudal sclerotized shoulder (LL) behind which is the point of contact with the ventral process of the adjacent mandible. Onyli (the protruding, sclerotized hypopharyngeal process or processes present in most scarab larvae) absent.

*Epipharynx* (Fig. 12) symmetrical, slightly broader than long with rounded lateral margins, trilobed apically. Apical lobe, or corypha (CO), set with coarse setae and bounded on each side by a clithrum (CLI). Plegmatia present, each plegmatium (PL) consisting of about 11 to 15 semi-circular, sclerotized plegmata, each plegma surrounding the base of a coarse acanthoparial seta. Proplegmatia absent. Chaetoparia (CPA) large, separated from the acanthoparia by a narrow gymnoparia (GP). Each chaetoparia consisting of a dense patch of sharp setae not interspersed with sensilla. Chaeta stoutest toward the pedium (PE). Haptemerum (H) bearing a rather sparsely set, semi-circular group of 9 to 12 large, stout heli (HE). Anterior to the bases of most of the heli is a single large sensillum. Tormae rather indistinct, symmetrical, not branched, not meeting mesally. Haptolachus (HL) incomplete, nesia absent. Caudomesad of the inner end of the dexiotorma (DX) and the pternotorma (PTT) is a longitudinal curved phoba (PH). The area laterad of each phoba has 20 to 30 crepidial punctures CP). Four macrosensilla (MS) are found between the caudal ends of the phobae. Posterior to the phobae is the curved, transverse crepis (CR).
Fig. 8. Left maxilla, dorsal view. Fig. 9. Labium and hypopharynx, dorsal view. Fig. 10. Distal portion of right, metathoracic leg, ventral view. Fig. 11. Third abdominal segment, left lateral view. Fig. 12. Epipharynx. Fig. 13. Right metathoracic leg, lateral view.

Legs (Figs. 1, 10 and 13) well developed with the prothoracic shorter than the mesothoracic pair and the mesothoracic shorter than the metathoracic pair. Each leg 4-jointed, consisting of a fairly long, stout subcylindrical coxa (CX), a slightly shorter trochanter (TR), a short femur (FE) and a short tibiotarsus (TT) which bears a terminal claw (CL). Mesothoracic and metathoracic legs with stridulating organs, these consisting of a finely striated area on the posterior surface of the mesothoracic coxa and a V-shaped row of about 12 sclerotized teeth (SD), each tooth at the base of a seta, on the anterior surface of the metathoracic trochanter. Anterior ventral surface of meso- and metathoracic trochanters and ventral surface of meso- and metathoracic femora densely set with stout spine-like setae (FOS, Fig. 13) undoubtedly useful in burrowing through the hard soil. Claws simple, each consisting of a straw-colored base and a dark, slender, sharp, distal portion. Base of each claw with 2 setae. Prothoracic claws much longer than meso- and metathoracic claws.

Body (Fig. 1) consisting of 3 thoracic and 10 abdominal segments. Prothorax with 2 dorsal areas each with a single transverse row of slender setae. Mesothorax and metathorax each with 3 dorsal annulets, a prescutum, a scutum, and a scutellum. Scutum of mesothorax with a transverse row of slender setae; scutum of metathorax similarly clothed and, in addition, with an irregular, transverse, single or double row of short stout setae cephalad of the slender setae.

First and second abdominal segments each with 3 dorsal areas. Prescuta of each with a transverse band of short stout setae; that on the first abdominal segment 2 or 3 rows wide, that on second abdominal segment about 5 or 6 rows wide. Scuta each with a long transverse band of setae consisting anteriorly of about 5 irregular rows of short stout setae and posteriorly of a single sparsely set row of fairly long slender setae. Scutellum of first abdominal segment with a short sparsely set transverse patch of short, stout setae on each side and a bare, middorsal area. Scutellum of second abdominal segment with a long, narrow, transverse, single or double row of short, stout setae. Abdominal segments 3 (Fig. 11) to 7 inclusive each with 4 dorsal annulets, a prescutum, scutum, scutellum and postscutellum. Each prescutum bears a transverse patch of about 5 to 7 irregular rows of short, stout setae. Each scutum with a short, transverse, irregular, double
row of short, stout setae. Each scutellum has a long transverse band of short, stout setae posterior to which is a single sparsely set row of rather long slender setae. Each postscutellum (except that of abdominal segment 7 which is bare) with a long, transverse, irregular double or triple row of short, stout setae.

Dorsa of abdominal segments 8 and 9 not divided into distinct annules. Each dorsum anteriorly with scattered slender setae and an occasional short, stout setae; posteriorly with a sparsely-set transverse row of long slender setae cephalad of which are a few scattered, short, stout setae. Dorsum of tenth abdominal segment with a transverse sinuate dorsal impressed line. Region between dorsal impressed line and anterior margin of abdominal segment 10 set with scattered short, stout setae. Dorsal area between upper anal lip (UAL, Fig. 15) and dorsal impressed line clothed with short, stout setae interspersed with long, slender setae.

Thoracic shield, located on each side of prothorax, rather inconspicuous, straw-colored, roughly triangular in outline. Spiracle-bearing areas (SPA, Fig. 11) of abdominal segments 1 to 8 each with 5 to 9 setae. Pleural lobes (PLL) of abdominal segments 1 to 8 each with a patch of 8 to 16 setae. Eusterna (EUS) of abdominal segments 1 to 7 each with a transverse row of 6 to 16 setae. Pedal areas (PEA) of same segments with 2 to 7 setae on each side.
Anal Slit (ASL, Fig. 15) Y-shaped, basal cleft short. Anus bordered dorsally by the triangular upper anal lip (UAL) and ventrally by the mesally cleft lower anal lip (LAL). Both anal lips covered with short, stout setae.

Raster (Figs. 14 and 15) consisting of a simple teges (T) in the form of a narrow transverse band of 50 to 70 short, stout, caudally directed setae, located cephalad of the lower anal lip. Cephalad of the teges, especially toward each side, are several long, slender setae. Anterior to these setae and the teges, the venter of the tenth abdominal segment is bare (C, Fig. 14).

Spiracles (Figs. 1 and 11) consisting of 1 pair of thoracic spiracles and 8 pairs of abdominal spiracles. Thoracic spiracles considerably larger than the abdominal spiracles which are alike in size. Respiratory plates of spiracles kidney-shaped, with their concavities facing ventrally. Spiracles cribiform but “holes” of respiratory plate rather opaque, not arranged in definite rows.

Bibliography


TWO NEW SPECIES OF APANTELES FROM CALIFORNIA
(Hymenoptera: Braconidae)

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The following descriptions are presented at this time in order to provide names for use in connection with biological studies involving two new parasites.

Apanteles medicaginis Muesebeck, new species

Apanteles flaviconchae Riley\(^1\) was originally described from Missouri and Connecticut and considered a possible parasite of the armyworm since the cocoons had been found in clover fields infested with that pest. It is now known to occur from Maine to Texas as a parasite of Colias. Although so wide a host range is unusual for a species of Apanteles, it appears that phalaenid larvae are also successfully parasitized on occasion by flaviconchae, for there are what seems to be authentic records of rearings from Plathypena scabra (F.), the green cloverworm. The principal host, however, is the pierid Colias philodice philodice Latr., the so-called clouded sulphur, the larva of which is a common and widespread clover pest. A. flaviconchae is a gregarious parasite, some 20 or more individuals developing within a single caterpillar.

Recently an Apanteles, parasitic on the alfalfa caterpillar, Colias philodice eurytheme Bdvl., has attracted attention in California; and several samples have been submitted to me for identification. This form agrees so closely with flaviconchae, except for the paler hind femora of the female, that I have been inclined to regard it as only a western race of flaviconchae. Dr. Ray F. Smith, of the University of California, now has informed me, however, that this parasite always develops singly in its host. It would appear, therefore, that despite the similarity in structure and host relations the eastern and western populations are distinct species. Accordingly, the California parasite of the alfalfa caterpillar is here described as new.

The only structural differences I have discovered between this species and flaviconchae are quantitative and subtle. They are not easily defined. In medicaginis the upper third of the face has a more or less distinct, median, longitudinal, keel-like elevation, of which there is only a faint suggestion in flaviconchae. The malar space in medicaginis is slightly longer and the face a little narrower than in flaviconchae, the face at its narrowest point being narrower than the eye height. In flaviconchae the punctures on the posterior half of the mesoscutum are separate although close, whereas in medicaginis they tend to be confluent, especially along the lines of the notaulices. The polished lateral margins of the second tergite are usually complete in flaviconchae and are continued upon the basal part of the third tergite, whereas in medicaginis they are usually not complete and seem never to extend upon the third tergite. Although these two species are not always readily separated by these distinctions, the females may normally be recognized at a glance. In flaviconchae the posterior femora are black in both sexes, but in medicaginis those of the female are reddish-yellow or, at the most, blackish along the upper and lower edges.

Female. Length about 2.5 mm. Face smooth and shining; malar space at least one and one-half times as long as clypeus. Punctures of mesonotum very small but sharp and close throughout, in places confluent as noted above, scutellum convex with scattered weak punctures, shining; propodeum rugose with a complete median longitudinal carina and strong though incomplete costulae; mesopleuron closely punctate on lower half and anteriorly, smooth and polished above the longitudinal impression. Stigma barely twice as long as broad; radius strongly inclined outwardly, longer than intercubitus and joining it in a definite angle; nervellus strongly oblique but nearly straight. Calcvaria of hind tibia subequal, slightly less than half as long as metatarsus.

Abdomen rather stout; plate of first tergite broadening apically, finely rugulose; second tergite nearly three times as long as broad, much shorter than third, closely rugulose with very narrow lateral polished margins; suturiform articulation sharply impressed, minutely pitted; third tergite usually with a little indefinite sculpturing basally; hypopygium attaining apex of last tergite; ovipositor sheath barely exserted.

Black; maxillary palpae yellowish except toward base; labial palpae usually piceous, tegulae and radices black; stigma dark brown, most of the veins pale; legs reddish yellow with all coxae and trochanters, bases of fore and middle femora, apices of hind femora and of hind tibiae, and the posterior tarsi, blackish.
Male. Like the female but with black hind femora.

Type locality. Dos Palos, Merced County, California.

Type. United States National Museum No. 58213.

Described from 94 specimens from the type locality, reared from Colias philodice eurytheme Bdvl. in August 1946, by Ray F. Smith. In addition to the type series I have before me specimens of this species from Berkeley, Tracy, Westley, Hemet, and Sacramento, California, reared from C. philodice eurytheme or collected in alfalfa fields.

Apanteles praesens Muesebeck, new species

This species, which was discovered by N. L. H. Krauss in southern California as a parasite of the geometrid Anacampodes fragilaria (Grossb.), has been taken to Hawaii to combat that pest, which recently became established there. It very closely resembles A. caffreyi Mues., but may be distinguished by its more strongly punctate head, conspicuously longer calcaria of hind tibiae, and darker posterior legs.

Female. Length 2.5 mm. Head dull; face, vertex, and temples closely punctate; ocellococular line less than twice the diameter of an ocellus; temples receding; antenna a little longer than body. Mesoscutum mat covered with closely placed but very shallow punctures; scutellar furrow very fine, minutely pitted; scutellum mat with scattered shallow punctures; propodeum smooth and shining laterally, weakly punctate medially; mesopleuron mat closely punctate anteriorly, smooth posteriorly and above, the longitudinal impression broad and shallow with some irregular, weak, vertical wrinkles; metapleuron mat smooth, radius barely longer than intercubitus; hind coxa mat, mostly smooth, with an elongate flattened area on outer upper edge at base; inner calcarium of middle tibia slightly longer than metatarsus; inner calcarium of hind tibia about three-fifths as long as metatarsus. Abdomen very slender, compressed; plate of first tergite parallel-sided to apical third, from where it narrows strongly to apex, entirely smooth and polished, its width at apex less than half the length of second tergite; plate of second tergite triangular, bounded laterally by sharp oblique grooves, entirely smooth and polished; hypopygium not attaining apex of abdomen; ovipositor sheath subexserted.

Black; wings hyaline; stigma dark brown, veins paler; all coxae black; trochanters, femora, tibiae, and tarsi of fore and middle legs entirely yellow; posterior femur reddish-yellow, apical third blackish; posterior tibia yellow, blackish on apical two-fifths; posterior tarsus blackish, pale at base.
Male. In all essentials similar to female but with the middle and hind legs darker; hind femur entirely black; hind tibia black on apical half.

**Type locality.** Pasadena, California.

**Type.** United States National Museum No. 58214.

Described from the female type and three male paratypes reared from *Anacamptodes fragilaria* (Grossb.) at the type locality in October 1945, by N. L. H. Krauss; one female from Los Angeles, California, and one from “Southern California,” both reared from *A. fragilaria* in January 1946, by Mr. Krauss; and nine males bred by Mr. Krauss in the laboratory at Honolulu, Hawaii, January 1946, upon the same host.

**ENOCLERUS HUMERALIS (SCHAEFFER), A PRIMARY HOMONYM**

(Coleoptera, Cleridae)

**BY WILLIAM F. BARR**

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In 1823, Thomas Say, in the Journal of the Academy of Natural Sciences of Philadelphia, volume 3, page 192, described a new species of Cleridae and gave to it the name *Clerus humeralis*. This species was later placed in the genus *Hydnocera* and at the present time, correctly belongs in the genus *Phyllobaeus*. Charles Schaeffer in 1905, apparently not aware of the previous usage of the trivial name *humeralis* in the genus *Clerus*, described a different species of Cleridae under this same name—*Clerus humeralis*, in the Bulletin of the Brooklyn Institute of Arts and Sciences, volume 1, page 155. This species has since been placed in the genus *Enoclerus* by some workers.

According to the International Rules of Zoological Nomenclature, Article 35, “A specific name is to be rejected as a homonym when it has previously been used for some other species or subspecies of the same genus.” Both Say’s species and Schaeffer’s species are now in different genera, but the important fact is that both species when described, were placed in the genus *Clerus*. Thus *Clerus humeralis*, as described by Schaeffer, is a primary homonym and cannot stand. Therefore, *Enoclerus schaefferi* Barr, new name, is proposed by the writer to take the place of *Clerus humeralis* Schaeffer (nec Say).
DESIGNATION AND DISTRIBUTION OF TYPES OF NEPTICULA BRAUNELLA JONES (Lepidoptera: Nepticulidae)

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W. W. Jones, in his paper, "The description and biology of Nepticula braunella new species (Lepidoptera: Nepticulidae), a species of leaf miner on Prunus ilicifolia Walp. and the variety integrifolia Sarg." (1933, Univ. Calif. Publ. Ent., 6(4):49-78), did not designate the types nor give any data on the type series.

The material, upon which this paper and the above-mentioned description were based, had been retained in the Jones collection until recently when it was turned over to Professor E. O. Essig of the Division of Entomology and Parasitology of the University of California. This matter was called to the writer's attention by E. O. Essig, and the following type designations have been made.

Lectoholotype, male, BERKELEY, CALIF., Mar. 22, 1928 (W. W. Jones), No. 5682, California Academy of Sciences, Entomology; lectoallotype, female, Berkeley, Calif., April 3, 1928 (W. W. Jones), No. 5683, California Academy of Sciences, Entomology. Lectoparatypes, 105 specimens of both sexes, all from Berkeley, Calif. (W. W. Jones), with the following range of dates: April 20-30, 1924; March 1-20, 1925; March 8-14, 1927; March 9-April 15, 1928; April 2-20, 1929.

The lectoparatypes are to be distributed as follows: six each to the American Museum of Natural History, British Museum of Natural History, Canadian National Collection, Los Angeles Museum, Museum of Comparative Zoology, United States National Museum, and collection of writer; the remainder to be deposited in the collections of the University of California, Berkeley, and the California Academy of Sciences.

Attention is drawn to the fact that this species was not included in the "Check List of the Lepidoptera of Canada and the United States of America. Part II. Microlepidoptera" (J. McDunnough, 1939. Mem. So. Calif. Acad. Sci., 2:1-171), and should be added thereto.
TWO NEW SPECIES OF BEES FROM ARIZONA
(Hymenoptera, Apoidea)  

BY P. H. TIMBERLAKE  
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The types of the new species here described are included in the collection at the University of California Citrus Experiment Station, Riverside.

Heriades (Neotrypetes) micheneri Timberlake, new species

In Michener’s table of Neotrypetes (Ann. Ent. Soc. Amer., 31:517, 1938), the female runs to variolosa (Cresson) and differs in having a broad, very shallow emargination in clypeal margin, armed with five small denticles; punctures of frons coarser than those of mesoscutum; and abdominal bands very narrow and absent on the fifth tergite. The male runs to leavitti Crawford in the same table, but differs in having the first ventrite truncate at apex, hardly produced, and armed on its disk with a large conical process that ends very bluntly, as seen both from behind and from the side. The process, therefore, is much like that of carinata Cresson, which belongs to a different group.

Female. Black, the apex of last joint of tarsi and claws brownish testaceous. Apex of mandibles, tegulae, and smooth inner surface of legs more or less tinged with dark reddish. Mandibles not broadened at apex, twice as long as wide, the two carinae on outer surface parallel, but uniting close to the apex. Cutting edge of mandible tridentate. Clypeal margin very broadly truncate, with a slight broad median emargination armed with five small denticles. Punctures of frons and vertex very coarse and close, with those of face below antennae and of cheek much smaller. Punctures of mesocutum, scutellum, and mesopleura coarse and close but slightly smaller than those of frons. Punctures of abdomen coarse and close, becoming coarser and shallow on tergite 3, where they are nearly as coarse as those of thorax. Pubescence very fine, short and inconspicuous, except for patches of white plumose hair on sides of face, pronotum, area around tubercles and base of wings, and on apical margin of scutellum and suture between

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1Paper No. 554, University of California Citrus Experiment Station, Riverside, California.
2Associate Entomologist in the Experiment Station.
meso- and metapleuron. Hair of legs short and scanty, except on tarsi; that on inner side of hind tarsi long, abundant, and pale fulvous. Apical hair-band on tergites 1 to 4 white and very narrow, except that the one on first tergite is considerably widened on each side. These bands composed of small scalelike hairs, with microscopic plumosity. Scopa white. Wings uniformly grayish dusky, with dark fuscous nervures and stigma. Length, 5.25 mm.; anterior wing, 3.5 mm.

Male. Similar to female in punctuation and pubescence. Front femora, except behind, and front tibiae reddish ferruginous. Apical joint of front tarsi entirely ferruginous. Anterior side of middle femora dark reddish. Mandibles narrow and bidentate. Clypeal margin simple. Face more narrowed than in female. Punctures of head and thorax a little less coarse and dense. Punctures of first two tergites as in the female; those of the third a little coarser but not shallow as in the female. Femora strongly swollen (much more so than in variolosa and other species). Front tarsi short and broadened, the first joint about twice as long as wide, the three middle joints very short and strongly bilobate about as in bruneri Titus. Face between antennae and clypeus covered with white plumose hair. Dense white hair also on anterior part of cheeks, especially the gular region, on the coxae, the apical part of first ventrite, and disk of second ventrite. Front tarsi with a white fringe behind, and hair on inner side of hind tarsi whitish. Apical bands of white scalelike hairs on abdomen present only on tergites 1 to 3, and not widened at sides of first segment. Fifth ventrite (fig. 1) deeply and broadly emarginate at apex, the emargination formed by a large triangular lobe on each side, the tips of lobes acute and curved inward. A small acuminate tooth on outer side of base of these lobes. Base of the emargination armed with a transverse band of rather short, erect, curved hairs, which are strongly capitate at apex, except a few longer hairs at tips of the lateral teeth. Sixth ventrite as in allied species, the triangular apical part having a patch of fine, long hairs on each side. Length, about 5 mm. (or 6.5 mm. with abdo-
men extended to expose the ventral segments); anterior wing, 3.7 mm.

Described from a pair (holotype female and allotype) taken on damp sand, Patagonia, Arizona, August 8, 1940 (Timberlake).

Named for Charles D. Michener, who has given us an excellent revision of North American Heriades.

Calliopsis squamifera Timberlake, new species

Allied to andreniformis Smith and rhodophila Cockerell, but differs in the white face markings and very long slender middle tarsi. It is probably closer to the little-known teucrii Cockerell, the female of which has white markings, but differs from squamifera in larger size, piceous tegulae, and dusky wings.

Male. Black, the mandibles, except reddish tips, labrum, and face below antennae, white. Supraclepeal and lateral marks extending above level of antennae almost exactly as in andreniformis. Scape broadly in front, interrupted band on hind border of pronotum, and tubercles, yellowish white. Flagellum, a large quadrate area on middle of mesosternum, and legs lemon-yellow, the tarsi being a little more brownish, and apical joint of hind pair dusky. Flagellum dusky behind, the obscurity more pronounced on basal joints and there extending further around the joints. Scape behind and pedicel black. Narrow apical depression of tergites testaceous brown. Tegulae pale testaceous with a white dot. Wings nearly clear, the neuration pale testaceous brown. Large callus-like areas on metanotum pale grayish-brown (described more in detail below). Form more slender than in andreniformis. Head broader than thorax, somewhat broader than long, with the inner orbits of eyes slightly converging below. Clypeus not prominent as in andreniformis. Legs slender, nearly as in rhodophila and andreniformis, except that the middle tarsi are extremely slender and elongate. Recurrent nervures received at nearly equal distances from base and apex of second submarginal cell. Puncturation similar to that of andreniformis, but the dark part of frons with relatively coarser, shallow, and subconfluent punctures, mesoscutum a little more sparsely punctured, and mesopleura nearly impunctate. Pubescence white, nearly as in andreniformis, except that the hairs of clypeus are less bristle-like. Length, 4 mm.; anterior wing, 2.8 mm.

Holotype, a male, at flowers of Euphorbia, Picacho Pass, Arizona, August 7, 1940 (Timberlake). The type was taken with a small series of Calliopsis (Perissander) anomoptera Michener, at the type locality of the latter species.
The males of the typical group of *Calliopsis* (the male of *teucrrii* being unknown) may be distinguished by the following key:

1. Face yellow; middle tarsus no more than twice as long as tibia; callus-like areas of scutellum and metanotum black..............2
   - Face white; middle tarsus about thrice as long as tibia; callus-like areas of scutellum and metanotum pale grayish-brown.....
      .................................................. *squamifera*

2. Legs and scapes yellow; clypeus convexly prominent in middle; callus-like areas of metanotum small and widely separated
   - Scape black, or at most with a slender yellow line in front; femora black, except at apex, and tibiae with a black patch behind; callus-like areas of metanotum very large and contiguous; clypeus less prominent........................................*rhodophila*

The callus-like areas of scutellum and metanotum of the male in the typical group of *Calliopsis* are reported here for the first time, I believe. These areas in *rhodophila* and *andreniformis* are opaque black and densely covered with extremely short, moss-like pubescence. In the latter species the areas are comparatively small, those on scutellum being easily hidden by the wings, as they occupy the depression between the disk of scutellum and base of hind wings. Posterior border of areas on scutellum yellowish white, with a little patch of whitish hair. Areas on metanotum cover all but the median fifth of the segment, the middle part being subpubuplicate and provided with long, erect hairs.

In *rhodophila* the areas on scutellum are large, so that the exposed disk covers rather less than one-third of the total width of segment, and as seen from in front or behind its surface is slightly below that of the somewhat protuberant lateral areas. The latter are pale testaceous or whitish on the hind border as in *andreniformis*. The areas on metanotum are extremely large in *rhodophila*, and subquadrate, extending about two-thirds of the distance from base of metanotum to apex of propodeum. They appear to extend far over the base of the propodeum, and are contiguous except on the basal half, where there is a very narrow line of the normal metanotum exposed and provided with a tuft of long hair.

In *squamifera* the peculiar areas are pallid and covered with fine, shingled, or overlapping scales. The areas on the scutellum are small and restricted to the lateral impressed part of the scutellar sclerite, as in *andreniformis*. On the metanotum they are
large and broadly oval, not quite meeting medially, with the constricted hairy area at base in the form of an equilateral triangle. They reach a little more than half way from base of metanotum to apex of propodeum.

I have seen similar structures, but apparently glabrous, and hence more callus-like, on the scutellum and metanotum of the male of a small undescribed species of Nomadopsis from Texas.

SOME RECORDS OF PARASITISM OF SOLITARY BEES BY CONOPID FLIES

BY J. W. MACSWAIN AND G. E. BOHART
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Conopid flies have been observed in the field to attempt oviposition in many species of bees including Apis mellifera L. In addition, the considerable variation in size among the individuals of a single species may also indicate a lack of host specificity. However, many records of successful parasitism will have to be collected before a clear picture of the degree of host specificity can be obtained. For this reason the following observations are placed on record.

Three dead adults of Andrena vierecki Ckll., each with a conopid puparium in its abdomen, were taken from burrows in a small nesting site of this bee at Berkeley, California, on March 14, 1939. During the following spring, adults of Myopa rubida Bigot emerged from two of the specimens. The same conopid species was observed striking Diandrena chalybioides Viereck and Andrena complexa Viereck on flowers of buttercup, Ranunculus californicus Bentham, one mile west of Orinda Crossroads, Contra Costa County, California, on April 11, 1946. When a series of these two species of bees were taken into the laboratory and dissected, two out of eight of the Diandrena chalybioides had a small dipterous larva attached to the outer wall of the foregut, although twenty-five Andrena complexa contained neither eggs nor larvae of the parasites.

One dead female of Panurginus melanocephalus Ckll., containing a conopid puparium was taken from a burrow at Berkeley on March 16, 1939. Although the fly did not emerge from the bee, upon dissection it was recognizable as a member of the genus Zodion.

NEW SPECIES OF THE GENUS TRIOZOIDA
(Psyllidae, Homoptera)¹

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The three species of Triozoida herein described bring to four the total number assigned to this genus. Although quite distinct from one another they form a very homogeneous group which is readily distinguished from the other genera of Triozinae. The principal distinguishing characters are the presence of more than one spine on the lateral surface of the apex of the metatibia, the shape of the vertex and genal processes. While the wing venation is similar, it shows considerable variation between species.

Two of the species included have been received from Senor S. C. Bruner of the Estacion Experimental Agronomica, Santiago de las Vegas, Cuba. The third, from Panama, is in material borrowed from the United States National Museum.

Triozoida media Tuthill, new species

Length to tip of folded wings, 3-3.5 mm.

Color: General color green to chocolate brown. More teneral specimens green with legs, tip of antennae, vertex and thoracic dorsum brownish. Fully matured males dark brown except basal portion of antennae, meso-scutellum, thoracic venter, genitalia green to yellow. Wings hyaline except area about furcation of M, Cu and R and spot on margin of clavus embrowned.

Structure: Head narrower than thorax. Vertex minutely pubescent, concave, smoothly rounded down to genae, medial suture prominent. Lateral ocelli raised. Genae produced as blunt, widely separated lobes, contiguous basally. Clypeus visible as third medial lobe. Antennae arising far down on genae, slender, twice as long as width of head. Eyes of moderate size, hemispherical. Thorax well arched. Pronotum large, nearly vertical, not depressed below vertex. Mesopleurites strongly developed. Forewings straight, acutely angled, 2.8 times as long as wide; basal vein short, Rs short, nearly straight to costa, not reaching furcation of media, medial cell much larger than cubital, latter strongly flattened. Head wings 0.6 as long as forewings. Metatibiae without basal

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armature, 2 outer and 3 inner apical spines. Metacoxae raised anteriorly.

Male proctiger produced caudad basally, tapered to narrow apex. Forceps as long as proctiger, in lateral view parallel-sided, somewhat curved caudad, tapering apically; in caudal view stout, arched to black tips; in dorsal view apices concavely narrowed to small, truncate, black tooth. Female genital segment 0.75 as long as rest of abdomen, stout; dorsal valve with small, blunt styliform apex; ventral valve slender, equalling dorsal, acute.

**Holotype**, male, **allotype**, female, 1 male and 4 female paratypes, all collected by J. Acuna in the **Sierra de Anafe, Havana Province, Cuba**, February 24, 1946. They were found in the tender leaves of *Eugenia rocana* Britton and Wilson enclosed by the leaves which were folded lengthwise and somewhat misshapened, forming a kind of pseudo gall.

**Holotype**, allotype and paratypes in author's collection, paratypes in collection of the **Estacion Experimental Agronomica, Santiago de las Vegas, Cuba**.

This handsome species resembles *T. johnsonii* but is readily distinguished by the shorter radial sector and smaller cubital cell of the forewing and the less bulging vertex.

**Triozoida mutabilis** Tuthill, new species

**Length** to tip of folded wings, 3-3.4 mm.

**Color**: General color rufous with legs, tip of antennae, vertex and genal processes brown to black or general color greenish yellow with rufous areas on sclerites of thorax and abdomen, legs and antennae darker, genal processes black. Wings hyaline, without dark areas.

**Structure**: Head narrower than thorax, strongly deflexed. Vertex excavate between eyes, strongly depressed discally, bulging far over median ocellus, medial suture prominent. Lateral ocelli strongly raised. Genae produced as widely separated, blunt cones, concave on meso-cephalic surface, not touching basally. Clypeus small, visible between genal processes. Antennae slender, 1.6 times as long as width of head, arising far down on genae. Eyes large, hemispherical. Thorax broad, rather flat. Pronotum small, vertical, below caudal margin of vertex. Mesopleurites well developed. Forewings broad, obtuse apically, 2.7 times as long as wide; basal vein short, Rs long and somewhat sinuate, equalling or exceeding M2, medial cell larger than cubital, latter somewhat flattened. Hind wings 0.6 as long as forewings. Metatibiae with serrate basal carina, 2 outer and 3 inner apical spines. Metacoxae raised anteriorly.
Female genital segment 0.66 as long as rest of abdomen, stout; dorsal valve blunt, slightly attenuate at apex; ventral valve slender, acute, nearly equalling dorsal.

_Holotype_, female, MOA, ORIENTE PROVINCE, CUBA, April 13, 1945, one female *paratype* same locality, November 15, 1945. Both specimens were collected by J. Acuna.

The two specimens at hand show marked difference in size and coloration. The specimen which was collected in November is smaller and of a nearly uniform rufous color. The differences are similar to those encountered in specimens of the same species collected in moist and arid regions elsewhere. While unfamiliar with the climate of northeastern Cuba, I would conclude that the November specimen developed during a hot, dry period.

This species resembles _T. johnsonii_ but is readily distinguished by the smaller size, broader and obtusely pointed wing and shorter antennae.

_Triozoida inconstans_ Tuthill, new species

Length to tip of folded wings, 2.5 mm.

_Color_: Head dark brown, shining. Antennae light basally, darkening toward tip. Thorax chocolate brown dorsad, lighter ventrad. Legs lighter, metatibiae almost white. Forewings dark brown along basal vein and radius to costa. Abdomen brown dorsad, nearly white ventrad. Female lighter, thorax yellowish.

_Structure_: Head small, narrower than thorax. Vertex smoothly excavate between eyes, protruding anteriorly over median ocellus, smoothly rounded to genae. Genae produced as short, blunt, widely separated processes. Clypeus showing between genal processes as a third similar lobe. Antennae about twice as long as width of head. Eyes small, hemispherical. Thorax broad, rather flat. Pro- notum strongly depressed but not below center of vertex. Mesoscutum finely punctate. Forewings slender, 3 times as long as wide, acutely angular; basal vein strongly raised, branching variable, M and Cu often with distinct common petiole, Rs short, nearly straight, reaching to or beyond furcation of media, medial cell larger than cubital, latter somewhat flattened. Hind wings 0.6 as long as forewings, minutely setate. Metatibiae with several small teeth basally, outer apical spines varying in size and number, usually 2, some specimens with 3 or 1, in addition several small setae along margin, 3 or 2 inner spines. Metacoxae not raised anteriorly.

Male proctiger produced caudad as blunt triangular lobe, with prominent apical epiphysis. Forceps slightly shorter than proctiger; in lateral view straight, narrow, tapered to sharp black tips; in caudal view slender, strongly arched to apex, small black
tooth at tip. Female genital segment 0.6 as long as rest of abdomen, straight; dorsal valve blunt; ventral valve nearly as long as dorsal, sharp apically.

The number and size of the spines or setae on the apex of the metatibiae is quite variable in this species. In several of the specimens at hand there is a variation between the right and left tibia.

Described from 5 males and 1 female collected at Ancon, Canal Zone, Panama, June 26, 1919, by H. Dietz and I. Molino, "on Guara."


This handsome species resembles T. johnsonii but may be distinguished by its smaller size, coloration and wing venation, especially the shorter, straight radial sector.

AN ADDITIONAL LOCALITY FOR AULICUS TERRESTRIS LINSLEY
(Coleoptera, Cleridae)

BY G. S. MANSFIELD AND J. W. TILDEN

On May 26, 1940, a single specimen of Aulicus terrestris Linsley was collected by the writers near Silver Creek Hills, Santa Clara County, California, about twelve miles southeast of San Jose. The insect was found resting on grass in a small meadow in the foothills of Mt. Hamilton.

Although no specimens of the Lubber Grasshopper, Esselenia vanduzeei Hebard, were taken at this time, a single specimen was collected in the same area on April 13, 1941. The association of these two insects has been shown by Linsley.

This record is only eight or ten miles southwest of a previous one from Mt. Hamilton, but is of interest because of the much lower elevation. The point at which this collection was made is between 1000 and 1500 feet high, whereas the elevation of Mt. Hamilton is about 4200 feet.

A SMALL SAGE APHID

BY GEORGE F. KNOWLTON
Utah State Agricultural College, Logan

The following report deals with an apparently undescribed genus and species of sagebrush aphid. Distribution records for a few species in the genus Microsiphum are also included.

Zyxaphis Knowlton, new genus

Size small; head with antennal tubercles undeveloped; antennae six segmented (sometimes with tendency for antennals III and IV to not fully separate); sensoria of antennae circular to subcircular, not abundant; fore wings with the media twice branched; hind wings with both media and cubitus present; cornicles truncate, sub-cylindrical, not longer than thick; cauda slightly developed, with numerous hairs and with some tendency to be angular at apex; anal plate rounded; lateral tubercles on abdomen prominent; reticulated areas on cuticula of abdomen.

Type, Zyxaphis utahensis Knowlton.

Zyxaphis utahensis Knowlton, new species

Alate vivipara: Size small, body 1.52 to 1.6 mm. long and .72 to .8 wide across abdomen; ocellar tubercles well developed; antennal tubercles undeveloped; antennae .64, dusky to blackish and imbricated beyond antennal II; antennal III and IV with a tendency not to fully divide (on 2 of the antennae); antennal III, .16 mm long with 2 to 4 sensoria; IV, .112 to .15 with 0 to 1 sensorium; V, .128 to .132; VI, .098 plus .078, to .096 plus .08; restrum reaching second coxae, tip acute, rostral IV + V, .14 mm. long; wing venation normal, media twice branched; hind tibiae pale to dusky near apex, .51 to .61 mm. long; hind tarsi .07 to .115; lateral portions of body cuticle reticulated in some areas; lateral tubercles prominent; cornicles .033, dusky, truncate, about as broad as long, short-cylindrical in shape, imbricated; cauda short, dusky, broadly triangular with blunt apex; abdominal tubercles well developed.

Collection: Taken on Artemisia tridentata at Mt. Carmel, Utah, May 24, 1940, by G. F. Knowlton. Type in the collection of the writer.
Taxonomy: *Zyxaphis utahensis* differs conspicuously from *Microsiphum acophorum* S.-K. and other *Microsiphum* species occurring in Utah in having the unguis of antennal VI shorter than base; cauda somewhat larger and with tendency to be angular rather than rounded as in *Cryptosiphum artemisiae* Buckton, and with prominent lateral tubercles.

*Microsiphum acophorum* S.-K. collected on *Artemisia tridentata* at Lakota, Bear Lake, Utah, July 29, 1945; Battle Mt., Nevada, August 16, 1945; Elko, Nevada, July 1, 1939; Wells, Nevada, August 20, 1943; Thousand Springs, Idaho, August 8, 1939.

*M. artemisiae* (Gillette) on *Artemisia vulgaris* and *A. tridentata* at Oak Creek Canyon, Utah, July 10, and Junction, Utah, July 11, 1942; Snowwater Lake, Nevada, August 20, 1943; Wells, Nevada, August 16, 1945; Craig, Montana, August 5, 1944; Tumalo, Oregon, August 24, 1944 (Knowlton); also Blue Gulch and Castleford, Idaho, September, 1932 (D. E. Fox).

*M. oregonensis* Wilson on *Artemisia*, Cornish, Utah, July 15, 1941.

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NOTES ON SOME COLEOPTERA TAKEN FROM WET PAINT

On April 18 of this year I collected nearly 250 beetles from a newly painted bridge at Ben Lomond, California, in the Santa Cruz Mountains. Although the paint was nearly dry, many of the insects were still alive. Among the thirty-five species collected was the rather rare clerid, *Thanasimus repandus* Horn, represented by twelve individuals; probably the greatest number to be collected at one time. Four specimens were taken of another noteworthy clerid, *Thanasimus undatulus rubiventris* Lec. Of the twelve families represented, the Scolytidae had the largest number of species (six) and individuals. Many other insects were also trapped in the paint but were not collected. Ordinary paint remover proved satisfactory in cleaning the specimens.

The attractiveness of paint to beetles was also cited by Essig in Vol. XIX, p. 91, of this journal in some notes on *Rosalia funebris* Mots.—E. S. Dethlefsen.
ON FOUR NEW AMERICAN CHILOPODS

BY RALPH V. CHAMBERLIN

University of Utah, Salt Lake City

The new species here described were noted while identifying several small collections submitted to me by Dr. A. M. Woodbury, from Utah, P. W. Fattig, from Georgia, and Dr. J. M. Linsdale from California. The types are retained at present in the author's collection.

SCHENDYLIDAE

The new species described below is the first of the genus to become known from the western United States. It is essentially a northern genus, being represented by two species from the northeastern states and by five in Alaska and northeastern Asia. Its extension down the western mountains into the United States is natural. The known species of the genus may be separated by means of the following key.

KEY TO SPECIES OF ESCARYUS

1. Claw of anal legs as large as those of the penult pair..............2
   - Claw of anal legs small in comparison with those of other legs.4
2. Last sternite as broad as long narrowed caudad; Anal coxae with only 5 or 6 pores (Alaska)..........................E. albus Cook
   - Last sternite narrow, relatively long, scarcely narrowed; coxal pores more numerous (Northeastern United States)...........3
3. Yellowish brown in color; 41 pairs of legs.E. urbicus (Meinert)
   - Waxy white; 49 pairs of legs..................................E. liber Cook
4. Anal pores present................................................................5
   - Anal pores absent..........................................................6
5. Pairs of legs 47; last ventral plate narrow, with sides nearly parallel (Alaska)....................................................E. delus Chamberlin
   - Pairs of legs 43; last ventral plate broad, conspicuously narrowed caudad (Utah).............E. monticolens Chamberlin, n. sp.
6. Pairs of legs 33 (Alaska).............E. paucipes Chamberlin
   - Pairs of legs 49-51.......................................................7
7. Syncoxite of first maxillae with long membranous lappets; lateral teeth of labrum with long slender tips......E. sibiricus Cook
   - Syncoxite of first maxillae without lappets; all teeth of labrum short and stout..............................................E. japonicus Attems

Escaryus monticolens Chamberlin, new species

Apparently related to the Alaskan E. albus Cook. It differs in general appearance in being yellow, with head and prehensors
darker, instead of being a waxy, translucent white. It differs in
the more numerous soxal pores these numbering about 18 on each
side instead of 5-6. Last ventral plate trapeziform, about equal
in length to the anterior width. Claws of the anal legs somewhat
smaller than those of the penult legs.

Cephalic plate broadest anteriorly, considerably overlapping the
basal plate the exposed portion of which is short. Clypeus wholly
lacking nonerelate fields. Labrum evenly and moderately incurved,
the teeth all stout and subconical, 15 in number. First maxillae
with palpi having well developed lappets. Coxosternum of second
maxillae with anterior border deeply notched at the middle, the
median area less sclerotized, membranous. Mandible with teeth
in three blocks; e.g., 3, 3, 4.

Anal pores present.
Number of pairs of legs, 43.
Length, 18 mm.

Locality. Utah: Mill Creek Canyon. One female dug up in
soil at an elevation of about 7,500 ft. A. M. Woodbury, collector.

Lithobiidae

Nadabius cherokeenus Chamberlin, new species

Dorsum brown or light chestnut. Legs proximally pale, but
with the fourth and fifth joints brown and the tarsus yellow.
Antennae brown.

The antennae composed of the usual 20 articles which are of
moderate length. Ocelli in 4 longitudinal series; thus, 1+5, 5, 4, 3.

Prosternal teeth 2 2; the median incision acute.
None of the dorsal plates produced.

Coxal pores, small and circular; 2, 3, 3, 3.

Ventral spines of first legs, 0, 0, 1, 2, 1 (2); dorsal, 0, 0, 0, 1, 1.
Ventral spines of penult legs, 0, 1, 3, 2, 1; dorsal, 1, 0, 2, 1, 0;
claws 2. Ventral spines of anal legs, 0, 1, 3, 1, 0; dorsal, 1, 0, 2, 0, 0;
claw single. Last two pairs of coxae laterally armed.

The anal legs of the male with the usual subdorsal crest at
distal end of the fifth joint, its form and relations as shown in the
accompanying figure. Length, 10 mm.

Locality. Georgia: Atlanta. A male taken February 17,
1946, by P. W. Fattig.

Distinguished from all other known species excepting N. eremites
in having the dorsal spines of the anal legs 1, 0, 2, 0, 0
and those of the penult 1, 0, 2, 1, 0.

It is separated from N. eremites chiefly on the basis of having
the last two pairs of coxae laterally armed, whereas they are
unarmed in eremites, and of having the ocelli in 4 series instead
of in 3.
Arebius sequens Chamberlin, new species

A species agreeing with *A. crenius* and differing from *A. dolius*, to which it runs in the key, in having the claw of the female genital forceps distinctly tripartite, the lateral lobes smaller than the median which, however, is short and relatively broad. The basal spines of the genital forceps slender, subcylindrical but narrowest at middle, the acuminated apex short. It differs from *crenius* in having the dorsal spines of the 12th and 13th legs 1, 0, 3, 1, 1 instead of 1, 0, 3, 2, 2. It also differs in the more numerous ocelli arranged in three series instead of in two; e.g., 1 5, 4, 3.

Length, 10 mm.

**Locality.** CALIFORNIA: MONTEREY COUNTY, HASTINGS RESERVATION. A male and female taken June 10, 1943, by Dr. J. M. Linsdale.

*Nudabius cherokeeenus* Chamberlin, n. sp. Fifth segment of left anal leg, subdorsal view.

Arebius petrovius Chamberlin, new species

In the author's key this form runs out to *A. diplonyx* of the Santa Barbara region. It is like that species in having two claws on the anal leg, but the supplementary claw is very small instead of being rather large and distinct. It is also like that species in having the claw of the female genital forceps tripartite; the basal spines, however, are acuminated from base instead of being cylindrical to an acuminated apical part.

The ventral spines of the penult legs are 0, 1, 3, 3, 1 instead of 0, 1, 3, 3, 2, the dorsal being 1, 0, 3, 1, 1. Dorsal spines of anal legs 1, 0, 3, 1, 0, the ventral 0, 1, 3, 3, 0. Last two pairs of coxae laterally armed.

The ocelli are fewer and are in two series instead of in three; e.g., 1+3, 2 or 3, 3.

Length, 7-7.5 mm., thus being smaller than *A. diplonyx* which is 8 to 8.5 mm. long.

**Locality.** CALIFORNIA: MONTEREY COUNTY, FINCH CREEK.

Four specimens under a rock, taken March 24, 1945, by Dr. J. M. Linsdale.
NOTES ON HIPPOMELAS CALIFORNICUS (HORN) AND CHRYSOBOTHRIS CYANELLA HORN
(Coleoptera: Buprestidae)

BY GEORGE S. MANSFIELD
Atascadero, California

Hippomelas (Nanularia) californicus (Horn) and Chrysobothris cyanella Horn have been taken by the author at Atascadero, San Luis Obispo County, California, on a wild buckwheat, Eriogonum nudum Dougl. These records represent a new locality and considerably extend the range of both species. Further, some additional notes on each species are presented.

Hippomelas (Nanularia) californicus Horn

Two specimens of this species were taken on the stem of wild buckwheat on June 23, 1940, and thirteen additional specimens were collected during July, 1946, at Atascadero. These specimens average 9.5 mm. in length and range from 7.0 mm. to 10.3 mm. Although the color of this species is a deep reddish brown, individuals in the field appear quite gray due to their coating of white pile. Most of the specimens were taken within six inches of the ground on the buckwheat stem. Several of those taken late in July, 1946, were collected higher up, where they were observed feeding on the outer layers of the stem.

This beetle is very rare in collections. Van Dyke (1942) mentions three specimens in the collection of the California Academy of Sciences. Subsequently the Academy has added another specimen collected August 21, 1927, at Laguna, San Diego County, California, from the collection of W. J. Chamberlin. Through the kindness of Prof. N. Banks, I have had an opportunity to examine two additional specimens in the LeConte Collection at the Museum of Comparative Zoology, Harvard University. These are from “California” and were collected by Horn. One is labeled “Type”, although Van Dyke (1942) states that the species was described from a unique collected by Horn and now in the Philadelphia Academy of Sciences.

Judging from the distribution of the collected specimens (Calaveras, Santa Cruz, San Luis Obispo, and San Diego coun-
ties), it appears probable that this species is to be found throughout cismontane California, ranging from elevations of 4000 feet (Laguna, San Diego Co.) to 1000 feet, or lower. Because of its habit of moving to the opposite side of the stem from the collector and its rather inconspicuous color and pattern, this species is probably often overlooked. This buprestid was taken in 1940 and 1946 in the same restricted stand of *Eriogonum nudum* and observations of other stands of this plant in surrounding areas failed to produce more specimens.

**Chrysobothris cyanella** Horn

Thirteen specimens of this species were collected on the stems of *Eriogonum nudum* at Atascadero during the period from May 28 to July 15, 1946. Other collectors have taken this species in Oregon and California from the flowers of wild buckwheat. All of the author’s collections were made from the stems of the buckwheat, where the beetles were resting, and most of them were taken before the plants came into bloom in July. The average length of these specimens is 7.2 mm. and they range from 5.8 mm. to 8.3 mm. The color ranges from a bright bluish green to a violaceous blue. The individuals collected in July were mostly blue, whereas those taken in May and June were all bluish green.

Fisher (1942) states the distribution of this species to be from Ashland, Oregon, south to Kings River and Bishop, California, and mentions one record of Chamberlin’s from Pasadena. The specimens in the California Academy of Sciences collection range from Modoc and Humbolt counties to Kings River and Bishop, and Tonopah, Nevada. The specimens from Atascadero appear to be the first record of this species from the Coast Range of California and from such a low elevation (1000 feet), with the exception of the Pasadena record (which may have been collected on a mountain near there.) Most of the specimens in the Academy collection are from the Sierra Nevada Mountains at elevations in excess of 5000 feet.

This species was taken on the same restricted stand of *E. nudum* at Atascadero as the preceding species. Likewise, no other collections were made in surrounding areas, although a periodic search was made for them.

I am indebted to Dr. E. C. Van Dyke for the identification of
these two species of insects, and to Mrs. Roxana Ferris and Mr. J. W. Tilden of Stanford University for determining the species of buckwheat.

REFERENCES


AN OCCURRENCE OF THE PUPA OF GLAUCOPSYCHE LYGDAMUS BEHRII (EDWARDS) IN AN ANT NEST (Lepidoptera, Lycaenidae)

BY J. W. TILDEN

Redwood City, California

February 14, 1942, a lycaenid pupa was taken from an ant nest in Alum Rock Park, Santa Clara County, California. The ant nest, in a log of Quercus agrifolia Nee, was partly under loosened bark and partly in decayed wood. The lycaenid pupa was surrounded by ant pupae and so situated as to preclude the probability that its presence in the nest was accidental. A normal male of G. lygdamus behrii (Edw.) emerged from this pupa on February 21, 1942.

F. X. Williams (1908) gives the food plant of behrii as Lupinus micranthus Dougl., and obtained a pupa which emerged when reared on this plant under laboratory conditions. Bowler (1911) in recording the early stages of the typical form of lygdamus, mentions that the larvae are attended by ants and that cannibalism is common among the larvae. Many lycaenid larvae have been shown to be attended by ants, the ants obtaining secretions from special organs on the lycaenid larvae.

Balduf (1939) gives a full discussion and citation of literature concerning mymecophilous Lycaenidae. European workers have found that the fourth and fifth stadia as well as the pupal stage of certain species are passed in ant nests. The lycaenid larvae are taken into the nests by the ants at the beginning of
the fourth stadium. They then cease phytophagous habits and subsist during the last two stadia upon the pupae of their hosts. The ants in return obtain the secretions of the lycaenids.

A survey of American literature indicates that this habit has not been observed in American species. But the pupa mentioned above either must have been transported to the ant nest as a larva, or allowed to enter it unmolested. This suggests a phase of myrmecophily in American Lycaenidae that so far is not fully understood.

References


NORTHWARD RANGE EXTENSION OF OEME GRACILIS LEC.
(Coleoptera: Cerambycidae)

A specimen of Oeme gracilis Lec. was found dead beneath a light on the Hale Ranch, about eight miles south of Atascadero, San Luis Obispo County, California, on September 11, 1940. This beetle is apparently rare in collections. There are ten specimens in the collection of the California Academy of Sciences from Los Angeles, Pasadena, and Poway, San Diego County, California. In the Museum of Comparative Zoology at Harvard, there is LeConte's type from Poway, and a specimen from Catalina and two specimens from Ventura(?), in the Fall collection. From these records it appears that the specimen from Atascadero represents a new northern limit of this species.—GEORGE S. MANSFIELD, Atascadero, California.
ANOPHELES XELAJUENSIS DELEON, A NEW ADDITION TO THE KNOWN ANOPHELINE FAUNA OF PANAMA

BY PEDRO GALINDO
Campana Anti-Malairica, Ministerio de Previsión Social
Panama, R. de P.

Anopheles xelajuensis DeLeon, was described in 1938 from the high mountains of Guatemala. Vargas in 1942 reported the species from southern Mexico and created the subgenus Russellia with this species as the genotype. No other record of it appears in the literature to the writer’s knowledge.

During May, 1946, while collecting in the Chiriqui Volcano region, republic of Panama, Dr. G. B. Fairchild, of the Gorgas Memorial Laboratory, and the writer were fortunate in collecting six males and four females of an anopheline identified by the writer as Anopheles xelajuensis DeLeon. The specimens were taken while resting in hollow trees in the forest bordering Mr. Louis Martinez’ farm, “Carithia,” at an elevation of approximately 6,200 feet.

All the females collected agree rather closely with DeLeon’s description of xelajuensis, except for the fact that the panamanian specimens have the tip of the wing somewhat darker than the guatemalan female figured by DeLeon. The terminalia of the males from Panama appear to agree in every respect with the published figures of the terminalia of xelajuensis.

Mr. W. H. W. Komp, U. S. Public Health Service, who confirmed the writer’s identification of this material, informs him that Dr. T. H. G. Aitken collected larvae of xelajuensis some years ago in the same general area, but did not rear them through to the adult stage.

The finding of A. xelajuensis in Panama increases considerably the known distribution of this species. Further intensive collections in the highlands of Costa Rica and Nicaragua should reveal its presence there, as it appears to have the same general distribution of Anopheles parapunctipennis, another highland species known from Mexico, Guatemala, Costa Rica and Panama.

The material on which this report is based has been deposited in the following collections: U. S. National Museum, Washington, D. C.; George Williams Hooper Foundation for Medical Research, San Francisco, Calif.; Campana Anti-Malairica, Panama, R. de P.; Mr. W. H. W. Komp’s.

The minutes of the previous meeting were read and approved.

The membership committee proposed the following for membership in the Society: Paul D. Hurd, Jr., Lorin R. Gillogly, B. Dwight Culver, Ellsworth Hagen, Welton L. Lee, Winifred H. Hart, Harold T. Reynolds and Karl S. Snyder. They were unanimously elected.

In response to President Duncan’s request for notes, observations, and exhibits of entomological interest, Dr. Michelbacher called attention to his observation of an unusually large population of pea weevils in a field of alfalfa and the almost complete absence of eggs in spite of the great density of adults. Dr. Duncan exhibited some well prepared life history specimen mounts for classroom use, recently obtained from Germany.

The President then introduced E. S. Ross who spoke on some of his entomological experiences in Texas, New Guinea, and the Philippines while serving in the Army. During his assignment in Texas as Entomologist for the Eighth Service Command Laboratory at San Antonio, he had many opportunities for general insect collecting on off-duty time. Noteworthy was a special investigation of the arthropod fauna of Geomys burrows and nests made during the winter of 1942. Specimens were obtained by direct excavation to the nests and by use of molasses bait traps placed in the sub-
surface runways. The many new and interesting species found, as well as the interesting ecological data, indicate that similar investigations of the burrows of other animals, especially desert rodents, should be made wherever possible.

The speaker then told of his association with Dr. H. R. Roberts of the Philadelphia Academy and their development of the “Mosquito Atlas” which lead to an assignment at the U.S. National Museum where they completed parts dealing with the important malaria vectors of the world. The advantages of the loose-leaf “Atlas” type of publication with standardized treatment and illustrations was emphasized and it was urged that such technique be applied more widely especially in economically important groups of insects.

Later assignments, as Commanding Officer of the 38th Malaria Survey Unit at New Orleans; Finschhafen and Maffin Bay, New Guinea; and on Leyte and Mindoro Islands of the Philippines, provided ample opportunities for mosquito and general insect collecting. Representation lots of specimens, as well as photographs and drawings, were passed among the members and visitors to illustrate the presentation.

Following a brief discussion, the meeting was adjourned.—E. S. Ross, Secretary.

One Hundred and Ninetieth Meeting


The minutes of the previous meeting were read and approved.

The membership committee proposed the following for regular membership in the Society: Edwin Quinnell, Miss La June Dunn, Clark O. Eads, and John Harville. Frank Skinner was proposed for student membership. They were unanimously elected.
President Duncan then appointed a Nominating Committee comprising Dr. Middlekauf (Chairman), Dr. Kessel, and Dr. Usinger to nominate candidates for the election of officers at the Annual Meeting.

Dr. E. C. Van Dyke was called upon to speak on the life and work of the late Dr. F. E. Blaisdell, a Charter Member of the Society. He was followed by Dr. E. S. Ross who spoke on the life and work of the late Mr. F. E. Nunenmacher, also a Charter Member. Biographies on these members will be published in forthcoming issues of the Pan-Pacific Entomologist.

Dr. H. K. Townes, Division of Insect Identification, U.S.D.A., reported briefly on his recent insect survey of the formerly Japanese mandate islands. His remarks were illustrated by a series of photographs of insect damage and scenery.

Dr. D. D. Jensen, recently returned from Hawaii, mentioned the trend toward diversity in Hawaiian agriculture and the resultant increase in entomological problems.

J. W. Tilden exhibited a collection of microlepidoptera reared from the plants growing on the Stanford University campus. He also reported on sugar beet leafhoppers migrating to tomatoes which showed little resultant virus damage. Dr. Michelbacher stated that this was probably due to the late infection but that a loss in fruit size could probably be measured.

Following these notes and observations, President Duncan then called on Dr. R. L. Usinger who presented the main paper of the program entitled "The systematics and biology of the Triatominae." His presentation was illustrated by drawings, charts, and boxes of specimens. His remarks were largely based upon his recent paper on this subject which appeared in Public Health Bulletin No. 288, 1944.

Following a lively discussion on Dr. Usinger's paper, the meeting was adjourned.—E. S. Ross, Secretary.

One Hundred and Ninety-first Meeting


The minutes of the previous meeting and the treasurer's financial statement were read and approved.

The nominating committee proposed, and the Society elected, the following Officers for 1947: E. L. Kessel, President; A. E. Michelbacher, Vice-President; E. S. Ross, Secretary; R. C. Miller, Treasurer; and G. F. Ferris, Member-at-large, Executive Committee.

The membership committee proposed the following for membership in the Society: T. O. Thatcher, R. L. Doutt, A. E. Pritchard, A. W. Larson, W. H. Nutting, and W. A. Russell. They were unanimously elected.

As chairman of the nomenclature committee, Prof. Ferris read a petition signed by members of the Committee on Zoological Nomenclature of the Smithsonian Institution which requests that the United Nations Educational, Scientific, and Cultural Organization give favorable consideration to Secretary Hemming's proposal for adequate financial support for the International Commission on Zoological Nomenclature. Prof. Ferris then moved that the Society endorse this petition. The motion was seconded and unanimously passed.

President Duncan appointed R. W. L. Potts Chairman and J. W. MacSwain and W. F. Barr members of a committee to audit the financial accounts of the Society.

The frequency of meetings was discussed and Dr. Usinger moved that the number of meetings be increased to four Spring meetings and two Fall meetings. The motion was carried unanimously.

In response to a call for notes and exhibits, Miss Henry spoke on her study of the innervation of the heads of Annelida and arthropods and its value in the interpretation of the segmentation of the insect head. Her remarks were illustrated by a display of her fine drawings.

Mr. MacSwain reported on his success in collecting Protura in the Berkeley Hills on rotting twigs deep in the litter under bay trees (Umbellularia californica).

Dr Ross called attention to his recent discovery of Dinopate wrightii in palms southwest of El Mante, Tamaulipas, Mexico. This spectacular beetle was at one time believed to be endemic to California.

Because of Dr. Kessel's absence, President Duncan turned the meeting over to the newly elected Vice-President, Dr. Michelbacher, who introduced the new officers and presided during Dr. Duncan's retiring presidential address entitled "Insects and Human Welfare." (This address is published in full in the present issue of the Pan-Pacific Entomologist). After a brief discussion of the paper, the meeting adjourned.—E. S. Ross, Secretary.
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1947
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Frank Ellsworth Blaisdell, Sr.
THE BIOGRAPHY OF FRANK ELLSWORTH BLAISDELL, SR

BY EDWIN C. VAN DYKE
California Academy of Sciences, San Francisco

Dr. Blaisdell was born March 13, 1862, in Pittsfield, New Hampshire, the son of Solon Greenleaf Blaisdell and Anna Greeley (Clark) Blaisdell. Both parents were of old New England ancestry. The father was a saddler and harness maker and during the Civil War he served as a sergeant in the Twelfth New Hampshire Volunteers. In 1870, the family, including three children, moved to San Francisco where the father entered the real estate business and later became an agent of the A. L. Bancroft Company, the well-known book dealers. In 1871, the three children were attacked with scarlet fever. The two younger, John and Elmer, died, but Frank survived though he was left in a weakened condition which prompted his parents to move to San Diego where the father opened a harness and saddlery store. Frank attended the B and D Public Schools. In 1875, the elder Blaisdell took up a ranch in Poway Valley, about 26 miles northeast of San Diego, where he started an apiary and orchard and planted a considerable acreage to grain. Here Frank grew up into a strong and healthy young man. He attended the country school and later took over most of the work of the ranch.

In 1886, he decided to study medicine, so the ranch was disposed of, the father starting a nursery at Coronado and selling the plants in San Diego. Frank secured a position in a store in San Diego and began reading medicine under the instruction of Dr. P. C. Remondino and Dr. C. C. Valle. He also prepared himself for the medical school examinations. To a considerable extent, Dr. Blaisdell was a self-taught man. He never had a modern high school or college education, but through diligent study, whenever he could get the time, he made up for the deficiency. In 1887, he entered Cooper Medical College, San Fran-

\[1\] From a short autobiographical sketch of Frank Ellsworth Blaisdell, Sr.
cisco, and graduated November 12, 1889, with the degree of Doctor of Medicine. He immediately returned to San Diego and started to practice but with very poor success. Consequently, in 1892, he returned to San Francisco where he learned that there was an opening in the mining town of Mokelumne Hill, Calaveras County. He left for the mountains and before long was well established there. On February 18, 1894, he married Miss Ella Katherine Peek and on March 31, 1896, his son and only child, Frank Ellsworth Blaisdell, Jr., was born.

In 1900, he accepted an offer to become an instructor in Cooper Medical College, from an old classmate, Professor Albert H. Taylor, who was head of the Department of Anatomy. Before entering upon his duties at the College, however, because he felt the need of a vacation, he accompanied his brothers-in-law to Nome, Alaska, where they worked a claim on Dexter Creek during the summer. Here the Doctor took advantage of the opportunity to collect and as a result made an extensive collection of the plants, birds, and insects of the region. The bird skins and plants were given to the California Academy of Sciences but, unfortunately, all except a few plant types were destroyed at the time of the San Francisco fire, in 1906. In September, he returned to San Francisco from Alaska and started his work at the medical school. He was first a demonstrator, later was made Professor and head of the Department of Anatomy. During this period, he made a trip to Johns Hopkins Medical School at Baltimore, for some post graduate work, and while there utilized his spare time for field work in entomology and visits to Washington to consult with Dr. E. A. Schwarz. In 1910, Cooper Medical College affiliated with Stanford University, becoming the Stanford Medical School. Dr. Blaisdell was then appointed Assistant Professor of Applied Anatomy, later transferring to the Division of Surgery as Professor of Surgery in charge of Surgical Pathology. This post he held until 1927 when he was retired at the age of 65 years, as Professor Emeritus of Surgery.

The next year, Doctor and Mrs. Blaisdell visited the town of his birth, Pittsfield, New Hampshire, and also New York, Washington, Philadelphia, Boston and Chicago in order to visit the various museums centered there and the entomologists connected with them. After returning home, the Doctor spent much of his time at the rooms of the Department of Entomology of the Cali-
ifornia Academy of Sciences. His collection of Coleoptera, close to two hundred thousand specimens, had been deeded to the Academy in 1924, but he continued his entomological work at the Academy until failing health in 1945, compelled him to give up and move to Watsonville, California, in order to be near his son. There he died on July 6, 1946. His wife, son, Dr. Frank Ellsworth Blaisdell, Jr., and three grandchildren survive him.

Dr. Blaisdell was a first-class collector. Whenever he had the opportunity, he made it a point to collect and in this way he built up his large collection. He collected in many places but the areas where he did his best work and which will always be associated with his name are as follows: San Diego and the ranch at Poway where his earliest field work was done; Mokelumne Hill in Calaveras County where he practiced medicine many years; the San Francisco Peninsula and the Bay Area generally which was his home in later years; Nome, Alaska; Baltimore, Maryland; and Pittsfield and Barnstead, New Hampshire. His summer vacations were generally spent in regions which were supposed to be good collecting places. As a result he visited a great many different areas up and down the Pacific Coast.

In his early years, he was greatly aided and encouraged by such good naturalist friends as O. N. Sanford, Frank Stephens and G. H. Field, residents of San Diego or neighboring communities. With Henry Ulke of Washington, he corresponded for many years and he also received much aid from him. Later, he corresponded extensively with Colonel T. L. Casey. In fact, he was a correspondent for most of his life with leading Coleopterists of the country such as Dr. E. A. Schwarz, Charles Liebeck, Henry C. Fall, Frederick Blanchard, Charles Dury, H. F. Wickham, W. S. Blatchley, Dr. A. Fenyes, H. C. Loding, Ralph Hopping and others. In later life, when he became an authority in his own right, he aided many a beginner by naming up his specimens for him. This work was mutual, too, for in this way and through extensive exchanging, he acquired many desirable additions to his collection.

In evaluating Dr. Blaisdell and his work, we must recognize first that he was an able naturalist. He was a good botanist, a good ornithologist and in general, a keen observer. He early acquired a working knowledge of San Diego plants and while at Nome, Alaska, assembled a good collection of the plants of that
region which was presented to the California Academy of Sciences. In ornithology, his first work was done with the birds of San Diego County. He not only knew the birds of the region but through close observation, proved to his satisfaction that his Poway ranch was in the direct line of migration of the great majority of the migration birds of that part of the state. He also made dissections of many birds and detailed anatomical drawings. Some of these are preserved and show that he had first-class artistic abilities. In Alaska, he collected a series of bird skins which, like the botanical specimens, were lost in the San Francisco fire of 1906. It was in Entomology, however, that his best work was done. At first, he collected specimens of all orders of insects. His collection of miscellaneous insects was given to the California Academy of Sciences before 1906 and in consequence lost by fire. His main collection, that of the Coleoptera, was not given until 1924. Upon this, his major entomological work was based which continued from the time of his early manhood until shortly before his death. Dr. Blaisdell was primarily a morphologist and this influenced his systematic work which was likely to accentuate such features as form and ornamentation. In his papers he was able to present his views in the most convincing way because of his expert drawings, especially those pertaining to structural details. In his best work, his study and interpretation of details was excellent. His work on the male genitalia of the Eleodini which he demonstrated was of an entirely different type from that of the Old World Blapstini with which it had been formerly associated, was a major contribution. He was not much interested in theories nor did he care to study exotic material to any great extent. A glance at his bibliography will show that he studied in all families but later in life he gave most of his attention to the Tenebrionidae and Melyridae and in consequence became the outstanding authority on these groups.

Dr. Blaisdell was a man of fine character and he had an attractive personality. As a result, he had a host of friends and was much respected. He was generous and loyal. He was particularly generous in the manner of giving both time and attention to beginners. To those of us who knew him best, he will be greatly missed but we will also have the satisfaction of remembering that he lived a long life and a very productive one.
Entomological Bibliography of F. E. Blaisdell, Sr.


29. 1924. Two new species of Melyridae from California and one from British Columbia, including two new genera. Can. Ent. XLI, pp. 1-5.


37. 1925. Revised check-list of the species of Eleodes inhabiting America, North of Mexico, including Lower California and adjacent islands. Pan-Pac. Ent. II, pp. 77-90.


* This is an error; it should be Tenebrionidae.
44. 1928. Two new species of Coelocnemis (Coleoptera: Tenebrionidae). Pan-Pac. Ent. IV, No. 4, pp. 163-165.
47. 1929. Revised synopsis of the species of Eleodes belonging to the Subgenus Metablapylis with description of
49. 1929. Miscellaneous studies in the Coleoptera, Number Three**. Pan-Pac. Ent., VI, No. 2, pp. 57-62.
56. 1931. Two new species of Eleodes from Utah (Coleoptera: Tenebrionidae). Pan-Pac. Ent., VIII, No. 2, pp. 74-78.

** This should be Number Four.


87. 1939. Studies in the relationships of the subfamilies and tribes of the Tenebrionidae based on the primary genital characters, also descriptions of new species (Coleoptera). Trans. Am. Ent. Soc., LXV, pp. 43-60, pls. IV-V.

PARASITES OF TWO SPECIES OF COLEOPTERA ASSOCIATED WITH MONTEREY CYPRESS

In December of 1945 a large diseased Monterey Cypress (Cupressus macrocarpa) on the campus of the University of California at Berkeley was cut down. Upon examination of the trunk and limbs of this tree, rather large populations of adults and larvae of the scolytid, Phloesinus cupressi Hopkins, and larvae of the cerambycid, Atimia maritima Linsley, were found under the bark. Adults and pupae of the cerambycid were in pupal cells in the wood.

Several of the limbs were taken into the laboratory and in a few days, specimens of a braconid wasp, Dendrosoter integer Muesebeck, (det. C. F. W. Muesebeck) and an ichneumonid wasp, Xorides insularis (Cresson) (det. H. K. Townes) had emerged through the bark. Upon closer examination, it was discovered that D. integer had parasitized larvae of P. cupressi and X. insularis had parasitized larvae of A. maritima.—W. F. BARR, University of California, Berkeley.
A NEW GENUS AND SPECIES OF THE COLEOPTEROUS FAMILY TENEBRIONIDAE

BY FRANK E. BLAISDELL, SR.

California Academy of Sciences, San Francisco, California

Lariversius Blaisdell, new genus

Labrum transverse, apex slightly sinuate at middle, deflexed in apical third and densely, strongly punctate; each puncture with a moderately long fulvous seta; angle of deflection slightly raised, behind which the surface is narrowly impunctate and smooth, thence to base densely punctate, punctures small.

Epistoma quite deeply and arcuately emarginate between the rounded lateral lobes, margin of lobes slightly reflexed and rather prominent, surface rather densely punctate, the latter slightly coarse, central part of surface slightly convex.

Mentum rather short, transverse and somewhat oblong, ligula and labial palpi exposed, capable of entire retraction; apex moderately arcuate. Last segment of maxillary palpi somewhat triangular, sensitive surface slightly oblique and oval. Last segment of labial palpi smaller and subtriangulo-oval.

Sides of head somewhat explanate over the antennal insertions and apical margin.

Eyes short and transverse, scarcely convex and somewhat sunken, not in the least prominent, except when viewed from above, partly emarginated by sides of the front; superior lobe of each slightly larger and rounded, thence to a point behind the antennal insertion narrower; temporal margin moderately prominent, the surface of the eyes directed forward and outward at narrowest part opposite side of front, about 3 facets wide, the latter slightly convex.

Antennae short, basal segment rather stout and only slightly visible from above; segments 2 to 8 inclusive cylindrical, short, third slightly the longest; 9, 10 and 11, dilated and transverse, forming a moderately wide club; eleventh segment more rounded at apex.

Pronotum not margined at apex, except just within the apical angles; lateral margins very finely and irregularly margined. Sides of prothorax densely punctate and ciliate. Intercoxal process

1 Named after Mr. Ira LaRivers of Reno, Nevada, who furnished the material upon which this paper is based.
Figure 1. Larixius tibialis Blaisdell, new genus and species.
arcuate and not in the least prominent posteriorly. Procoxae without trochantine. Metasternum and mesosternum broad between the coxae; mesocoxae with a small trochantine, metacoxae ovate. Side pieces small and poorly defined.

Protibiae ciliate with long yellowish cilia beneath, also along posterior and inferior margins, also for the mesotibiae.

Genotype: *Lariversius tibialis* Blaisdell, new species.

*Lariversius tibialis* Blaisdell, new species

Form oblong-oval, a little more than twice as long as wide, moderately oblong-convex; color piceous to moderately rufous. Luster shining to somewhat alutaceous. Sides of prothorax rather densely invested with rather long yellow pubescence, also sides of elytra; surface of sterna with scattered, short setiform hairs.

Head moderate in size, about twice as wide as long before the post-ocular line, and about equally wide across the eyes and sides over the antennal insertions. Sides of head somewhat explanate over the antennal insertions and apical margin; sides feebly arcuate and slightly convergent anteriorly, feebly emarginate at the feebly oblique epistomal sutures, thence arcuate to the lateral epistomal lobes. Submentum transverse with sides rounded, feebly bilobed in front and with a median longitudinal impression beneath. Epistoma transverse, quite deeply and somewhat emarginate apically between the arcately prominent lateral lobes; margins of the latter slightly reflexed, the surface slightly concave and rather densely and finely punctulate. Epistomal sutures rather feeble, more or less to obsolete centrally and feebly oblique to the small lateral emargination. Frons feebly convex centrally and laterally before the eyes, rather sparsely punctate, the punctures moderately small, vertex more or less impunctate and smooth. Antennae relatively short, moderate in stoutness, six-sevenths as long as width of pronotal apex, segments closely articulated; first segment invisible beneath the explanate side of the frons, segments two to the eighth short and annular, segments nine and ten slightly wider and transverse, the eleventh oval, the three forming a club.

Eyes short, transverse, scarcely convex, not in the least prominent, except when viewed from above, partly emarginated by the frontal process; superior lobe of each slightly larger and rounded thence narrower to a point behind the antennal insertion, temporal angle moderately prominent. Surface of the eyes directed forward and outward at narrowest part in line of the sides of the front and there about three facets in length.

Pronotum slightly oval, about one-third as wide as width at middle or equal to the length, broadly and not deeply emarginate between the rather small, slightly prominent and obtuse apical angles, margin not beaded at apex, except at the angles; side
margin broadly and continuously—including base—arcuate from side to side, very feebly beaded. Disk not prominent laterally, moderately and evenly convex, surface smooth, very sparsely punctulate, punctures a little larger against the margins, especially at the apical angles.

Prothoracic sides convex and flush with the discal margin, rather densely punctate, each puncture finely muricate and with a rather long yellowish hair. Intercoxal process of the prosternum arcuate between the coxae, terminating in a short blunt point. Procoxae without trochanter.

Elytra slightly longer than wide, as viewed from above, viewed more obliquely one-seventh longer than wide, one-sixth wider than pronotum. Base not margined. Widest about one-fourth from base. Form suboval, sides broadly arcuate in basal two-thirds, thence more convergent in apical third, apex obtuse. Disk moderately convex, laterally broadly declivous and inflexed to the epipleurae, apically obliquely declivous to the apex. Surface quite densely muricately punctate viewed from above irregularly punctate, viewed obliquely lengthwise series are somewhat evident; laterally and apically each puncture has a short seta.

First abdominal segment equal in length to the combined length of the second and third segments, the intercoxal part transverse and angulate; combined length of third and fourth segments quite equal to that of the fifth; fourth shortest and two-thirds as long as third. Length (anterior pronotal margin to sutural apex) 9 mm., breadth 5.4 mm.


Paratypes: Eighty-five specimens from type locality collected on above date as well as on August 24 and September 1, 1941, by Ira La Rivers. These are deposited in the La Rivers Collection, California Academy of Sciences, U. S. National Museum, Academy of Natural Sciences, Philadelphia, American Museum of Natural History, Museum of Comparative Zoology, Harvard University, and the British Museum of Natural History.

__________________________

Personal Note

Hugh B. Leech of the Forest Insect Laboratory, Vernon, B. C., has accepted a position in the Department of Entomology of the California Academy of Sciences. Mr. Leech will assist with general curatorial work and will carry on his research on aquatic and other Coleoptera.
ON THE GENERA OF PHILANTHINE WASPS, WITH THE DESCRIPTION OF A NEW SPECIES FROM ARIZONA
(Hymenoptera: Sphecidae)

BY V. S. L. PATE
Ithaca, New York

The Philanthine wasps are a small compact group of genera with representatives in all the major zoogeographic regions of the world save the Australian Realm1. Four genera occur in the New World: Philanthus Fabricius, Trachypus Klug, Aphilanthops Patton, and the Miocene fossil genus Prophilanthus Cockerell. All the extant Old World forms are referable to the nominate genus Philanthus2. For a fossil species discovered in the Oligocene beds on the Isle of Wight, England, Cockerell erected the genus Philoponites. In addition, Giner Marí has recently described Philoponoides3 for a new species, Philoponoides tricolor, which he captured in 1939 in northern Rio de Oro. Giner states this genus is intermediate between Philanthus and Philoponidea, and since the latter is a Cercerine genus, Philoponoides may eventually prove to be referable to that tribe.

The following table will serve to differentiate the genera of Philanthine wasps.

**Key to the Genera**

1. Fossil forms ........................................................................................................ 2
   Extant forms ........................................................................................................ 3
2. Oligocene forms; (Isle of Wight, England) Philoponites Ckl.   Miocene forms; (Florissant, Colorado) Prophilanthus Ckl.
3. Abdomen with first segment very slender, elongate and petiolate, two to three times as long as wide at apex and separated there by a distinct constriction from remainder of abdomen. Fore wing with marginal cell not appendiculate at apex. Eyes with inner orbits emarginate or distinctly angulate and more or less convergent toward vertex. (Neotropical, melittotherous forms) .......................... Trachypus Klug
   Abdomen with first segment broadly sessile with second segment, or if separated from second by a constriction then not appreciably longer than broad at apex. (Holarctic and Oriental forms) .................................................. 4

---

1Frederick Smith described a Philanthus (Trachypus) notaulus [1861, Journ. Proc. Linn. Soc., Zool., VI, p. 57] from Australia, but I believe this species is either referable to another genus, or perhaps had an incorrect locality label.

2Eos, XX, pp. 372-375, (1945).
4. Eyes with inner orbits entire, straight or convex, and parallel, never strongly convergent toward vertex. Fore wing with marginal cell distinctly appendiculate at apex. (Nearctic, myrmecotherous forms) ...........................................Aphilanthops Patton

Subgenera of Aphilanthops:

a. Postscutellum with a large, distinct, backward projecting laminate flange which more or less overhangs an excavation in the upper anteriolateral corner of propodeum. Females with both pygidium and hypopygium large, subquadrangle, and concave .................................................................Clypeadon Patton

aa. Postscutellum with lateral flange absent or very poorly developed and anteriolateral corner of propodeum without a marked depression. Females with pygidium and hypopygium simple, normal, trigonal, flat, not so modified.......................... 

.................................................................Aphilanthops sensu stricto

Eyes with inner orbits distinctly angulate medially and generally convergent toward vertex. Fore wing with marginal cell not appendiculate at apex. (Holarctic and Oriental, melittotetherous forms) ...........................................Philanthus Fabricius

Philoponites Cockerell, 1916, contains only one species: Philoponites clarus which Cockerell described from the Oligocene beds at Gurnet Bay, Isle of Wight, England.

Prophilanthus Cockerell, 1906, is likewise a monotypic fossil group. Its sole species, Prophilanthus destructus Cockerell, was discovered in the Miocene shales at Florissant, Colorado.

Philanthus Fabricius, 1790 (of which Simblephilus Panzer, 1801, Symblephilus Panzer, 1806, Cheilopogonus Westwood, 1824, Anthophilus Dahlbom, 1844, Chilopogon Kohl, 1897, Epiphilanthus Ashmead, 1899, Pseudanthophilus Ashmead, 1899, Ocloletes Banks, 1913, and Oclocletes Mickel, 1918, are synonyms) is the largest and most widely distributed genus in the tribe. The genus is best developed in the Holarctic Region, but there are a considerable number of species known from the Ethiopian Region. The Oriental Philanthus fauna is apparently an attenuation of that in the Palaearctic Region, for thirteen species have been described from India, one from Assam, and three from Tenasserim. Van der Vecht reports only one species from Java⁵, and the genus has probably reached the limits of its distribution here in Sundaland. The genus is apparently wholly absent from the Australian Realm. In North America, Philanthus is represented by thirty-one species and subspecies,

according to Strandtmann who has recently presented a review of the genus. The species of *Philanthus* are terricolous fossorial forms which provision their nests with various genera of bees such as *Andrena*, *Halictus*, and *Calliopsis*; some species prey more or less exclusively upon the honey bee, *Apis mellifera*. Hamm and Richards, and Berland have given digests of the biology of the European species; and the Peckhams, the Raus, and Reinhard have presented entertaining accounts of the North American forms.

*Trachypus* Klug, 1810 (of which *Simblephilus* Dahlbom, 1844 and *Philanthocephalus* Cameron, 1890 are synonyms) is confined to the Neotropical Region and is the only generic representative of the Philanthine wasps in that region. Various Old World species have at one or another time been referred to *Trochypus* but such forms have always eventually proved to be merely species of *Philanthus*. Like *Philanthus*, the species of *Trachypus* nest in the ground and provision their burrows with bees.

*Aphilanthops* Patton is a small endemic North American genus, peculiar and confined to the Nearctic Region. On the basis of structure, particularly that of the females, two distinct groups are easily recognizable: these may be accorded subgeneric status and are differentiated in the foregoing key on a preceding page. The species of *Aphilanthops* are fossorial myrmecotherous forms; one species, *A. frigida* (Smith), apparently restricts its attention largely if not wholly to queen ants. Only one species, *Aphilanthops* (*Aphilanthops*) *frigida* (Smith), occurs in the eastern United States. The remaining ten forms recognized by Dunning in his monograph of the genus are confined largely to western North America. To these may now be added the following distinctive Arizona species.

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Aphlanthops (Clypeadon) phoenix Pate, new species

This large and handsome Arizona species is readily distinguished from all other forms of Clypeadon by its bituberculate clypeus, polite ocellar and post-ocellar calli, and striking livery.

_Type._—♀; Phoenix, Maricopa County, Arizona. Elevation, 1100 feet. July 7. [Academy of Natural Sciences of Philadelphia, Type no. 10600.]

_Female._ Length 13 mm. Black; the following citrinous: a small spot at base of mandibles; clypeus laterally on each side with a spot; scapes except base and apex; pronotum dorsally, pronotal tubercles; tegulae and axillary selerites; axillae; anterior half of scutellum; postscutellum; a small spot dorsolaterally on each side of propodeum; abdomen with a large ovate spot laterally on each side; all tibiae with a longitudinal stripe on outer broad fasciae almost covering them except second which is narrowly interrupted medially; third sternite with a small spot laterally on each side of first tergite, the second to fifth tergites with faces. Castaneous: mandibles except piceous apices; clypeal flange; base and apex of scape, pedicel and first flagellar article; last abdominal segment and all sternites.

Head broader than high in anterior aspect. Front and clypeus with a moderately heavy vestiture of rather long appressed silvery hair; vertex more sparsely clad; temples with a thin clothing of long shaggy, silvery hair. Front with moderate, distinct, rather close punctures; rather strongly tumid between and above antennal sockets; interantennal line almost three-fourths (0.73) the antennocular distance; front very broad, the upper interocular distance almost one and a half (1.485) times the vertical eye length, the lower interocular distance almost one and seven-tenths (1.693) the vertical eye length. Vertex punctate like front; ocelli in a subequilateral triangle, the postocellar line three-fifths the ocellocular distance, posterior ocelli with a large, crescentic, glabrous, impunctate, polite callus along their inner margins; medio-posteriorly with a large, lenticular, glabrous, impunctate, polite callus; posteriolateral angles of head tumid, and more sparsely punctate than remainder of vertex and temples which are moderately finely punctate. Antennae with scapes short, obteterete, one-third the vertical eye length; pedicel subglobose, one-third the length of scape and one-fourth the length of first flagellar article; flagellum not clavate but tapering somewhat toward apex, the first segment elongate, twice the length of second segment which is equal in length to the third and following segments, penult segment five-sixths the length of last article which is equal in length to the second segment. Clypeus flat, punctate like front, with a broad and very shallow vertical furrow between the median and lateral lobes, disc of median lobe with a
pair of large acute tubercles medially, the apical margin flanged, entire, edentate.

Thorax and propodeum with a moderate vestiture of decumbent silvery hair. Mesonotum with rather coarse and close punctation; axillae impunctate; scutellum flat, impunctate discally, bisected by a fine impressed line; postscutellum tumid, almost impunctate. Mesopleura coarsely punctate, closely and rugosely so on prepectus, dorsally and posteriorly, but with punctures separated below; metapleura subnitidous. Propodeum rather closely, rugosely punctate throughout; trigonal area of dorsal face bisected on posterior half by a shallow, transversely striate groove, ending in a polite, impunctate prominence posteriorly.

Middle and hind legs with tibiae and tarsi strongly spinose.

Abdomen with a moderate vestiture of decumbent silvery hair; weakly constricted between first and second tergites. Tergites and sternites with separated rather coarse punctures. Pygidium subquadrate, strongly concave; the disc subfulgid and subgranulate; apical margin bisinuate; the lateral margins with a small, acute subapical tooth. Hypopygium elongate subrectangular, strongly concave; the disc polite, impunctate; lateral edges strongly raised and thickened; apical margin subquadrate excised medially.

This distinctive southwestern species is known only from the unique female described above.

BOOKS AND WORLD RECOVERY

The desperate and continued need for American publications to serve as tools of physical and intellectual reconstruction abroad has been vividly apparent by appeals from scholars in many lands. The American Book Center for War Devastated Libraries has been urged to continue meeting this need at least through 1947. The Book Center is therefore making a renewed appeal for American books and periodicals—for technical and scholarly books and periodicals in all fields and particularly for publications of the past ten years.

The generous support which has been given to the Book Center has made it possible to ship more than 700,000 volumes abroad in the past year. It is hoped to double this amount before the Book Center closes. The books and periodicals which your personal or institutional library can spare are urgently needed and will help in the reconstruction which must preface world understanding and peace.

Ship your contributions to the American Book Center, c/o The Library of Congress, Washington 25, D. C., freight prepaid, or write to the Center for further information.
A NEW BEE FROM THE MARSHALL ISLANDS

BY T. D. A. COCKERELL
Boulder, Colorado

Dr. Maurice James has kindly submitted to me a small series of bees from the islands of the Pacific, belonging to the Colorado State College at Fort Collins. These include eleven female specimens of a small Megachile from the Marshall Islands, which has the following characters:

Megachile loiensis Cockerell, new species

Female. Length about 12 mm.; black, with short broad abdomen; mandibles broad, without well developed teeth; clypeus densely punctured, mainly dull, but shining at middle of margin, and in middle of upper part; supraclypeal area with the disc polished and impunctate; antennae black; head and thorax with short white hair, dense at sides of face, no dark hair on thorax above; an interrupted band of white hair in suture between mesonotum and scutellum; mesonotum and scutellum dull; scutellum swollen in middle, but not conspicuously so; tegulae black; wings rather dilute fuliginous; legs black, femora with white hair beneath; hind tibiae with a conspicuous pale fringe in front; hair on inner side of hind tarsi entirely black; hind basitarsi large and broad; abdomen cordiform, shining above, the tergites with narrow hair-bands, which are dull whitish, more or less reddish, especially at sides; ventral scopa bright red, black on last sternite; tufts of hair at sides of first tergite entirely pale.

Marshall Islands: Loi Island (type locality), Jan.-Feb. 1945, many specimens; one from Bwaja I. These islands are in the Kwajalein Atoll. All collected by H. S. Wallace.

This runs in my table to M. diligens Smith, from the Hawaiian Is., and at first I supposed it to be that species. There is a series of closely related species in the Pacific Islands, and these may be distinguished from M. loiensis as follows:

M. diligens Smith. (Hawaiian Islands). Female. The two apical teeth of the mandibles acute; hair on tarsi beneath reddish brown; claws ferruginous, tipped with black (black in M. loiensis); wings subhyaline; abdominal bands distinctly red.
M. hedleyi Rainbow. (Funafuti). Female. Tergites fringed with short black hairs; under side of tibiae and tarsi ferruginous. Miss Cheesman (1936) treats this as a subspecies of M. diligens, and says the lateral tufts on first tergite are dark, with light hairs on outer side. The wings are dark fuscous.

M. buxtoni Perkins and Cheesman. (New Hebrides). Females very hard to separate from M. hedleyi, but the lateral tufts on first tergite light. Males more easily separated, and nesting habits distinct. This is treated as a subspecies of M. diligens.

M. doanei Ckll. (Tahiti). Described from the male. Black hairs on disc of mesonotum and middle of pleura; hair on inner side of hind tarsi copper red.

M. vavauensis Ckll. (Vavau, Tonga Is.). Described from the male. Scutellum and disc of mesonotum with long black hairs; bands on tergites only present at sides, very bright red.

M. calens Ckll. (New Hebrides). Much black hair on scutellum. Miss Cheesman (1936) treats M. calens and M. vavauensis as synonyms of M. hedleyi, but this is not correct.

M. woodfordi Ckll. (Solomon Is.). Female. Hair of face and vertex black; hair of mesonotum and scutellum black; hair of tarsi bright fox-red.

Miss Cheesman states that M. hedleyi, which she reports from the New Hebrides, nests in dry logs on coral beaches. It is easy to imagine that occasionally such logs would be washed into the seas, and might very rarely reach some other island with its bees alive. Thus the islands might have been colonized, but under conditions of isolation the populations have become appreciably different. I have treated these different forms as species, but Miss Cheesman has regarded them as subspecies of M. diligens.

Among the other bees submitted to me by Professor James, there are a few which deserve mention.

Megachile finschi Friese*

Female. About 15 mm. long; tergites 3 to 5 with dense red hair; ventral scopa black. One female from Gusika, New Guinea, August, 1944 (W. L. Howe). Friese described this (1911) from one female taken at Finschhafen, which is practically the same locality. Apparently the Gusika specimen is the second known.

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*I was much pleased, a few days ago, to receive a postcard from Dr. Friese, who is still at his home in Mecklenburg-Schwerin (Kirchenstr.).
Crocisa caeruleifrons W. F. Kirby

Morotai Is., Moluccas, May 10, 1944 (Jack Jones). Described from Timor Laut, about 700 miles to the south. I have examined the type.

Crocisa novaehollandiae Lepeletier

Two specimens of *Crocisa* from Gusika, New Guinea, 1944 (W. L. Howe) have been in alcohol and their bright colors are spoiled, but they must be referred to *Crocisa novaehollandiae* Lepeletier, which, in spite of its name, was never taken in Australia.

Anthophora spp.

A very fine female *Anthophora* from Gusika (Howe) seems to be new, as the hair on outer side of hind tibiae is entirely light red, and the broad tegumentary bands of abdomen (on tergites 1-4) are beautiful light emerald green. The hair of the thorax above is dense and light red. The clypeus has a reversed light T-mark, and the supraclypeal mark is strongly angulate above.

This is one of the forms which would be classed by authors as varieties or races of *A. zonata* L., but I think it is a distinct species. I do not give it a name, as Mr. T. Rayment wrote an elaborate paper on the *Anthophora* species of Australia and the Oriental Region, which he sent to Buitenzorg, Java, to be published. Soon after it reached Java the Japanese took over the island, but Mr. Rayment was informed that they published it, though at the time of writing he had not been able to procure a copy.

There is a second, smaller *Anthophora* from Gusika, with clear white hair on outer side of hind tibia. It is in very poor condition. In my key it runs to *A. zonata* L. (*pulchra* Smith).

Personal Note

Dr. E. G. Linsley of the University of California will spend the year 1947-48 on sabbatical leave with headquarters at the American Museum of Natural History in New York. Dr. Linsley leaves on June 16 and will study at various universities on the way east. His year of study will be devoted to completion of a monograph of North American Cerambycidae.
DESCRIPTIVE NOTES ON TWO SPECIES OF ANDRENA FROM CALIFORNIA
(Hymenoptera: Apoidea)

BY U. N. LANHAM
University of California, Berkeley

Described below are the previously undescribed sexes of two species of *Andrena*. Neallotypes are deposited in the California Academy of Sciences, San Francisco.

**ANDRENA DINOGNATHA TIMBERLAKE**

*Andrena* (*Micrandrena*) dinognatha Timberlake, 1938, Pan-Pacific Entom., 14:26, male.

*Female.* Integument black; pubescence light fulvous, except face and cheeks with hair all black, vertex with hair mixed light and dark, pleura with hairs mostly blackish, dorsal fringe of propodeal corbiculum with mixed light and dark hairs, and tibial scopa dark fulvous with a few blackish hairs above. *Head* wider than thorax; flagellum brownish toward tip, first segment slightly longer along outer margin than two following together; fovea narrow, occupying less than half the distance between eye and antennae, extending downward as far as lower margin of antennal insertions; clypeus impunctate, so strongly reticulate as to appear granular, process of labrum short, broadly triangular, narrowly rounded at tip. *Mesonotum* strongly reticulate, very weakly, rather sparsely punctured, clothed with rather sparse, long pubescence; *metanotum* reticulate, impunctate; propodeal triangle finely sculptured, poorly defined; propodeal corbiculum moderately well developed, with compound hairs throughout its face; wings moderately darkened at tips, second submarginal cell square, receiving recurrent nervure well beyond middle, basal nervure meeting nervulus; middle and hind basitarsi rather slender; tibial scopa with hairs of outer face simple, those of posterior and anterior margins compound; *floccus* of trochanter nearly perfect, fairly well developed. *Tergites* strongly reticulate, somewhat shining, impunctate; first two tergites sparsely clothed with long, erect hairs, the remainder with sparse, inconspicuous short hairs; no apical hair bands; caudal fimbria blackish-brown. Length about 9 mm.; anterior wing 7 mm.

*Neallotype* female (Calif. Acad. Sci., Ent., No. 5716): DAVIS, CALIFORNIA, March 6, 1940, G. E. Bohart; dug from same nest.
as a male dinognatha. Two additional females, same locality and date, one taken in copulation with male.

The other two females of the series differ from the neallotype by having the recurrent nervure meeting the second submarginal cell only slightly beyond the middle.

The characters of the female indicate that this species cannot be placed in the subgenus Micrandrena. It is very near A. anisochlora Ckll., differing by the pure black tergites, the weak punctures of the mesonotum (impunctate in anisochlora) and by the dark hairs of the pleura. It may be distinguished from a series of non-metallic, medium-sized Andrena which also have long erect hairs on the first one or two tergites, represented by species such as A. ribifloris Ckll. and A. harveyi Vier., by the pointed process of the labrum (more or less bilobed in these latter species). A. macrocephala Ckll. differs by its larger size, dense notal pubescence, and rudimentary propodeal corbiculum; the male of macrocephala, although resembling dinognatha in having a wide head and yellow clypeus, does not have the clypeus produced into lateral lobes and has the tip of the eighth sternite narrowly pointed (deeply emarginate in dinognatha).

**Andrena (Platandrena) orthocarpi Cockerell**

*Andrena (Platandrena) orthocarpi* Cockerell, 1936, Pan-Pacific Entom., 12:147, female.

**Male.** Similar to female, except for the usual sexual differences and with tergites almost entirely lacking the apical hair bands of the female. Pubescence light grayish, except for black hairs on head at sides of face, about bases of antennae and on upper cheeks. Cheeks narrow, only slightly broader than eyes, widest near upper end of eyes, rounded behind; flagellum with first segment slightly shorter along outer margin than second, middle segments slightly longer than wide; mandibles short. Ground sculpture of integument strongly reticulate, but somewhat shining, as in female. Length about 7 mm.; anterior wing 6 mm.

**Neallotype male** (Calif. Acad. Sci., Ent. No. 5717): Collected in copulation with female, 1 mile west of ORINDA CROSSROADS, CONTRA COSTA COUNTY, CALIFORNIA, March 19, 1947, on Ranunculus californicus Benth., by J. W. MacSwain. Also 3 males, 4 females at Berkeley, California, March 11, 1947, on Ranunculus (J. W. MacSwain). None of these females carried pollen.

The male differs from the other Platandrena of similar size,
April, 1947

NYE—MOUNTING APHIDS

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A. nasonii Rob., and A. pensilis Timb., by the black hairs of the head (all pubescence of head light in these two species), and also from nasonii by having the parapenial lobes of the genital capsule very slightly, rather than strongly, produced. From the larger A. (Platandrena) angustitarsata Vier. (about 9 mm.) it differs by the more shining mesonotum and tergites, and by the peculiar basal plate of the eighth sternite, which is widest at the proximal one-third in orthocarpi and widest at the distal one-third in angustitarsata.

A SIMPLE METHOD OF MOUNTING APHIDS

BY WILLIAM P. NYE

Utah State Agricultural College, Logan

Recent favorable comments have been received from Professors E. O. Essig and M. A. Palmer, and others, on aphid mounts made for Dr. G. F. Knowlton. In addition, several requests have been received for information concerning the mounting technique used. This has prompted the presentation of the following information:

Fresh specimens, or more commonly those preserved in 70-75 percent alcohol, are immersed directly in a 10 percent solution of KOH (or NaOH) in Syracuse watch glasses and placed in a warming oven, or the aphids may be contained in evaporating dishes and boiled over a flame or hot plate. The specimens soon become relaxed and are cleared to the desired degree. A medicine dropper or a fine pipette, is used to drain off the liquid each time from the Syracuse glass, and to replace it with the reagent which follows each time in processes of clearing and premounting. This procedure prevents injury which otherwise may result from moving specimens from one dish to another. Following KOH solution, transfer is made to 10 per cent acetic acid in which the KOH solution is teased or pressed out. The specimens then are flooded with fresh glacial acetic acid for 10 minutes. While in this solution the aphids may be stained, if desired, by adding acid fuchsin or alcohol fast green or other stain. Next the specimens are covered with a very thin and fluid mixture of Canada balsam and carboxylol (pure carbolic acid,
crystals, 1 part; xylol, 3 parts by volume; and sufficient Canada balsam to make a thin and fluid mixture) for 10 minutes. The premounting treatment prevents shrinking and the formation of empty spaces or bubbles in the legs, antennae, and other parts of the aphid body. The dilute premounting mixture appears to facilitate the rapid infiltration of balsam in all parts of each aphid specimen, before it is placed into the mounting medium. Apparently the lack of balsam infiltration is an important cause of shrinking and other defects. Transfer specimens into Canada balsam. The number per slide will depend on the size of the aphids, number of specimens and forms present, and size of the cover glass used; usually from one to five or six specimens. The mounting medium should be of such consistency as not to spread out too freely on the glass slip when the specimens are arranged in it immediately before laying down the cover glass.

A NEW PTERODONTIA FROM NEW GUINEA
(Diptera, Acroceratidae)

BY CURTIS W. SABROSKY

Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture

A strikingly distinct, undescribed species of Pterodontia Gray was recently sent me for determination by Dr. Edward S. Ross. This is believed to be the first record of the genus from the islands of the South Pacific, though several species are known from Australia and southern Asia. The present species is unique in its possession of unusually long squamae, as well as in the contrast of entirely shining black body and pale yellow legs.

Pterodontia longisquama Sabrosky, new species

Male. Body entirely black, thickly covered with unusually long, erect, black hair, of which the longest (on the second to fourth segments of the abdomen) are equal to the combined length of the two proximal segments of a hind tarsus. Genitalia pale yellow with yellow hairs.

Coxae and trochanters black to brownish, the rest of the legs entirely bright pale yellow, only the distal tarsal segment, the pulvilli, and the claws light brown, the latter black-tipped. The
legs are covered with bright yellow hair, heightening the contrast with the thorax.

Wings brown, apically somewhat paler, the veins deep yellow to brownish. Venation like that of *P. mellii* Erichson and *P. flavipes* Gray, except the anal vein does not quite reach the margin of the wing, the anal cell open; the costa is only slightly bent forward at the costal tooth. Squamae dark brown, covered with dark hair, each squama elongate, nearly half as long as a wing, and flared upward along the outer margin so as to project above the level of the wing. Halteres with black knob and yellow stalk.

Length of body, 5 mm.; of wing, 6 mm.; of squama, 2.9 mm.

A NEW GENUS (CRASSANA), NEW SUBGENUS (MACRASANA) AND NEW SPECIES OF NORTH AMERICAN LEAFHOPPERS
(Homoptera-Cicadellidae)

BY DWIGHT M. DELONG AND RUTH V. HERSHBERGER
Ohio State University

Several years ago Dr. Ball described a species of North American leafhopper from the southwestern United States which he named _Eutettix goniana_. Collections made in Mexico since 1939 have revealed this as a common and widespread species. A study of this species has indicated it does not belong to _Eutettix_, although closely related. Hepner* in a recent monograph of _Eutettix_ has also stated that it does not belong in this genus. Another species taken only at Chilpancingo, Gro. resembles _goniana_, but superficially.

The head structure is quite different and the genital structures of the male are entirely different. It is apparently undescribed. As a result of these studies it has been decided to erect the genus _Crassana_ to include _goniana_ and a subgenus _Macrasana_ to include the new species which is described here as _marginella_.

**Crassana** DeLong and Hershberger, new genus

Related to _Eutettix_. The vertex is sloping, then rounding to front forming a rather thick rounded marginal area. The vertex is parallel margined and is broad and short, more than three times as broad between eyes at base as median length. The venation is simple. The clypeus is narrower at base than at apex.

Genotype: _Eutettix goniana_ Ball.

**CRASSANA GONIANA (BALL)**

_Eutettix goniana_ Ball, Florida Entomologist, 15:1, 1931.

This is a wedge-shaped species with a broad head and a marginal black stripe. Length 5.5-5.5 mm.

The vertex is broad, short, almost parallel margined, more than three times as wide between eyes at base as median length.

Color: Vertex yellowish with a narrow black transverse band

just above margin extending between ocelli. Pronotum yellowish to brown, disc usually darker. Scutellum yellowish. Elytra yellowish subhyaline, veins pale, inconspicuous, claval area infuscated.

Face pale with faint arcs and a pale brown line just beneath margin.

Genitalia: Female last ventral segment broadly excavated with a median produced spatulate process at middle which extends beyond the posterior margin of segment. Male plates long, tapered to acutely pointed apices. Aedeagus rather short and broad in
lateral view with a dorsally projecting process. The apex is
narrowed to a blunt tip.

This species was described from specimens collected at Patag- 
gonia, Arizona. It has been found abundantly in Mexico and 
specimens are at hand from the following localities: Coyuca-  
Catalan, Gro., August 24, 1930 (M. F. 1771), El Mante, Tamaul.,  
October 26, 1930 (M. F. 1775), Cuautla, Mor., August 27, 1937  
(M. F. 6247), Pandancuarco, Gro., August 28, 1930 (M. F. 1785),  
Atencingo, Puebla, July 19, 1930 (M. F. 1703), Zir-  
andaro, Gro., August 29, 1930 (M. F. 1786), Los Mochis, Sinaloa,  
May 16, 1930 (M. F. 1645) by Dampf; Iguala, Gro., Sep- 
tember 11, 1939, and October 22, 1941, Tuxpan, Mich., October  
5, 1941, by Plummer, Good, Caldwell and DeLong; Mexico City,  
September 9, 1936, and September 16, 1936, by Stone; Valles,  

Macrasana DeLong and Hershberger, new subgenus

Related to Crassana but with the vertex bluntly angled with  
the front so as to form a definite margin. The vertex is short and  
broad, about three times as wide as long, almost parallel margined.  
Venation simple. Face short and broad.

Genotype: Macrasana marginella n. sp.

Crassana (Macrasana) marginella DeL. and H., new species  

Resembling goniana superficially but with vertex angled with  
front, vertex more produced at middle, marginal line heavier and  
extending to eyes and with distinct male genital structures. Length,  
male 4.5 mm.

Vertex short and broad, a little longer at middle than next to  
the eyes, almost three times as wide between eyes at base as  
median length.

Color: Golden brown, vertex with a rather heavy black trans-verse marginal line just above margin extending from eye to eye.  
The pronotum has the disc and posterior portion dark brown,  
smoky. Scutellum golden brown. Elytra brownish subhyaline,  
apex of clavus darker. Face dark brown with a white band on  
margin and a paler area at base of clypeus.

Genitalia: Male plates long, tapered to narrow blunt apices.  
Styles with narrow apical portions. Aedeagus in lateral view rather  
long, about uniform in thickness throughout except the dorsal pro- 
jection at base which is long and narrow. The aedeagus proper  
extends dorsally and caudally.

Holotype male collected at CHILPANCINGO, GRO., October 25, 
1941, by Good and DeLong.
NOTES ON MIGRATIONS OF THE PAINTED LADY BUTTERFLY IN 1945

BY JOHN W. SUGDEN*, ANGUS M. WOODBURY AND CLYDE GILLETTE

University of Utah, Salt Lake City

After an absence of four years, emigrational flights of the Painted Lady Butterfly, Vanessa cardui (L), again appeared in Utah. Previous such dispersal flights were reported in 1924, 1930, 1931 and 1935 by Sugden (Pan-Pac. Ent., 13:109-110) and in 1941 by Woodbury, Sugden and Gillette (Pan-Pac. Ent., 18:165-176). Available information was summarized by Williams (Ann. Ent. Soc. Amer., 31:219-223).

The reappearance in Utah was heralded by a similar movement along the Pacific coast. On March 28, 1945, C. H. Abbott, University of Redlands, reported to Woodbury that a migration of the butterflies had been in progress in California since March 12th. He states, "The migration is west to Hermosa Beach and north to the middle of the Mohave Desert, in both instances beyond the extent of the 1941 migration." If the 1945 movement in California was more extensive than in 1941, it was in contrast with the movement in Utah where it was only a fraction of the previous one.

The principal flight at Salt Lake City and vicinity occurred on April 22, 1945, although vanguards probably arrived two or three days earlier. Gillette noted two butterflies on April 19 and 20, but saw no flight in force until April 22. Ellis R. Wilson informed C. W. Lockerbie that the largest concentration of butterflies occurred on his farm near Centerville in Davis County, north of Salt Lake City, on April 21 and 22, when he noted butterflies concentrated around his apricot trees which were in bloom, an average of about 10 butterflies per tree.

Several observers noted them in Salt Lake City on April 22. Gillette noted on that date that on a north-south line, thirty paces long, repeated counts gave an average of 23 butterflies per minute passing the site. They were flying approximately northeast and varied from a few degrees east of north to a few degrees south of east. Those flying south or west would usually change the direction after a short time to the general north-east direc-

* Deceased.
tion. The butterflies were flying fast, singly as a rule but occasionally up to five in a group, and some would stop in the open fields or alight on the moist ground. The flight lasted all afternoon and diminished as evening approached. After April 23, he observed, the flight in Salt Lake City seemed to have dispersed.

On April 22, Ashby D. Boyle reported that there was a flight in the northern part of the city and that the butterflies were crossing Eighth Avenue, an east-west street, in a northern flight. David P. Sugden reported that they were numerous in the western part of the city and that they were coming from the south.

Sugden found many in his garden, on April 22, alighting on the moist, exposed ground and on some of the plants, feeding, taking water or resting in the sun’s rays especially on the sunny side of the garden house. The flight in the garden was erratic, without definite flight pattern but usually the butterflies went over the north fence when they left.

Sugden and Woodbury made observations over the eastern part of the city, then along a route south on State Street to Murray, east along 56th South to Holliday and back to Salt Lake bordering the foothills. From 5 to 10 were seen per block while travelling in a car over most of the route. The flight was not as direct as with previous flights and was generally toward the north and the northeast. In Murray and east of Holliday the majority that were flying steadily were going toward the east or slightly southeast but others were flying in other directions and many were fluttering about or feeding.

In the early morning of the next day, Woodbury found butterflies resting among the shrubbery in a gulley on the University of Utah campus. A few were resting on foliage, some were on flowers but others were selecting spots on the ground where the sun was shining directly upon it between the vegetation. Such spots appeared to be slightly warmer than surrounding areas and the butterflies alighting in such spots usually spread out the wings so that the outside was close to the ground and the inside was exposed to the direct rays of the sun. This seemed to be a “warming-up” process. They left during the day.

On April 22, C. W. Lockerbie observed the butterflies on the road from about 3 miles west of Brigham City to the Bear River Marshes, 20 miles west of the city. He counted from 5 to 10 per mile, flying against a strong north wind. This is the most north-
erly record available and the only one in Boxelder County. It is not to be supposed that the flight stopped here, however. It probably continued on at least into southern Idaho.

During the following weeks, butterflies were observed in several other places in Utah, as well as occasional scattered individuals from Salt Lake City. In response to a request for data by Woodbury in the newspapers, the butterflies were reported during the week of April 25 at the Japanese Relocation Camp at Topaz, Millard County. M. J. Madsen (in letter) stated that on April 28 the butterflies were noted, flying in a northerly direction all the way from Nephi to St. George. The next day on the return trip, they were noted near Richfield in Sevier County and northward.

On April 29, Lockerbie observed the butterflies at Payson, Utah County, and vicinity. Just before sun up, he flushed two or three from sage and rabbit brush about every ten or fifteen feet. They seemed to be resting overnight on the brush near the ground. On the old Payson-Spanish Fork road through open greesewood and salt grass country, forty-one were counted in a mile and most were feeding where dandelions were plentiful or flying north with the wind. At Lincoln Beach, Utah County, as many as ten per area of twenty square feet were feeding on a small yellowish white bloom. He also found them common in the bottoms of Spanish Fork Canyon and observed them from Jordan to Riverton, Salt Lake County, in groups up to five fluttering about each other.

Madsen noted them again, on May 5, along U. S. Highway 40 from the vicinity of Strawberry east to Vernal where they were crossing the highway flying north. Gillette noted the butterflies at several places in Zion National Park, from May 29 to June 3. These insects were definitely not in migrational flight, had torn and battered wings, had a weak flight and would fly only short distances. They were probably resting after a flight.

**DISCUSSION**

The flight of the Painted Lady Butterfly in Utah in 1945 was much less extensive than that of 1941. The extreme dates of observation of the butterflies extended from April 19 to June 3, 1945, but the numbers observed and reported were very meager compared with the flight four years earlier.
The main flight which seems to have reached Salt Lake City on April 22, probably represented the greatest intensity of the movement in Utah but minor flights which were not observed at Salt Lake City seem to have occurred through western Utah within the next week or two thereafter.

It seems probable that weather conditions affect the timing of flights. The next few days following April 22 were stormy and rainy in the Salt Lake Valley and the intensity of the flight rapidly diminished following the initial outburst. A drop in temperature accompanied by precipitation has been noted to nearly stop the movement.

Comparing the flights reported in past years at Salt Lake City, it appears that the height of the movement has varied in time about 6 weeks, from March 30 to May 8, as follows: April 13, 1924; March 30, 1930; May 3, 1931; May 7-8, 1935; May 8, 1941, and April 22, 1945.

During the migrations, the butterflies tend to feed upon almost any flower that is in bloom. At the time they appeared in Salt Lake City, about April 22, the first bloom of the dandelion was in progress and the flowers were available to the butterflies in roadsides, lawns and widespread extensive fields. Some orchards were also in bloom, especially apricots and cherries. As the season progressed, there was a change in bloom with the unfolding of new blossoms and withering of old ones, but they seem to have been sufficient to sustain, at least part of the migrant populations. The part that low food supply might play in decimation of the flying hordes has not been ascertained.

In 1941, it was noted that the migrants left a new generation to grow on all the thistles observed in many places in the Salt Lake region. When the first migrants appeared in 1945, none of the thistles were beyond the early rosette stage; some were just putting out the first leaves and none had begun the stalk. Apparently the thistles were not far enough advanced for oviposition and although Sugden examined many of the areas that had borne large numbers of caterpillars on the thistles in 1941, none were found at any time in 1945 although flights had passed over the areas.

The explanation appears to lie in the fact that the caterpillars in past years had been borne on the leaves of the stalk and not on the rosette, the leaves of which wither and die after the stalk
becomes established. Feeding of the larvae on the rosette at that early stage of development might hinder or prevent proper establishment of the stalk and result in failure to develop enough food for the larvae.

Report of the writers (op. cit., p. 174) on the 1941 flights indicated a characteristic pattern of movement during migration, in which the butterflies became more active during the warm parts of warm days and slowed down and stopped at night and on some cold days. Additional information is now available concerning the resting at night and on cold days. All three of the writers as well as Lockerbie observed them independently where they had been resting overnight. In addition, A. D. Boyle (field notes) "flushed" the butterflies all the day of April 21, 1935, near Vernon, Benmore and Lookout Pass in Tooele County. There was "no sun, a fairly stiff, cold wind and Painted Ladies were flushed all day, even when it was sprinkling slightly." J. L. Mullen reports much the same experience west of Utah Lake and at Alpine, Utah County.

The additional information accumulated from the 1945 migration tends to confirm the idea that these emigrations result from overcrowded areas of southern United States or Mexico; that they afford a means by which the surplus population may relieve congestion by dispersal flights; and in some cases provide a means of developing additional generations. The new generations, however, probably do not survive the severe winters of this area and since eggs are not laid until spring, there are no adults left to propagate and hence disappear. They persist farther south where adults can survive the winters.

REVIEW: CHECK LIST OF THE CICADELLIDAE

Check List of the Cicadellidae (Homoptera) of America, North of Mexico, by Dwight M. De Long and Dorothy J. Knall. Graduate School Studies. Biological Science Series No. 1. The Ohio State University Press, Columbus, Ohio. Pages V + 102. 1946. $1.50.

In 1937 De Long and Caldwell published a check list of the North American Cicadellidae which contained 145 genera and
over 1800 species. This was the first time the species of the group had been brought together since the publication of the Van Duzee catalogue in 1917 which contained some 69 genera and 700 species of leafhoppers with complete synonymy. According to the authors' statement in the Introduction, the present check list is a revision of the list as published in 1937 and contains 175 genera and 2276 species, varieties and subspecies occurring north of Mexico. Species which occur only in Mexico are omitted.

The publication is divided into 4 parts:

I. Introduction. A discussion of purpose, content and arrangement. (2 pages)

II. Check List. A preliminary arrangement of subfamilies and genera occupies the first two and a fraction pages followed by the listing of the species. The authors have attempted to arrange the subfamilies and genera to show their phylogenetic relationships. The species are listed under each genus in alphabetical order. In the author's own words, "... synonymy of the Van Duzee catalogue has not been repeated, but recent synonymy has been indicated as far as possible ..." References to the original descriptions are given for the species, genera and subfamilies. The genotype is cited according to its original designation. The original genus under which a species was described is placed in parenthesis after the citation in case the species has been placed in another genus. 79 pages.

III. Key lists of Publications. Publications are cited by number in the Check List and the title to which each number refers is given in this Key List of 137 publications.

Suggested Generic Papers on North American Cicadellidae. This is a list of many of the more important recent generic papers for the convenience of readers who wish to refer to a generic treatment. 10 pages.

IV. Index to Genera. 6 pages.

The publication is of convenient size, 6 by 9 inches, with easily read type, but poorly bound with heavy paper. Drs. De Long and Knoll have provided a serviceable, up-to-date check list which should be a great convenience not only to specialists in the group but also to others who are less familiar with the cicadellids.—NORMAN W. FRAZIER.
NOTES ON THE DASYMUTILLA OF THE PALO VERDE VALLEY, CALIFORNIA
WITH THE DESCRIPTION OF A NEW SPECIES
(Hymenoptera, Mutillidae)

BY WILLIAM F. BARR AND PAUL D. HURD, JR.
University of California, Berkeley

The Palo Verde Valley, a narrow strip of river bottom about thirty miles long lying adjacent to the Colorado River in eastern Riverside County, California, is bounded by mountains and a mesa to the north, south and west, and by the Colorado River to the east. It has a considerable acreage of cultivated areas although the greater portion of the valley consists of mesquite, tamarisk and arrow-weed thickets. Thus the valley offers a splendid opportunity for collecting a varied population of Dasymutilla in large numbers.

During the writers' investigations of alfalfa problems in this valley in the summer of 1946 they acquired a collection of Dasymutilla that consists of nine species, one of which is described as new.

Collections were also made by E. G. Linsley, J. W. MacSwain, and R. F. Smith during the summers of 1945 and 1946 and the writers wish to thank these individuals for the use of their material and data.

All localities and dates of capture for each species have been listed since they may prove to be of assistance to future workers in correlating males and females which have been described as separate species.

**Dasymutilla eminentia Mickel**


The capture of six specimens establishes the record of this species for the first time in California. It was taken at the following localities in the Palo Verde Valley: Blythe, 1♀, June 22, 1946 (Barr); 1♂, July 14, 1945 (MacSwain); 1♂, 1♀, August 9, 1946 (Barr and Hurd); 1♀, August 20, 1946 (Hurd). Ripley, 1♂, August 28, 1946 (Hurd).

One male was taken while sweeping alfalfa.
Dasymutilla atricauda Mickel


This species was described from Blythe by Mickel, additional specimens are now recorded from the type locality as follows: Blythe, 1 ♂, June 25, 1945 (Linsley); 1 ♀, August 9, 1946 (Barr); 2 ♀♂, August 13, 1946 (Barr and Hurd).

Dasymutilla magna (Cresson)


This well-known species was found to be rather common throughout the valley. One male was taken while sweeping alfalfa at Blythe on July 19, 1946. Previously the only California record of this species was from Brawley, Imperial County. New California records are as follows: Seven miles north of Blythe, 1 ♂, July 23, 1946 (Barr and Hurd). Blythe, 1 ♀, June 22, 1945 (Linsley); 2 ♀♂, June 22, 1946 (Barr); 1 ♀, June 23, 1945 (Linsley); 1 ♀, June 25, 1945 (Linsley); 1 ♂, 1 ♀, July 11, 1946 (Barr); 1 ♀, July 13, 1946 (Barr); 1 ♀, July 14, 1946 (MacSwain); 1 ♂, July 19, 1946 (Barr); 1 ♀, July 21, 1946 (Hurd and Smith); 1 ♀, July 26, 1946 (Barr and Hurd); 1 ♀, August 3, 1946 (Hurd); 1 ♂, August 7, 1946 (Barr); 1 ♀, August 9, 1946 (Barr). Ripley, 1 ♀, July 24, 1946 (Barr and Hurd).

Dasymutilla magnifica Mickel


Three females of this beautiful species were taken at the following localities: eight miles north of Blythe, June 26, 1946 (Barr) and Palo Verde, August 22, 1946 (Barr and Hurd), August 27, 1946 (Barr).

In one of the specimens from Palo Verde, the dorsal abdominal vestiture is quite worn and short and is of an orange color instead of red; however, it may be readily identified by the characters as given in Mickel's key.

Dasymutilla satanas Mickel


The male and female of this species were described by Mickel
in 1928 as separate species. In early August it was the writers' fortune to collect a copulating pair of the male (*mimula*) and the female (*satanas*) thereby establishing the correct status of the species as indicated in the synonymy above. The writers had suspected that such would be the case since the above males and females were the most commonly encountered *Dasymutilla* during the past summer.

The males were found to be common in the cultivated parts of the valley and were frequently captured in the alfalfa fields. The females, as in the case of the males, were most commonly observed in the cultivated areas of the valley, but were apparently restricted to the roads and roadside situations.

Mickel in 1936 records ten males from Blythe, additional localities and records from the Palo Verde Valley are: seven miles north of Blythe, 5 ♀♂; 3 ♀♀, July 23, 1946 (Barr and Hurd). Blythe, 1 ♂, June 22, 1946 (Barr); 1 ♂, July 11, 1946 (Barr); 3 ♂♂, July 11, 1946 (Barr); 3 ♂♂, July 13, 1946 (Barr); 2 ♂♂, 1 ♀, July 14, 1945 (MacSwain); 1 ♀, July 19, 1946 (Barr); 3 ♂♂, 1 ♀, July 21, 1946 (Barr and Hurd); 1 ♂, July 26, 1946 (Barr and Hurd); 2 ♂♂, July 27, 1946 (Barr and Hurd); 1 ♂, 1 ♀, August 1, 1946 (Barr and Hurd); 1 ♂, 7 ♀♀, August 3, 1946 (Barr and Hurd); 1 ♀, August 4, 1946 (Barr); 3 ♀♀, August 5, 1946 (MacSwain and Smith); 2 ♂♂, August 6, 1946 (Barr); 1 ♂, August 7, 1946 (Barr and Hurd); 1 ♀, August 9, 1946 (Hurd); 1 ♂, August 17, 1946 (Hurd); 4 ♀♀, August 19, 1946 (MacSwain); 2 ♂♂, 1 ♀, August 20, 1946 (Barr and Hurd); 1 ♀, August 22, 1946 (Barr). Ripley, 1 ♀, June 25, 1946 (Barr); 1 ♂, 1 ♀, July 2, 1946 (Barr); 1 ♂, 2 ♀♀, July 14, 1946 (Barr and Hurd); 1 ♂, 1 ♀, August 12, 1946 (Barr and Hurd); 7 ♂♂, 1 ♀, August 16, 1946 (Barr and Hurd); 3 ♀♀, August 28, 1946 (Barr and Hurd). Palo Verde, 1 ♀, August 20, 1946 (Barr).

**Dasymutilla gloriosa (Saussure)**


This distinctive xerophilic species was uncommonly encountered during the summers of 1945 and 1946. It appeared most abundantly toward the end of this past summer.

The Palo Verde Valley records include: seven miles north of Blythe, 1 ♀, July 23, 1946 (Barr). Blythe, 1 ♀, June 24, 1945
Dasymutilla heliophila (Cockerell)

Sphaerophthalma heliophila Cockerell, 1900, Entomologist, 33:65.

This species was not taken by the writers, its occurrence in the Palo Verde Valley is based on the record of Mickel\(^2\) of specimens taken at Blythe.

Dasymutilla arenivaga Mickel


Arenivaga was quite commonly collected throughout the Palo Verde Valley at the following localities: seven miles north of Blythe, 1 ♀, July 23, 1946 (Barr and Hurd). Blythe, 1 ♀, June 24, 1945 (Linsley); 1 ♀, June 25, 1945 (Linsley); 1 ♀, July 13, 1946 (Barr); 2 ♀ ♀, August 3, 1946 (Barr and Hurd); 1 ♀, August 4, 1946 (Hurd); 1 ♀, August 5, 1945 (Smith and MacSwain); 2 ♀ ♀, August 9, 1946 (Barr and Hurd); 1 ♀, August 20, 1946 (MacSwain); 1 ♀, August 22, 1946 (Barr); 4 ♀ ♀, August 27, 1946 (Barr and Hurd); 1 ♀, August 28, 1946 (Barr). Ripley, 1 ♀, August 14, 1946 (Barr); 2 ♀ ♀, August 28, 1946 (Hurd). Palo Verde, 1 ♀, August 27, 1946 (Hurd); 1 ♀, August 31, 1946 (MacSwain).

Dasymutilla paranocturna Barr and Hurd, new species

Female. Length 9 mm. Dark mahogany red, eyes enlarged; vertex, dorsum of thorax and second abdominal tergite rather sparsely clothed with erect and recumbent, rather long, ash-white pubescence; frontal area of head clothed with recumbent sienna pubescence; abdominal segments 3-5 densely clothed with erect, burnt umber pubescence; remainder of insect clothed as abdominal segments 3-5, but pubescence sparser.

Head very dark mahogany red, mandibles weakly unidentate, acuminate at apex, basal half dark mahogany red, apical half black, clothed exteriorly with a few, short burnt umber hairs; clypeus bidentate medially on apical surface, clothed with a thick fringe of rather short burnt umber hairs; antennae dark mahogany red, scape clothed with numerous, minute burnt umber hairs,

first segment of flagellum slightly shorter than twice its own width at apex; antennal scrobes distinctly carinate above, the carina extending nearly to the inner eye margin; eyes prominent, unusually large, the distance between the posterior margin of the eye and the postero-lateral angles of the head not greater than one-half diameter of eye; front and vertex with rather large, confluent shallow punctures; gena sparsely punctured with small non-confluent punctures; frontal area of head densely clothed with recumbent sienna pubescence; vertex sparsely clothed with a few, ashy-white recumbent hairs. Thorax dark mahogany red, slightly broader than long; dorsum sculptured with quite large, shallow confluent punctures, sparsely clothed with erect and recumbent ashy-white pubescence; scutellar scale evident; propodeum with large irregular punctures, clothed with a few, short, erect burnt umber hairs; anterior half of mesopleuron nearly glabrous, bounded caudally by a dorso-ventral fringe of very long burnt umber hairs; posterior half of mesopleuron with coarse, irregular and somewhat scattered punctures; dorsal surface, sides, and posterior surface of propodeum sculptured with rather large confluent punctures, dorsal surface clothed rather sparsely with mostly erect, rather long ashy-white hairs, some of which are tinged with yellow; legs dark mahogany red, clothed with erect burnt umber hairs. Abdomen dark mahogany red, first tergite glabrous except at apical and lateral margins where bordered by a row of small, confluent circular punctures, apex clothed with transverse row of short, erect sienna hairs, sides sparsely clothed with a few, erect rather long hairs; second tergite densely sculptured with confluent punctures, sparsely clothed with erect and recumbent ashy-white hairs, except at apex and sides where glabrous; tergites 3-5 densely clothed at bases with erect burnt umber pubescence; second sternite sculptured with rather small non-confluent punctures which are more or less transversely arranged, sparsely clothed with a few, short burnt umber hairs; remaining sternites similarly clothed as the corresponding tergites; pygidium distinctly longitudinally rugose.

Holotype, ♀, (No. 5619, California Academy of Sciences, Entomology) from Blythe, Riverside County, California, July 6, 1946, collected by W. F. Barr. One paratype, ♀, from San Felipe Creek, Imperial County, California, June 17, 1940, collected by R. G. Dahl.

D. paranocturna is known only from two female specimens and structurally appears to be most closely related to D. nocturna Mickel and runs to that species in Mickel's key. It differs from nocturna by possessing shorter, ashy-white and burnt umber

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pubescence on the dorsal surfaces instead of the long, contrasting black and white pubescence. *Paranocturna* further differs in that the coloration of the integument is distinctly reddish, not tending toward black as does *nocturna*.

The paratype of this species is somewhat larger than the holotype, measuring 14 mm. in length.

**DASYMUTILLA MEGALOPHALMA MICKEL**


*Megalophalma* was not commonly encountered in either year. In 1945, E. G. Linsley collected a male at Blythe on June 24 and R. F. Smith and J. W. MacSwain collected another male on August 5 at the same locality.

The writers collected but two males, one of which was taken in an alfalfa field at Blythe on August 7, the other was collected at Ripley on August 14.

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**INTERNATIONAL CONGRESS OF ENTOMOLOGY**

The eighth International Congress of Entomology will be held in Stockholm, Sweden, August 9-15, 1948. The fact that all steamship sailings are currently booked to capacity for months in advance makes it seem necessary for those expecting to attend the congress in 1948 to arrange for passage as early as possible. Steamship companies have not issued sailing lists for 1948, but expect to do so in the early fall. A number of lines have listed sailings for the present season, among them, the Cunard, French, Belgian, Swedish, Norwegian, Gdynia (Polish), Holland-American, etc., the first mentioned expecting soon to have two new steamers in service. It is understood that the Thirteenth International Congress of Zoology will be held in Paris some time in July, 1948, and it is hoped that all entomologists going to Stockholm will plan to attend the Zoological Congress also in order that the interests of the entomologists may be fully represented before the more comprehensive body. Should a sufficient number of individuals indicate that they expect to sail about mid June, it may be feasible to engage passage on the same steamer. Early information as to the probable number of participants is especially desired in order that the housing committee in Stockholm may make the necessary arrangements. The undersigned, as member of the executive committee, would appreciate it if he be kept informed as early as possible as to plans of those expecting to attend the sessions.—O. A. JOHANSEN, Cornell University, Ithaca, N. Y.
UNDESCRIBED SPECIES OF TIPULIDAE FROM THE WESTERN UNITED STATES
(Diptera)

PART III

BY CHARLES P. ALEXANDER
Massachusetts State College, Amherst

The preceding part under this title was published in the Pan-Pacific Entomologist, 21:91-97; 1945. At this time I am describing three new species of the genus Tipula from the San Bernardino Mountains, California. In July, 1946, Mrs. Alexander and I spent three days camping at East Barton Flats, on the East Fork of the Santa Ana River, at a general altitude of about 6250-6300 feet. This was close to the mountain cabins of the Melander and Sperry families, of Riverside, California, and we enjoyed and profited greatly by this visit with our good friends. On one occasion, Noël Crickmer, Melander, Sperry and I collected up the slopes of Sugarloaf Mountain, to the Little Cienaga, altitude about 7400 feet. During the remainder of the summer and fall, to the first snows about mid-October, the Sperrys continued to collect Tipulidae, chiefly at the lanterns operated at the Sperry Cabin. I am vastly indebted to all my friends above indicated for their many kindnesses, including the large series of Tipulidae that has been presented to me.

Tipula (Trichotipula) subapache Alexander, new species

Allied to apache; general coloration of thorax gray, the preascutum with a central paler gray stripe, the posterior sclerites of the notum with a yellow central line; antennae black, the scape chiefly yellow; femora brownish yellow, the tips narrowly blackened; wings with a strong blackish tinge, cell Sc and the stigma darker brown; obliteratorive areas conspicuous; macrotrichia in outer ends of cells Rs and M; abdomen brownish black, the basal tergal rings narrowly yellow; male hypopygium with the notch of the tergite V-shaped, provided with long cylindrical blackened spines; outer dististyle nearly twice as long as broad, with long black setae; inner dististyle with its main body nearly parallel-sided, the beak short and stout, slightly upturned; outer basal lobe
large and conspicuous, flattened, exceeding one-half the length of main body of style.

**Male.** Length about 12.5-13 mm.; wing 11-11.5 mm.; antenna about 4 mm.

**Female.** Length about 14-15 mm.; wing 14-15 mm.

Frontal prolongation of head black, more chestnut brown basally above; nasus elongate, black; palpi black. Antenna with scape obscure yellow, narrowly darkened at apex; pedicel brownish black, flagellum black; flagellar segments very gently incised. Head above yellow, the sides of the posterior vertex and the genae infuscated, pruinose.

Pronotum yellow, with a dark spot on either side of the midline. Mesonotal praescutum with a broad light gray central stripe that is more or less divided by a capillary darkened median vitta; lateral stripes narrow, more brownish gray, remainder of praescutum brownish black; posterior sclerites of notum black, more or less pruinose, with a continuous yellow stripe, broader and more testaceous yellow on scutellum, very narrow on the mediotergite; scutal lobes with the gray areas more or less distinctly ringed with black. Pleura with the propleura and mesepisternum more blackened, pruinose, the mesepimeron, meron and pleurotergite paler. Halteres with the stem blackened, its base and the apex of knob yellow. Legs with the coxae blackened, pruinose; trochanters brownish yellow; femora obscure brownish yellow, the tips narrowly blackened; tibiae and tarsi obscure brownish yellow, the outer tarsal segments passing into black. Wings with a strong blackish tinge, cell Sc and the stigma darker brown; pale areas before and beyond stigma and as a disconnected band at cord, the latter crossing the base of cell 1st M; further pale longitudinal streaks in several of the cells, especially on either side of vein M and as a V-shaped area in cell 1st A; less evident pale streaks in some of the outer cells; veins brown. Macrotrichia in outer ends of cells Rs and M. Venation: Sc, persistent; Rs arcuatu, shorter than M-cu; m longer than petiole of cell M.

Abdominal tergites brownish black, at least on sides, in cases paler brown medially, the basal rings narrowly but conspicuously light yellow; basal sternites more uniformly brownish yellow, the outer segments, with the hypopygium, more infuscated. Ovipositor with both cerci and hypovalvae compressed-flattened, their tips obtusely rounded. Male hypopygium having the posterior border of the ninth tergite with a deep V-shaped notch that is provided with several long cylindrical blackened spines with blunt tips; at ends of the obtuse lobes with a small group of more conical spines. Outer dististyle moderately broad, the length nearly twice the breadth, provided with long black setae, the longest on outer margin fully as long as the length of the style. Inner dististyle with the main body nearly parallel-sided, the beak short and stout, slightly upturned; outer basal lobe large and conspicuous, flat-
tened, exceeding one-half the length of main body of style. Phal-
osome more or less rolled into an open tube.

**Habitat. CALIFORNIA (SAN BERNARDINO COUNTY).**

**Holotype, ♂, East Barton Flats, San Bernardino Mountains, altitude 6300 feet, September 22, 1946 (John and Grace Sperry). Allotopotype, ♀, with the type. Paratopotypes, 11 ♀♂, August 19, September 27, 1946.**

This fly is closest to *Tipula (Trichotipula) apache* Alexander, of northern New Mexico, differing in details of coloration and in the structure of the male hypopygium, especially the tergite and both dististyles, particularly the large outer basal lobe of the inner style. The rather numerous California species of *Tri-
chotipula* have been revised recently by the writer (Bull. So. California Acad. Sci., 45:1-16; 1946).

**Tipula (Oreomyza) graciae** Alexander, new species

Belongs to the *marmorata (fragilis)* group; general coloration gray, the praescutum with four brownish gray stripes; femora brownish yellow, the tips broadly and conspicuously blackened; wings whitish subhyaline, with a pale grayish brown marbled pat-
tern, especially pale in the costal and apical portions heavier in the medial and anal cells; abdomen brown the lateral and caudal borders of segments yellow; male hypopygium with the tergite having a low V-shaped notch, the outer angles only slightly pro-
duced; outer dististyle with the upper margin at base blackened but very obtuse; inner dististyle with the apex blackened, rela-
tively stout, simple; eighth sternite with the caudal border pro-
duced into a low median lobe that bears about a score of long black setae.

**Male.** Length about 12-13 mm.; wing 13-15.5 mm.; antenna about 2.5-2.7 mm.

Frontal prolongation of head dark brown, heavily pruinose, es-
pecially above; nasus distinct; palpi black. Antennae short, scape and pedicel yellow, flagellum black; flagellar segments simple, a little longer than the verticils. Head gray, with indications of a delicate darker line on the low vertical tubercle.

Pronotum gray, the scutellum light yellow. Mesonotum gray, the praescutum with four brownish gray stripes, the intermediate pair more pruinose on anterior portions; lateral margin below the humeri blackened; posterior sclerites of notum light gray, each scutal lobe with two separate brownish gray areas; a delicate broken central dark vitta on scutellum and mediotor
gite. Pleura gray, with darker gray areas, most evident on the ventral sternopleurite and meron; dorsopleural region yellow. Halteres yellow,
knobs dark brown. Legs with the coxae gray pruinose; trochanters brownish yellow; femora obscure yellow basally, more darkened outwardly, the tips broadly and conspicuously blackened; tibiae brownish yellow, the tips more narrowly infuscated; tarsi brownish yellow, passing into black; claws (male) toothed. Wings whitish subhyaline, with a pale grayish brown marbled pattern, distributed about as in other members of the group, especially pale in the costal and apical portions of wing; heavier in the medial and anal cells, especially 1st A; stigma paler brown; veins brown. Venation: Rs about one-half to three-fourths longer than m-cu; basal section of R₉₉ short to very short; M₃₄ very short to punctiform.

Abdomen brown, the lateral and caudal borders of the tergites yellow, the latter more distinct and becoming more extensive on the outer segments; sternites generally similar, the bases of the eighth and ninth sternites extensively blackened. Male hypopygium having the ninth tergite with a low V-shaped notch on caudal margin, the outer angles only slightly produced, not spinous; margin of notch with a few small spinous points and setae. Outer dististyle flattened, the upper margin at base blackened but very obtuse, not at all toothed; surface of style with coarse black setae. Inner dististyle heavily blackened at apex and along margins; apex relatively stout, simple; outer basal lobe a low cushion, set with several erect stout black setae, the basal portion with a small blackened lobule that is provided with microscopic blackened setulae. Eighth sternite moderately sheathing, the caudal border produced into a low inconspicuous median lobe that bears about a score of long black setae, the marginal setae of the remainder of sternite similarly long but yellow; center of disk glabrous.

_Habitat._ California (San Bernardino County).


This very distinct fly is named for Mrs. John L. Sperry (Grace Herreshoff Sperry), of Riverside, California, who specializes on a study of the Lepidoptera. The Sperrys have camped and collected in hundreds of places in the West and many entomologists are greatly indebted to them for invaluable insect materials in many orders. The discovery of a member of this group of _Tipula_ so far to the south was very surprising. The only other species at present known from Western North America are _Tipula_ (Oreomyza) _fragilina_ Alexander, Alaska to Colorado, along the
Rocky Mountains, and *T. (O.) phroctenia* Alexander, from British Columbia, eastward to Maine, in the Canadian Zone. All three species are on the wing in the autumn. The species are well distinguished among themselves by hypopygial characters, particularly the dististyles and eighth sternite.

**Tipula (Lunatipula) dido** Alexander, new species

Mesonotum chiefly gray, the praescutum with four entire reddish brown stripes, the intermediate pair narrow; antennae relatively short, basal three segments yellow, remainder of flagellum black; flagellar segments only moderately incised; femora yellow, weakly darkened at tips; wings with a weak brownish tinge, the oblitterative area before cord conspicuous; abdomen, including hypopygium, dull yellow, scarcely patterned; ninth tergite almost divided medially by pale membrane, the lower outer angle of each lobe produced into a stout blackened spine; inner dististyle with beak long and slender, widely separated from the small lower beak; posterior crest of style produced into a triangular point; phallosome consisting of four rods in pairs of two each; eighth sternite sheathing, each outer angle with a strong fasciculate bristle; a broad median plate that suddenly narrows into a stout fingerlike lobe, the whole outer portion with a fringe of unusually long setae.

**Male.** Length about 15-17 mm.; wing 15-15.5 mm.; antenna about 3.5-4 mm.

**Female.** Length about 18 mm.; wing 17 mm.

Frontal prolongation of head yellow; nasus stout; palpi obscure brownish yellow, the outer half of terminal segment blackened. Antennae relatively short; basal three segments yellow, remainder of flagellum black; flagellar segments only moderately incised, a trifle shorter than the longest verticils. Head yellow, sparsely pruinose, especially on the scarcely developed vertical tubercle and the posterior orbits.

Pronotum brownish yellow. Mesonotum chiefly gray, the praescutum with four entire reddish brown stripes, the intermediate pair narrow; posterior sclerites of notum more heavily pruinose. Pleura yellow, sparsely pruinose; dorsopleural membrane clear yellow. Halteres with stem dusky, pale at base, knob more darkened. Legs with the coxae and trochanters yellow; femora brownish yellow, narrowly and weakly darkened at tips; tibiae and basitarsi yellowish brown, the remainder of tarsi passing into black; claws (male) toothed. Wings with a weak brownish tinge, heavier in the prearcular and costal fields; stigma small, darker brown; a diffuse brown cloud over *m-cu*; oblitterative area before cord conspicuous, extending to the basal third of cell *M*; no post-stigmal brightening; veins brown. Venation: *Rs* arcuated to weakly angulated at origin, nearly twice *m-cu*; *R*₁,₂ preserved; *m* and petiole
of cell $M_1$ subequal in length; $M_2+$ subequal to or a trifle longer than the basal section of $M_1+$.

Abdomen dull yellow, scarcely patterned. Ovispositor with the cerci long and relatively slender, only gently upcurved to the subacute tips. Male hypopygium with the ninth tergite relatively small, divided medially by pale membrane; lower outer angles produced caudad and ventrad into stout blackened spines; posterior border mesad of these spines less heavily blackened. Ninth sternite with its appendage long and curved, more or less flattened. Basistyle entire, unarmed. Outer dististyle with outer half dilated into a weak spatula. Inner dististyle with the bead long and slender, widely separated from the small more blackened lower bead by a large oval notch; dorsal crest low, slightly corrugated, setae small; posterior crest produced into a triangular point, the entire region with numerous coarse reddish setae; outer basal lobe elongate-triangular in outline, the posterior portion fringed with long coarse reddish setae. Phallosome conspicuous, consisting of four sclerotized toothed rods, arranged in pairs of two each. Eighth sternite distinctive, sheathing, with a semi-detached lobe at each outer angle, this tipped with a single strong fasciculate bristle; a broad median plate that suddenly narrows at apex into a stout fingerlike lobe, the whole outer portion, including the lobe, with a fringe of unusually long setae that appear as a flattened brush directed caudad.

Habitat. CALIFORNIA (SAN BERNARDINO COUNTY).

Holotype, ♂, East Barton Flats, San Bernardino Mountains, altitude 6300 feet, August 17, 1946 (John and Grace Sperry). Allotopotype, ♀, at light, July 16, 1946. (Sperry and Alexander). Paratopotypes, 2 ♂ ♀, with the allotype.

This fly appears to belong to the unicincta group but is not typical and its exact relationships are in doubt. Some points of similarity with species such as Tipula (Lunatipula) mormon Alexander seem to be indicated.

A EUROPEAN WEEVIL NEWLY INTRODUCED INTO THE SAN FRANCISCO BAY REGION

While collecting in the outskirts of Mill Valley, Marin County, on April 4, 1947, D. Giuliani, one of our younger entomologists, noticed numerous specimens of Barypithes pallucida Boh., crawling up the curbing along the roadside.

This European weevil has long been esestablished in the Eastern part of our country but this is, I believe, the first time that it has been noticed on the Pacific Coast.—EDWIN C. VAN DYKE.
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Entered as second class matter, February 10, 1925, at the post office at San Francisco, California, under Act of August 24, 1912.
A NEW APHID ON PENSTEMON IN THE SIERRA OF CALIFORNIA

BY E. O. ESSIG

University of California, Berkeley

A single specimen of a beautiful little green aphid was first collected by the writer on a seed bearing shoot of the mountain pride, *Penstemon Newberryi* Gray, in the Echo Lake Region of the Sierra Nevada Mountains, California. Although I had assiduously collected aphids almost every summer in this area since 1924, I first encountered this aphid on our cabin site, Upper Echo Lake, 7500 ft. altitude, on August 11, 1938.

The following year on August 11, 1939, a very large series of aperous females and a single aperous male were taken at this same locality. Although a persistent and diligent search extending over a week was made, no alate individuals could be found. On August 10, 1946 I made extensive collections at Upper Echo Lake and secured good series of sexuparae and sexuales. They were feeding chiefly on the ripening seed stalks of mountain pride.

*Aphis sierra* Essig, new species

*Color.* All forms, excepting the males, are deep green, often of a bluish cast. In life the mature aperae have a dark spot on the median dorsum of the abdomen. This spot may be due to body contents since it disappears when the specimens are cleared. The drawings (Fig. 1) show the black markings of the various forms. When cleared the pigmentation shows up very distinctly.

*Aperous viviparous female* (sexupara). Very small, somewhat robust and almost triangular in shape. Smooth and with few hairs. A pair of lateral tubercles present on prothorax and on abdominal segments I and VII. Pale or bright green with conspicuous dark spot on the dorsum in life which does not appear in the cleared and mounted specimens. Antennae black excepting basal half of segment III. Cornicles and cauda black (the base of the latter clear). Legs pale, dusky and black as illustrated. Antennae scarcely more than half as long as the body; I, 0.02 mm.; II, 0.02 mm.; III, 0.23 mm.; IV, 0.15 mm.; V, 0.15 mm.; VI, 0.28 mm. (base 0.08; unguis 0.20 mm.); total 0.85 mm. Secondary sensoria absent. Rostrum
slender, extending to the base of the abdomen. Cornicles black; nearly cylindrical, wider at base and gradually narrowing apically; imbricated, with slight flange, length 0.23 mm. Cauda rough and scaly; triangular with wide clear base and bluntly rounded black apical half; with 3 pairs of fine recurved spines. Length of body 1.5 mm.; width 0.7 mm.

**Alate viviparous female** (sexupara). Mostly black with green and dusky abdomen. Rather slender, with few hairs which are short on the body and antennae and rather long on the legs. Antennae a little more than half the length of the body. Length of segments: I, 0.06 mm.; II, 0.06 mm.; III, 0.29 mm.; IV, 0.17 mm.; V, 0.17 mm.; VI, 0.30 mm. (base 0.08 mm.; unguis 0.22 mm.); total 1.05 mm. Secondary sensoria circular, arranged in an uneven row along the full length of segment III, varying from 11 to 18 in number; none to 2 (in a single case) on segments IV, V, and VI. Wing veins clearly defined; mediae of fore wings with second fork 0.4 the distance from margin of wing to the first fork; radial sector only slightly bent. Rostrum as in apterae. Cornicles black, cylindrical; heavily imbricated, 0.20 mm. long. Cauda triangular, rather sharply-pointed as indicated in accompanying drawing. Length of body, 1.5 mm.

**Oviparous female** (sexual). Apterous; slightly smaller than the apterous viviparous female and much paler in color and with only remnants of the dark dorsal markings. Antennae short; length of segments: I, 0.04 mm.; II, 0.05 mm.; III, 0.17 mm.; IV, 0.10 mm.; V, 0.12 mm.; VI, 0.22 mm (base 0.08 mm.; unguis 0.14 mm.); total 0.70 mm. Secondary sensoria absent. Rostrum extending beyond coxae of the hind legs. Hind tibiae slightly swollen and with sensoria distributed sparsely over the whole area excepting the basal and distal portions. Cornicles dusky, short, cylindrical, imbricated. Cauda dusky, much as in the apterous viviparous female. Length of body 1.24 mm.

**Male** (sexual). Apterous, almost wholly black with dark green markings on thorax and abdomen; small, slender active. Antennae almost as long as the body. Length of segments: I, 0.04 mm.; II, 0.05 mm.; III, 0.22 mm.; IV, 0.15 mm.; V, 0.15 mm.; VI, 0.21 mm. (base 0.08 mm.; unguis 0.17 mm.); total 0.86 mm. Small circular secondary sensoria numerous and variable in numbers. They are distributed as follows: III, 11 to 25 (in one specimen 4-7); IV, 10-13 (in one specimen 20; in another 4); V, 6-12; VI, none. Rostrum extending well beyond the third coxae. On the hind tibiae of at least one individual, possibly an intermediate, were a number of single or paired sensoria-like organs similar to those found on certain oviparous females. (Fig. 1). Cornicles very short, about same

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**Fig. 1. Aphis sierra** Essig, n. sp. Winged and apterous viviparous females, apterous oviparous female, apterous male, first instar young with important characters greatly enlarged. Drawings by Frieda Abernathy.
length as the cauda. Cauda broadly triangular. Claspers and penis as drawn.

Ova. Regularly oval. Mounted oviparous females appeared to contain one or possibly not more than two or three ova. These were being deposited on the plants in late August.

*Aphis sierra* differs from *Aphis pentstemonicola* Gillette and Palmer (1929a) in rarely having secondary sensoria on antennal segment IV, and without such sensoria on segment V of the alate viviparous female; with triangular rather than conical cauda; and with many more sensoria on the hind tibia of the oviparous females. It differs from *Aphis pentstemonis* Williams in having larger sensoria on III in the alates, shorter antennae with relatively shorter segments; and wider and shorter cauda with fewer hairs.

The specimens studied consist of a large series of individuals cleared in lactic acid-balsam-alcohol mixture and mounted in Euparal on 44 microscopic slides. These were mostly apterous viviparous females and 2 alates, and a goodly number of apterous oviparous females and apterous males. These have been variously designated as follows: *Holotype*—alate viviparous female—wings not quite perfect, Upper Echo Lake, California, August 10, 1946. *Morphotype*—apterous viviparous female, Upper Echo Lake, California, August 10, 1946. *Morphotype*—apterous oviparous female, Upper Echo Lake, California, August 10, 1946. *Andratype*—apterous male, Upper Echo Lake, California, August 10, 1946. *Paratypes*—all the remaining specimens of various kinds of all those studied. Collected at Upper Echo Lake, California, August 11, 1938, August 11, 1939, and August 10, 1946. All these specimens are in the author's collection. Paratypes are to be deposited in the California Academy of Sciences and the U. S. National Museum.

**Literature Cited**


A NEW MYRMECOPHILOUS MILLIPED FROM MEXICO

BY RALPH V. CHAMBERLIN

University of Utah
Salt Lake City, Utah

Specimens of the new polydesmid diplopod described below were received recently from Dr. Alfonso Dampf, Professor of Applied Entomology of the Escuela Nacional de Ciencias Biológicas, Mexico City, D.F. Concerning these millipedes Dr. Dampf writes: "Diplods marching with military precision in a column of migrating ants are not often seen. I collected therefore the 15 specimens which I saw during a half hour's watch in the citrus grove of Sayuila. The ants [a black species of an army ant, identified by Dr. Neal A. Weber as Eciton (Labidus) praedator F. Smith] were traveling up hill in the undulating terrain of the grove in the morning in a fast running stream 4 to 6 individuals deep, some carrying insect remains. The diplopods, plainly visible on account of their white color, were moving slowly, but without any stop, in the center of the column. No ant paid any attention to them. As the ants were running so fast, sooner or later the last of the ants would pass one by one the slow diplopods which have then to follow the same trail by smell in case they were to get to the new nest. Our time was limited and we could not stay longer to see what would happen to these ant pets."

The adult male holotype and allotype, and some of the paratypes are retained by the author, the others being returned to Prof. Dampf.

Yucodesmus dampfi Chamberlin, new species

The dorsum is naturally pale yellow in color, with the venter and legs white or nearly so; but older individuals may appear brown from dirt adherent to the granula and tubercles.

Vertex and frons of head densely granulo-tubercular, elsewhere smooth; antennae with fifth joint large, moderately widening clavately from base to distal end, obviously longer than the fourth and sixth articles together, these two being relatively small.

Horizontal rim of the collum divided into the usual 12 areas by radiating sulci, the margin presenting 12 corresponding, low crenatures; surface granulo-tubercular, the tubercles arranged in two
transverse series, an anterior one across middle composed of six tubercles, and a posterior one composed of four.

The other tergites also granulo-tubercular, the large tubercles being arranged in the usual four rows, with three contiguous tubercles in each row. Keels long in the transverse direction; those on second to fourth segments with three lobes or crenatures, the fifth and succeeding one with four; the poriferous cone projecting about the third lobe. Lobes on 19th keels but weakly indicated. Anal tergite deeply notched at middle of caudal margin and with two lobes on each side toward base.

The gonopods of the male with telopodite as shown in the accompanying figure 1. Its form is distinctive, e.g., in the geniculate lower prong.

Length, about 6 mm.

Fig. 1. Yucodesmus dampfi Chamberlin, n. sp. Right gonopod of male, aspect a little ventrad of caudad.

Locality. Mexico: State of Veracruz, about 30 km. west of the port of Veracruz on the Hacienda Sayula. Fifteen specimens, mostly immature, taken September 24, 1946, by Dr. Alfonso Dampf.

The Hacienda Sayula is situated “in the flat coastal plain probably not more than 5 m. above sea level; swampy grassland with patches of trees and bushes; the specimens were collected in a citrus grove on the northern side of the hill with the administration buildings, at 8 o’clock in the morning, the weather somewhat cloudy, in a stream of army ants which were migrating up hill.”
THE GENUS ERYTHROTHRIPS MOULTON
(Thysanoptera: Orothripini)

BY STANLEY F. BAILEY
University of California, Davis

As new genera in the Aeolothripoidea have been described, various workers (particularly Bagnall, 1913, '24, '26, '30, and '31 and Hood, 1915) periodically have revised upward the subgroups, creating new sub-families and families for a relatively small number of genera. This super-structure seems rather cumbersome considering the small number of species involved, especially when compared with other orders of insects. These higher groups have been separated chiefly on the number of segments in the maxillary palpi as compared with the number in the labial palpi and the number of terminal antennal segments that exhibit, more or less, the lack of free articulation. Treherne (1919), however, separated *Erythrothrips* from related genera on the number of segments in the labial palpi. Priesner's review (1939) of the aeolothripid subfamilies makes use of other characters such as the armature of the fore legs, the sensory areas, and the chaetotaxy of the pronotum which de-emphasizes the above mentioned characters to advantage.

In studying the related genera of aeolothripids one notes a reduction in the number of segments in the maxillary palpi from eight in *Erythrothrips*, seven in *Orothrips*, *Stomatothrips*, and *Desmothrips* to five or six in *Audiothrips*, four in *Eucerathrips*, and three in *Aeolothrips*. In the genus *Erythrothrips* alone, the number of maxillary segments varies from five in *nigripennis* to nine in some individual specimens of *fasciculatus*. If then, for convenience, one draws the line at five maxillary segments, the genera falling into the tribe Orothripini Pr., 1939, are *Allelothrips* Bagn., *Audiothrips* Mlt., *Desmothrips* Hd., *Erythrothrips* Mlt., *Orothrips* Mlt., and *Stomatothrips* Hd.

What appear to be thirty valid species in the Orothripini have been described in these genera and it is now possible to better evaluate the generic characters. A key to these genera is given below.
KEY TO THE GENERA OF OROTHРИPINI PRIESNER, 1939

1. All antennal segments articulated. Antennal segments III and IV each with two similar sensory areas. Fore wings slightly broadened towards tip. .......................... Orothrips Moulton, 1907 (No. America and India)

- Terminal antennal segments more or less shortened and united. Antennal segments III and IV with a single sensory area on each segment ............................................. 2

2. Fore wings markedly constricted in basal third............................... 3

- Fore wings not so constricted..................................................... 4

3. Sensory areas on antennal segments III and IV linear, similar, and parallel with length of segment, that on IV hooked at distal end.................................................. Stomatothrips Hood, 1912

- Sensory areas on antennal segments III and IV sinuately vermiciform, that on IV reaching to the basal third of joint..........................

.................................................. Allelothrips Bagn., 1932

4. Antennal segments V to IX closely united. Sensory areas on antennal segments III and IV not alike; that on segment III long, narrow and parallel with segment, sensory area on segment IV near tip, expanded at distal end and partly encircling segment at an oblique angle.................. Desmothrips Hood, 1915 (Australia)

- Antennal segments VIII and IX short and not clearly articulated. Sensory areas on antennal segments III and IV similar.............. 5

5. Sensory areas on antennal segments III and IV extending full length of segments.................................................. Audiothrips Moulton, 1930 (So. Africa)

- Sensory areas on antennal segments III and IV not extending more than two-thirds the length of the segments and lying in the distal portion.......................... Erythrothrips Moulton, 1911 (No. and So. America and India)

The genus Erythrothrips was described by Moulton in 1911, based on the species arizonae. Since this time eight additional species have been described of which one is from India, three from South America, and one from Mexico. Only three species are known from California (Bailey, 1935, 1937).

A tabulation of all characters of the described species of Erythrothrips was made in this study but, since not all nine species were available for study, especially in series, the key given below is partly based on the descriptions only. The species durango, bishoppi, and stygicus each was based on an unique female. The latter, a South American species, is strikingly distinct with its black wings and antennae. The writer has four female specimens of durango from Texas and its clear yellow third antennal segment readily separated it from the other North
American forms. These specimens were compared with Watson’s type. Moulton’s *bishoppi* is very difficult to separate from *arizonae*. The writer has studied the type of *bishoppi* and found it very difficult to accurately count the number of segments in the maxillary palpi. In comparing the antennae of *arizonae*, *bishoppi*, and *fasciculatus* (see figures 4, 5, and 6) it can be seen that *bishoppi* is between the two in length of segments and size of sensory areas. Until a series of this species is collected, it (the holotype) can best be told from *arizonae* by the shorter head. The types of *arizonae*, *fasciculatus*, and *keeni* also have been examined.

*Erythrothrips*. Antenna of: 1, *nigripennis* (redrawn from Hood 1937a, fig. 1b); 2, *keeni*; 3, *durango*; 4, *arizonae*; 5, *fasciculatus*; 6, *bishoppi*; 7, mature larva of *fasciculatus*. Fore wing of: 8, *keeni*; 9, *durango*. Figure 10, Maxillary palpus of *durango*. Figure 11, front tarsus of *keeni*. Figure 12, dorsum of head of *arizonae*. Scale: Figure 7, line equals 0.1 mm. Figure 8, line equals 0.1 mm. Figures 10 and 11, line equals 0.01 mm.

The males of *arizonae*, *asiaticus*, (see Ayyar, 1934, page 3), *fasciculatus*, *keeni*, and *costalis* only are known. Species differentiation in this sex is readily made on the basis of the chaetotaxy of the terminal abdominal segments.

**Erythrothrips** Moulton, 1911

Head (figure 12) usually longer than wide, cheeks arched. Ocelli present. Postocular and interocular bristles nearly always weak.
Compound eyes rounded dorsally and produced in an angular manner ventrally. Antennae nine-segmented with the last two segments closely joined and their length together less than segment VII. One sensory area on segments III and IV (see figures 1-6). Maxillary palpi geniculate (figure 10), the basal segment usually as long as remaining four to seven segments. Labial palpi four-segmented. Mouth cone blunt and not projecting beyond posterior margin of prothorax. Prothorax small, about as long as wide and but little shorter than head, with all setae small. Legs slender, fore femora thickened. Fore tarsi with finger-like hook (figure 11). Wings (figures 8 and 9) large, bluntly rounded with typical aeolothripid venation. Abdomen in female robust, terminal segments long and abruptly pointed. Ovipositor upturned. Male much smaller than female; sensory areas on antennal segments smaller and abdomen very slender.

Genotype: *E. arizonae* Moulton, 1911 by monotypy.

The larva of *E. arizonae* was illustrated by Moulton (1911, Plate I, fig. 7) and described briefly (page 36) as follows—

"The larva of this species is uniformly light brownish-yellow and has conspicuous red pigment bands across the dorsal plates of mesothoracic and metathoracic segments and all segments of abdomen." The larva of *E. fasciculatus* is very similar in coloration and appearance. For comparison with the adult, we have illustrated the antenna of a mature larva (figure 7). The larvae of the other species are unknown.

**Key to the Species of Erythrothrips**

1. (2) Fore wings uniformly dark blackish brown..........................2
   - Fore wings with posterior half with blackish brown longitudinal band ..........3
2. (1) Third antennal segment black..........................*stygicus* Hood, 1938
   - Third antennal segment golden yellow..........................*nigripennis* Hood, 1937
3. (1) Fore wings with dark band along distal two-thirds of posterior margin only (scale black) (figure 8)......*keeni* Moulton, 1929
   (see also Moulton, 1927)
   - Fore wings with dark band extending the entire length of posterior margin (figure 9)..................................................4
4. (3) Segment III of antenna light yellow..........................5
   - Segment III of antenna bicolorous, yellow at base and shading to dark brown in outer portion.............................................6
5. (4) All tibiae and tarsi lemon yellow in color..........................*asiaticus* A. and M. 1930-1931
   - All tibiae and tarsi dark brown..........................*durango* Watson, 1923
6. (4) Segment III of antenna very long (200 microns). Distal three-fifths of segment II yellow..........................*costalis* Hood, 1937
   - Segment III of antenna much shorter. Segment II uniformly dark brown ..........7
7. (6) Sensory area on antennal segment III very short (about 16 microns) and often oval (figure 5) ....fasciculatus Moulton, 1929 (see also Moulton, 1927)
Sensory area on antennal segment III extending at least one-third the length of segment, narrow and often curved..............8
8. (7) Head longer than wide. Sensory area on antennal segment III about 60 microns (figure 4). Maxillary palpi 8-segmented.
...........................................................................arizonae Moulton, 1911
Head about as long as wide. Sensory area on antennal segment III about 33 microns (figure 6) ..............bishoppi Moulton, 1929

Large or wide-spread collections of Erythronthrips have not been reported. This is probably not because of their scarcity but because of their limited hosts, their appearance for a short seasonal period in the blossoms, and occurrence almost entirely at high altitudes. There is only one generation a year (Bailey, 1940) at least in the case of the species found in California. This is similar to nearly all other aeolothripids in this region. The life history of none of the Erythrothrips species has been previously reported. The details of the life history of E. fasciculatus Moulton only, are known to the writer, but this species is doubtless typical of the majority of the members of the genus.

The adults emerge from the soil beneath the host plant as it comes into bloom in late spring or early summer. The eggs are inserted into the flower parts and green stems and the larvae hatch about the time the petals fall. There are two larval instars and this stage develops in about 10 days. When mature, the larvae drop to the ground beneath the host, penetrate the soil, crawl down among rocks, leaf debris, etc. and, when a suitable niche is found they spin a cocoon (Bailey, 1940). The time of the year at which they transform to pupae is not known but is doubtless in the fall.

During their period of life on the host plants, the California species, at least, are extremely active in both the larval and adult stages. These thrips appear to be plant feeders although they may be predacious on occasion (Treherne, 1921) and are limited to a very small number of hosts, usually one preferred host being indicated in a locality. None of the principal hosts are crops.

The distribution of the genus, with the exception of E. asiaticus A. and M., is limited at present to the Pacific Coast, the southwest, Mexico, and Peru. Further collecting will almost certainly extend this genus to the mountainous areas of Canada, Central America, and other western states of the United States.
Catalog of the Species of Erythrophilus Moulton, 1911


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1937a. Studies in Neotropical Thysanoptera IV. Rev. de Ent. 7(2-3):255-257. Fig. 1, a-b. July. Rio de Janeiro, Brazil.
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A NEW GENUS USANUS AND NEW SPECIES OF MEXICAN LEAFHOPPER RELATED TO CHLOROTETTIX

BY DWIGHT M. DeLONG

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A bizarre species of leafhopper from the standpoint of both the color pattern and unique genitalia has been collected in Mexico at Iguala. A new genus and species is being erected to accomodate this insect.

Genus Usanus DeLong, new genus

In form resembling a broad headed Chlorotettix. The vertex is short, broadly rounded and broadly rounding to the front. The venation of the elytra is simple and reduced. There are no costal veinlets. The cross vein forming the first apical cell is just anterior to the cross vein forming the second apical cell. The third apical cross vein is more anterior than either of the others. The clypeus is broader at the apex than at the base.

Usanus stonei DeLong, new species

A broad blunt headed species with a pair of oblique black dashes on the margin and a pair of large round black spots on the pronotum. Length, 6 mm.

Vertex short and broad and broadly rounded between the eyes; more than four times as wide between eyes as median length; broadly rounded to the front. Pronotum almost four times as long as vertex.

Color: Vertex cream with a pair of heavy oblique black marks extending over margin to just above apex and enlarged where they converge at the median line just above apex. A small black spot on the base next each eye. Pronotum gray with a large round black spot about the middle each side on the posterior portion of the disc. Scutellum brownish anterior to median impressed line; white on posterior portion. Elytra whitish subhyaline; veins black.

Genitalia: Male plates elongate, triangular, apices narrow but blunt. Style elongate, tapered, apical half narrow, curved inwardly and basally at apex. Aedeagus rather robust with a basal dorsally directed process. At the apex there is a broad quadrature process which bears a rather long finger-like dorsally directed spine both anteriorly and posteriorly on each side.
Holotype, male, and male paratypes collected at Iguala, Gro., Oct. 22, 1941 (K. 188, Mexico City, Acapulco Road) by E. E. Good and D. M. DeLong.

Usanus stonei DeLong, n. sp. Fig. 1, dorsal view of head, pronotum and scutellum; Fig. 2, ventral view of male genitalia; Fig. 3, lateral view of male genitalia.

A NEW SPEYERIA FROM WASHINGTON

BY F. H. CHERMOCK AND D. P. FRECHIN

Butler, Penn., and Bremerton, Wash.

Speyeria cybele pugetensis Chermock and Frechin, new race

Mean expanse of series, 70-80 mm. Average, 75 mm.
Both sexes resemble leto (Behr.), (Proc. Cal. Acad. Nat. Sci., vol 2, pp. 172-177), but are at once separable by several diagnos-
tic characters. Above, *pugetensis* is noticeably melanic. The males show an accentuated bold dark pattern, especially noticeable in the dark marginal markings. The basal and discal areas show a heavy suffusion of very dark fuscous, often completely obliterating the discal black pattern. The same areas under surface are also correspondingly much darker than normal *leto*. The brown marginal bands of the under surface are accentuated and unbroken. This results in a noticeable reduction in the width of the dull yellow belt of the secondary. The submarginal crescents are usually imperfectly formed and reduced in size, with less silvering than in the general run of *leto*. The secondary belt is seldom straw yellow, and is usually overcast with light brown scaling.

The females also show all dark markings accented, with these markings intense black. *Pugetensis* never exhibits the brownish-black washed-out appearance demonstrated by *leto* and *letona*. On the upper surface the basal and discal areas are so completely suffused with black fuscous that the normal *leto* pattern is completely obliterated. An occasional example shows the yellow bar in the cell of the fore wing. The under surface shows the diagnostic pattern of the male, with the brown markings replaced by black to brownish-black. The submarginal lunules are usually well-formed and distinct.

Holotype, male, July 12, 1945, STIMSON CREEK, NEAR BELFAIR, MASON COUNTY, WASH. Allotype, female, August 4, 1945, STIMSON CREEK, NEAR BELFAIR, MASON COUNTY, WASH. Paratypes 1-390, various localities in Mason, Kitsap, Thurston and Clallam counties, Wash. Paratypes 391-400, Portland and McMinnville, Oregon.

The holotype, allotype, and paratypes will be deposited in the collection of the American Museum of Natural History. Paratypes will also be distributed to other museums, specialists, and private collections.

*Pugetensis* represents a *leto* dispersal to the extreme Northwest, culminating in this large, melanic population, indicative of the humid environment. East of the Cascade Crest, *leto* is again found in near typical form, but showing a slight tendency towards *letona* dos Passos and Grey (Am. Mus. Nov., No. 1297, 1945). In extreme northeastern Washington, the junior author has taken examples of *letona* that match topotypes nicely.

We wish to acknowledge the aid of Mr. L. P. Grey, who kindly compared our material with the types of *letona* and topotypes of the other western races of *cybele*. 
TAXONOMY OF THE LARVAE OF SOME NORTH AMERICAN NOVIINI
(Coleoptera, Coccinellidae)

BY BRYANT E. REES*
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Of the numerous species of Coccinellidae named and described, *Rodolia cardinalis* (Mulsant) has received a major portion of publicity. The quantity of literature regarding this species is great, but too little deals with the morphology and taxonomy of its larva in relation to the larvae of closely related species. Although a comprehensive study of the approximately 55 known species of the tribe Noviini is desirable, owing to the lack of study material this paper deals only with the larvae of the species occurring in America north of Mexico.

As proposed by previous authors and now accepted, *Exoplectra subaenescens* Gorham is placed in the Exoplectrini, and *Novius koebelei* Coquillett is transferred to the genus *Rodolia*. Such being the case, the tribe Noviini is represented in North America principally by two genera: *Rodolia*, through the introduction of *R. cardinalis* and *R. koebelei* into California from Australia, and *Anovia*, native to the south-western states and represented by its single species, *A. virginalis* (Wickham). Another mono-basic genus of the tribe is represented in Mexico by *Vedalia seiboldi* Mulsant.

The larvae of *Rodolia cardinalis* and *R. koebelei* were described by Coquillett in 1889 and 1893, respectively. Following this author, others have redescribed the larva of *R. cardinalis*, but the descriptions are inadequate for practical taxonomic purposes. It seems desirable, then, to redescribe and compare the larvae of the species in question and to formulate a key by means of which they may be distinguished. The descriptions herein given are based upon larvae taken with associated adults or upon reared material. The identifications of the adults were made or verified by E. A. Chapin, United States National Museum, Washington, D. C.

*Formerly with the Bureau of Entomology and Plant Quarantine where this work was done.
Since the larvae of the Coccinellidae exhibit a great variation in structure, some of them may be confused with the few chrysomelid larvae they closely resemble. They may be distinguished, however, from the chrysomelid and other larvae by the possession of various characters. In the larvae of the Coccinellidae the head always possesses three ocelli on each side and usually a depression located anteriorly on each frontal suture. The mandible is broad at its base, narrowed distally, usually with simple or bidentate apex, and generally possessing a distinct retinaculum. If the mandible is multidentate and bears a retinaculum, the teeth are small; if the mandible is multidentate and without a retinaculum, the teeth are large and digitiform. The stipes is fused with its corresponding cardo, and the hypopharyngeal bridge is present.

**Tribe Noviini Ganglbauer**

The tribe Noviini, as here interpreted, is based on the study of the three North American species and *Rodolia bellus* Blackburn from Australia. Its members may be distinguished from other coccinellid larvae by the fusion of the cardines, submentum and mental area into a solid, sclerotized and pigmented structure possessing a slender anterior extension on each side. The extensions pass anteriorly and laterally about the labial palpi and then converge in the buccal area. The entire structure assumes the appearance of an egg cup in which are encompassed the labial palpi. (See fig. 8.)

The close similarity of the larvae of the four species permits a further characterization of the tribe and general description applicable to all.

Body (fig. 5) ovoid, with greatest width at second and third abdominal segments; strongly convex dorsally, slightly convex ventrally; abdomen in general view with longitudinal series of strumae; pleura protuberant. Pronotum trapezoidal, lateral and anterior margins rounded, sparsely setiferous and with chalazae, setae of chalazae long, pale yellow; tergite longitudinally divided by broad, semi-membranous, non-pigmented line, with dark area immediately on each side of midline, densely asperate and with each postero-lateral angle elevated into struma. Mesonotum and metanotum each

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1*Chalaza*, a distinct, frequently slight, pimplelike projection of the body wall bearing a seta. *Struma*, a distinct, moundlike projection of the body wall upon which are situated a few chalazae.
incompletely divided transversely by shallow depression; tergites distinct, small, situated dorsolaterally, asperate and with setae and chalazae; mesopleura and metapleura each with small anterior and large posterior struma. Abdominal segments 1-8 each with intersegmental pore, a dorsal, dorsolateral, and lateral struma on each side; pleura protuberant; ninth abdominal segment semicircular, broader than long, setiferous and with chalazae. Body membrane and sclerites, including strumae, with seta-like asperites. Legs well developed, slender, sclerotized and darkly pigmented; coxae of corresponding legs widely separated; tibia slightly longer than femur, with distinct, setiferous, semimembranous and non-pigmented, ventral surface or “sole”; terminal setae of tibia abruptly enlarged distally; claw gradually and evenly curved, base simple, broad.

Head small, pigmented, transversely subrectangular; epicranial suture lacking; frontal sutures indicated posteriorly by broad, non-pigmented, straight lines, indistinct and obsolete anteriorly; sutural fossae of head distinct, linear; head adorned with few long setae, principally about ocelli. Labrum, when viewed from above, subrectangular, broader than long, posterior and lateral marginal areas darkly pigmented, mesal and anterior areas non-pigmented and semimembranous. Antenna composed of one or two segments, if two-segmented, second segment small. Mandible apically simple, base enlarged, retinaculum present. Maxillary palpus two-segmented and with distinct, sclerotized and pigmented, narrow palpifer; first segment prominent, large, broader than long; second segment small, about one-half length and diameter of first. Mala bluntly subconical, proximally sclerotized and pigmented, distally non-pigmented and membranous. Labial palpus two-segmented, second segment longer but of less diameter than first. Premental sclerite lacking.

**Key to Genera and Species**

1. Antenna composed of two segments; second segment small, short and broad (fig. 3) ...................................................... *Rodolia* .. 2

   - Antenna composed of a single segment (fig. 1) ..............................

   .......................................................... *Anovia virginalis* (Wickham)

2. Lateral strumae of abdominal segments 1-8 each with two chalazae of which the setae are conspicuous and long (fig. 6); head capsule without asperities .......... *R. cardinalis* (Mulsant)

   - Lateral strumae of abdominal segments 1-8 each with four chalazae of which the setae are conspicuous and long (fig. 4); head capsule with few short, spine-like asperities immediately lateral to each frontal suture .......... *R. koebelei* (Coquillett)

**Genus Rodolia Mulsant**

The genus *Rodolia* is represented in this study by *R. cardinalis* and *R. koebelei*, but a third species, *R. bellus*, although
not included in this treatment of the genus, has been studied. If the larvae of these species are typical of the genus, the following characters may be considered applicable:

Antenna composed of two segments; first segment large, with stout, colorless, acute, sensory process on ventral terminal area and small second segment on dorsal terminal area; second segment about one-third or less size of first, terminally with slender, acute sensory process and several minute, acute, sensory papillae. Body with fine, seta-like asperities, asperities of membrane finer than of sclerites, those of membrane fine to extremely fine, sometimes lacking in dorsal areas. Strumae asperate and setiferous.

**Rodolia cardinalis (Mulsant)**

Body sparsely setiferous, setae short; membrane and sclerites, including strumae, densely covered with fine, seta-like asperities and few fine, pale yellow setae (fig. 2). Pronotum with chalazae and fine setae; each posterolateral angle with three chalazae of which the setae are about three-fourths as long or as long as pronotum; mesothoracic and metathoracic tergites sparsely setiferous, each with single mesal and two lateral chalazae the setae of which are stout, stiff, and brown. Anterior struma of each mesopleurum and metapleurum with fine, pale, short setae and single chalaza with long, brownish-yellow seta; each posterior struma setiferous and with two chalazae, one anterodorsal to other, setae of chalazae about as long or longer than segment. Dorsal and dorsolateral strumae of abdominal segments 1-8 darkly pigmented, each with fine, brownish-yellow setae and single prominent chalaza with stout, stiff, brown seta, seta about one-third length of segment (fig. 9); each lateral struma of abdominal segments 1-8 bearing two chalazae (fig. 6), one anterodorsal to other, setae of chalazae one and one-half to two times length of segment, seta of anterodorsal chalaza one-half to three-fourths length of other, longer on posterior segments. Head uniformly pigmented, smooth, sparsely setiferous.

**Material studied:** Numerous specimens from California, Louisiana, and Mexico.

**Rodolia koebelii (Coquillet)**

Body with few, fine, pale yellow setae; membrane and sclerites, including strumae, very densely covered with fine, seta-like asperities, asperities of sclerites slightly coarser than of membrane. Pronotum with chalazae and fine setae; each posterolateral angle with three chalazae of which the setae are about as long as pronotum; mesothoracic and metathoracic tergites sparsely setiferous, each with single mesal and two lateral chalazae of which the setae are slender, slightly curved, brownish-yellow, prominent. Anterior
struma of each mesopleurum and metapleurum with fine, pale setae and single chalaza with long, pale yellow seta; posterior strumae each similarly setiferous and with four chalazae, one situated anteriorly, one posteriorly, one dorsally, and one ventrally, setae of chalazae about one and one-half times as long as segment, anterior seta shortest of four. Dorsal and dorsolateral strumae of abdominal segments 1-8 darkly pigmented, each with fine, pale setae and chalazae of various sizes of which the seta of one is long, brownish-yellow and about one-third as long as segment (fig. 7); each lateral struma of abdominal segments 1-8 bearing four chalazae (fig. 4), two horizontally and two vertically situated, setae of chalazae about one and one-half times length of segment, seta of anterior chalaza shortest of four, progressively longer to subequal on posterior segments. Head uniformly pigmented, setiferous, with small spine-like asperities lateral to each frontal suture.

Material studied: One specimen from California; three from Brisbane, Australia.

**Genus Anovia Casey**

The genus *Anovia* is represented by its single species, *A. virginalis* (Wickham). It is listed as occurring in Utah and Texas, but it has been taken in other southwestern states.

*A. virginalis* larvae can be distinguished from members of *Rodolia* principally by the number of antennal segments. In this species the antenna (fig. 1) is composed of a single segment as compared with the two-segmented antenna found in the species of *Rodolia*. Terminally, it possesses a stout, acute, colorless, sensory process, a similar but shorter sensory process, and several minute, acute, sensory papillae, The short, slender process appears to be homologous with that possessed by the small, second antennal segment of the *Rodolia*.

**Anovia virginalis (Wickham)**

Body sparsely setiferous, setae pale yellow; membrane and sclerites, including strumae, uniformly covered with fairly coarse, setalike asperities, asperities separated by a distance approximately one-half to three-fourths length of one of the asperities. Pronotum with chalazae and setae, each posterolateral angle with two chalazae, setae of chalazae longer than surrounding setae. Mesothoracic and metathoracic tergites sparsely setiferous, setae of various sizes, each tergite with one mesal and two lateral chalazae each with long, brownish-yellow seta. Anterior struma of each mesopleurum and metapleurum with setae of various sizes and single chalaza with long seta; posterior struma similarly setiferous,
with two chalazae, one anterodorsal to other, setae of chalazae long and prominent. Dorsal and dorsolateral strumae of abdominal segments 1-8 pigmented, each with fine, pale setae and chalazae of various sizes, seta of one prominent, brownish-yellow, about one-third as long as segment (see fig. 7); each lateral struma of abdominal segments 1-8 with chalazae of various sizes of which the setae of two are conspicuous, each about as long as segment or slightly longer. Head setiferous, uniformly pigmented, with few, small, spine-like asperities lateral to each frontal suture.

Material studied: Five specimens from New Mexico.

REFERENCES


A NEW SUBSPECIES OF BUTTERFLY

BY DON B. STALLINGS AND J. R. TURNER

Caldwell, Kansas

While collecting in the vicinity of Folsom in northeast New Mexico, we took a series of a new subspecies of Strymon ontario which we describe in this paper. Collecting in this area was of particular interest because nearly all of the species of butterflies that we collected showed basic subspecific differences*, most of which (in our opinion) have not developed sufficiently to merit names at this time.

Strymon ontario violae Stallings and Turner, new subspecies

Resembles Strymon ontario autolycus on the upper surfaces except that the ground color is a dark gray-brown rather than a red-brown. On the upper surfaces of the fore wings the males have four fulvous (orange) spots, while the females have two such spots. The hind wings in both sexes have two (sometimes three) restricted fulvous spots in the anal area. The fulvous spots in both sexes are of a more yellowish color than the fulvous in autolycus and the fulvous in viola has a tendency to be faded on the inner side of the spot.

*It being our opinion that one of the basic characters of valid subspecies of Lepidoptera on continental areas is change of ground color.
The males have one short stubby tail tipped with white. The females have two tails tipped with white, the second (top) tail being so short that it hardly merits the title. The tails of violae are less developed than in either autolycus or ilivia.

On the under surfaces the markings of violae are similar to autolycus. It is the ground color that is distinctive, in that it is gray-black rather than the reddish-brown to black of autolycus and ontario. At certain angles it appears silvery-gray which was the reason that we first confused specimens in flight with Strymon melinus. The gray in the ground color is more dominant in the females.

Violae averages about the same size as autolycus and is slightly larger than ilivia. The shape of the hind wing is like autolycus in not having the sharp outer angle like ilivia.

In some respects violae appears to be an intergrade between autolycus and ilivia but the difference in ground color (ilivia has a light ground color but it shows the reddish influence of autolycus) establishes it as a separate subspecies.

Size: male, expanse 25 mm.; female, expanse 28 mm.

Holotype: Male. Folsom, N. Mexico June 15, 1946. Elevation 5600 ft. Allotype: Female. Same data. Paratypes: 10 males, 12 females, same data, except one female caught at 5700 ft. Type series collected by Mr. and Mrs. Don B. Stallings and sons, Dee and Jack. Named for Viola N. Stallings, wife and sister of the authors, who caught the first specimen. The holotype and allotype will be retained in our collection for the time being. Paratypes will be distributed to various museums and private collections.

For the present the range of this subspecies can only be guessed at. However, it is evident that it does not extend east as far as Shamrock, Texas, where we have collected specimens of autolycus. Nor can it be expected as far south as Globe, Arizona, where we have collected ilivia.

We have compared these New Mexico specimens with a series of Strymon ontario ilivia collected near Globe, Ariz., at 5700 feet and with specimens of typical ontario and the subspecies autolycus in our collection from: Lancaster, Mineral Wells, Shamrock, Hondo and Palo Pinto, Texas; Cache and Tulsa, Okla.; Eureka and Caldwell, Kansas; St. Louis, Mo.; Quitman, Ark.; Marquette, Ill.; Augusta, Ga.

Our New Mexico specimens were collected in association with Strymon melinus and at first we were unable to distinguish the two while in flight.
STUDIES ON NORTH AMERICAN MORDELLIDAE, V
(Coleoptera)

BY EUGENE RAY
Chicago, Illinois

This is the fifth of a series of papers dealing with North American members of the family. Two species are described from Arizona, two from Oregon (one also from Kansas), and one each from Tennessee, Michigan and Florida. Notes have been added for ten previously known forms.

Mordella quadripunctata (Say)

One specimen: Methow, Washington, May 3, 1941, on rose buds (M. H. Hatch). This is the first West Coast record for this Eastern species. Previous records indicated its distribution from New York west to Colorado and Manitoba.

Mordellistena wenzeli Liljeblad

One specimen: Charleston, South Carolina, May 2, 1945, in light trap (R. L. Wenzel). This species has hitherto been known only from Tybee Island, Georgia.

Mordellistena fenderi Ray, new species
(Figs. 1, 15)

Form elongate, moderately narrow, sides subparallel along basal two-thirds of elytra, derm black, front, maxillary palpi, four basal segments of antennae, basal angles of pronotum, a broad humeral vitta that narrows abruptly and ends before middle, legs (except posterior femora) and apical margins of abdominal segments, castaneous, anal style and hypopygium fuscous. Body densely covered with fine, recumbent, flavocinereous pubescence.

Eyes densely covered with short, fine, erect hairs. Antennae slender, filiform, 1.45 mm. long, reaching to base of abdomen, segments 1-2 robust, equal; 3 as long as 2, but much narrower; 4 one-half longer and distinctly broader than 3; 5-10 each as long as 4 but

broader, sides parallel; 11 oval, one-half longer than 10, sides and apex rounded. Terminal segment of maxillary palpi enlarged, form of a rather broad scalene triangle, inner margin but slightly longer than apical edge, sides and angles rounded.

Pronotum distinctly broader than long (1.16 x .95 mm.), anterior margin and sides rounded, broadest before base, the latter arcuate, midbasal lobe moderately long, rounded. Scutellum small, broad, triangular, rounded at tip.

Elytra more than two and one-half times as long as broad (2.7 x 1 mm.), narrower at base than pronotum, sides subparallel on basal two-thirds, thence broadly rounded to apex, apices individually rounded. Anterior and intermediate tibiae about as long as their tarsi, penultimate segment of the latter slightly broadened. Posterior tibiae with two equal, oblique, parallel ridges (excluding subapical one), each extending half way across outer face; basitarsi with two, second segment with one ridge, all near apex and strongly indicated. Anal style slender, a slight constriction before middle, attenuate to apex, two and one-third times as long as hypopygium (1.15 x .5 mm.).

Length: to apices of elytra, 3.65 mm.; to tip of anal style, 4.8 mm.

Holotype, male, Peavine Ridge near McMinnville, Oregon, August 6, 1945, and allotype, female, type locality, July 29, 1945 (K. M. Fender); holotype in collection of Eugene Ray, allotype in collection of Kenneth M. Fender, to whom this species has been dedicated.

This species is allied to the eastern limbalis (Melsheimer) but may be separated adequately by its different antennae, in which the fourth segment is one-half longer than the third, the

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Fig. 1, Antenna of Mordellistena fenderi Ray. Fig. 2, Antenna of Mordellistena malkini Ray. Fig. 3, Antenna of Mordellistena arizonensis Ray. Fig. 4, Antenna of Mordellistena suturalis Ray. Fig. 5, Antenna of Mordellistena pilosella Ray. Fig. 6, Antenna of Mordellistena bihirsuta Ray. Fig. 7, Antenna of Mordellistena y-notata Ray. Fig. 8, Pronotum of Mordellistena y-notata Ray. Fig. 9, Maxillary palpus of Mordellistena y-notata Ray. Fig. 10, Maxillary palpus of Mordellistena bihirsuta Ray. Fig. 11, Maxillary palpus of Mordellistena pilosella Ray. Fig. 12, Maxillary palpus of Mordellistena arizonensis Ray. Fig. 13, Maxillary palpus of Mordellistena suturalis Ray. Fig. 14, Maxillary palpus of Mordellistena malkini Ray. Fig. 15, Maxillary palpus of Mordellistena fenderi Ray.
fourth to tenth being equal in length, with no noticeable narrowing distally, by the triangular terminal segment of the maxillary palpi (in limbalis this segment is boat-shaped) and by the difference in the color of the pronotum.

The frontal spot of the male is absent in the female. In the latter sex the broad humeral vitta darkens gradually and ends about one-third from the tip of the elytra.
Mordellistena suturalis Ray, new species
(Figs. 4, 13)

Form, narrow, elongate, sides narrowing, but slightly cuneate. Derm fuscous or fusco-piceous, head fuscous in male with apical half of front fusco-brunneous, entirely fusco-brunneous in female with a dorsal cloud on vertex; maxillary palpi fusco-brunneous, antennae varying from fusco-brunneous at base to fusco-piceous at apex; pronotum fuscous in male, fuscous in female with basal margins and angles fusco-brunneous, the angles broadly so; elytra fuscous in male, fuscous in female with a broad fusco-brunneous vitta covering base, except narrowly along suture and margins and abruptly narrowing one-fourth from base, extending therefrom in a narrow sub-sutural line to within one-fifth of apex; anterior legs fusco-brunneous in male, legs completely fusco-brunneous in female except for the posterior femora, which are fuscous. Surface densely covered with fine, recumbent pubescence, partaking of ground color, except on light parts, where it is golden.

Head strongly convex, eyes entire, densely covered with short, erect hairs. Antennae 1.06-1.43 mm. long, reaching base of pronotum; segment 4 twice as long as 3 in male, one-half longer in female, and one-half broader in both sexes; 5-10 each slightly broader than 4, but slightly shorter; 11 equal in length to 10, broadest subapically, sides and apex rounded. Terminal segment of maxillary palpi enlarged, form of a scalene triangle, apical edge rounded, intermediate in length between the inner and outer sides.

Pronotum convex, distinctly broader than long (1.06-1.36 x .94-1.21 mm.), apex and sides rounded, basal angles obtuse, base arcuate, midbasal lobe broad, short, but rounded. Scutellum broad, triangular, sides and apex rounded.

Elytra two and-one-third times as long as broad (2.49-3.25 x 1.06-1.36 mm.), sides subcuneate to within one-fifth of apex, thence strongly curved, apices individually rounded. Anterior and intermediate tarsi equal in length to their tibiae. Posterior tibiae with two equal, oblique ridges, each extending across almost one-half width of outer face; basitarsi with three ridges, second segment with two. Anal style slender, acuminate to apex, three times length of hypopygium in male (1.17 x .38 mm.), three and one-half times length of hypopygium in female (1.47 x .42 mm.).

Length: to apices of elytra, 3.43-4.46 mm.; to tip of anal style, 4.64-5.93 mm.

Holotype, male, allotype, female, and two paratypes, both males, GREAT SMOKY MOUNTAINS NATIONAL PARK, GATLINBURG, TENNESSEE, June 13-19, 1942 (H. S. Dybas); holotype and allotype in the collection of Eugene Ray, paratypes in the collection of the Chicago Natural History Museum.
This species is allied to *egregia* Liljeblad³ and may be separated by the broad basal vitta of the elytra, which abruptly narrows one-fourth from base and extends in a narrow sub-sutural line almost to apex, by the shorter antennae with the fourth segment slightly longer than the fifth, by the uniformly fuscopicose color of the ventral surface, by the shorter, broader maxillary palpi, by the longer, narrower posterior tibiae and by the broader form. Comparisons have been made with the types of *egregia*, as well as with *argenteola* Liljeblad⁴ and *syntaenia* Liljeblad⁵, with which this species is also allied.

**Mordellistena bihirsuta** Ray, new species

(Figs. 6, 10)

Form moderately slender, narrow, sides subparallel on basal half of elytra, derm black, four basal segments of antennae fuscobrunneous, front, mouthparts, anterior legs and middle femora castaneous to fuscous. Body densely covered with fine, recumbent pubescence, sericeocinereous, except on pronotum and elytra, where it is flavocinereous, with the elytral suture and apex broadly and the apical half of lateral margin narrowly covered with dark pubescence that appears to be purple in certain lights.

Eyes densely covered with short, fine, erect hairs. Antennae 1.1 mm. long, extending to base of pronotum, segments 1-2 robust, equal; 3 distinctly longer but narrower than 4; 5-10 each longer than 3 and one-half broader, subserrate; 11 slightly longer than 10, oval, sides and apex rounded. Terminal segment of maxillary palpi enlarged, form of a moderately elongate scalene triangle, distinctly longer than broad, inner and apical margins straight, angles rounded.

Pronotum one-half broader than long (1.26 x .8 mm.), anterior margin and sides broadly rounded, base arcuate, midbasal lobe moderately produced, broad, rounded. Scutellum small, broad, triangular, broadly rounded at tip.

Elytra short, slightly more than twice as long as broad (2.7 x 1.16 mm.), narrower at base than pronotum, broadest at base, sides subparallel on basal half, thence curved to apex, apices individually rounded. Anterior and intermediate tibiae shorter than their tarsi, the latter filiform, penultimate segment shortest. Posterior tibiae with two equal, oblique, parallel ridges (excluding subapical one), each short, extending no more than one-third distance across outer face; basitarsi with three, second segment with two short ridges. Anal style short, robust, attenuate to apex, but twice length of hypopygium (1.16 x .58 mm.).

Length: to apices of elytra, 3.5 mm.; to tip of anal style, 4.66 mm.

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Holotype, male, Malheur Lake, Oregon, June 10, 1940 (K. M. Fender); allotype, female, Boardman, Oregon, June 26, 1941 (K. M. Fender); two paratypes, Othello, Washington, June 18, 1932 (M. H. Hatch); one paratype, Topeka, Kansas, June 10, 1941 (H. S. Dybas); holotype in the collection of Eugene Ray; allotype in the collection of Kenneth M. Fender; paratypes in the collection of the Chicago Natural History Museum, Melville H. Hatch and Eugene Ray. This species is closest to *syntaenia* Liljeblad⁶ and has been compared with the type of the latter. It differs in its broader form, in the broad, laterally placed yellowish vitta on the elytra, which in *syntaenia* is double and medially placed on each elytron, by the antennae, which have the third segment longer than the fourth, and by the shorter anal style.

*Mordellistena arizonensis* Ray, new species (Figs. 3, 12)

Form narrow, elongate, sides subparallel to middle of elytra. Derm black, except for a narrow, rufocastaneous line along caudal margins of abdominal segments, clypeus, labrum and mesal half of mandibles rufocastaneous. Surface densely covered with fine, recumbent pubescence, partaking of ground color, except for the following whitish areas: head, pronotum, scutellum, base and basal fifth of elytral margins broadly, single scattered hairs elsewhere on disc, meso- and metasternum and basal halves of abdominal segments.

Head strongly convex, but little narrower than pronotum; eyes entire, densely covered with fine, erect hairs. Antennae short, robust, 1.1 mm. long, extending only to basal third of pronotum; segments 1-2 large, equal; 3-4 equal in length, 4 distinctly broader than 3; 5-10 each one-third longer and broader than 4, subserrate, each broadest subapically, mesal edges rounded, lateral edges straight; 11 distinctly longer than 10, sides straight, angles obtuse. Terminal segment of maxillary palpi enlarged, form of a broad scalene triangle, apical edge shortest, lateral margin almost straight, angles rounded.

Pronotum moderately rounded, distinctly broader than long (1.21 x 1.02 mm.), completely and finely margined, apex, sides and basal angles rounded, the latter obtuse, base arcuate, midbasal lobe short, broad, rounded. Scutellum moderately large, broadly triangular, sides and apex rounded.

Elytra narrow, elongate, two and one-half times as long as broad

(3.02 x 1.21 mm.), sides subparallel on basal half, thence strongly curved caudad, apices individually rounded. Anterior and intermediate tarsi filiform, as long as their tibiae, penultimate segment shortest. Posterior tibiae with two short, oblique, equal, parallel ridges near the tip (excluding subapical one); basitarsi with four oblique ridges, second segment with two. Anal style but twice length of hypopygium (1.17 x .64 mm.), robust, acuminate to apex, the latter truncate.

Length: to apices of elytra, 4.04 mm.; to tip of anal style, 5.21 mm.

Holotype, female, Huachuca Mountains, Arizona, August 18, 1938 (J. N. Knall); in the collection of Ohio State University.

This species is allied to both pullata Liljeblad⁶ and nigella Liljeblad⁷. Comparison with the types of these two species reveals the following differences: a larger size, broader form, broader terminal segment of the maxillary palpi, the whitish color of the body pubescence, particularly on the meso- and metasternum and basal margins of the abdominal segments, the bicolored elytral pubescence with single, shining, whitish hairs among others of dermal color, except along base and basal half of lateral margins, where they are more numerous but not dense enough to be considered a fascia, and the shorter antennae, which reach only to basal third of pronotum.

**Mordellistena egregia** Liljeblad


One specimen: Seaview, Washington, July 25, 1932. This species was described from two specimens taken in Mariposa County, California.

**Mordellistena pilosella** Ray, new species

(Figs. 5, 11)

Form narrow, linear, sides subparallel. Derm black; labrum, palpi, anterior and intermediate legs and six basal segments of antennae flavocastaneous, intermediate femora and tibiae darker, antennal segments seven to eleven fuscous. Surface covered with fine, recumbent pubescence, sericeocinereous everywhere, except on light areas, where it has a yellowish tinge.

Head strongly convex, almost as broad as the pronotum, eyes entire, densely covered with fine, erect hairs. Antennae 1.51 mm.

long, reaching beyond base of pronotum; segments 1-2 large, equal; 3-4 short, equal; 5-10 equal, each two-thirds longer and slightly broader than 4, not, however, serrate, but slightly broadened to apex; 11 one-half longer than 10, flattened, broadest at apical third, sides and corners rounded. Terminal segment of maxillary palpi enlarged, moderately robust, with the form of a scalene triangle, apical edge distinctly longer than inner margin, sides and angles rounded.

Pronotum convex, slightly broader than long (.72 x .68 mm.), completely and finely margined, apex and sides rounded, basal angles obtuse, base arcuate, midbasal lobe broad, short, truncate. Scutellum large, triangular, sides rounded, apical angle broadly so.

Elytra narrow, elongate, two and seven-tenths times as long as broad (1.96 x .72 mm.), sides subparallel to within a fourth of apex, thence strongly curved, apices individually rounded. Anterior and intermediate tarsi distinctly longer than their tibiae, subfiliform, penultimate segment slightly broadened at apex. Posterior tibiae with two oblique, parallel ridges, anterior one extending entirely across outer face; basitarsi with three oblique ridges, second segment with two. Anal style distinctly more than twice length of hypopygium (.91 x .41 mm.), slender, acuminate from base to apex.

Length: to apices of elytra, 2.64 mm.; to tip of anal style, 3.55 mm.

Holotype, male, Patagonia Mountains, Arizona, August 20, 1940 (D. J. and J. N. Knall); in the collection of Ohio State University.

This species is most closely allied to blatchleyi Liljeblad and may be separated by the more elongate form, larger size, longer pronotum, larger, more rounded scutellum, shorter anal style, the castaneous anterior and intermediate legs, with their tarsi longer than the tibiae, the longer, bicolored antennae, with the six basal segments flavocastaneous and the remainder fuscous and the difference in the relative lengths of these segments, the fifth being two-thirds longer than the fourth.

**Mordellistena subfuscus** Liljeblad


Four specimens: Forest Hill, Rapides Parish, Louisiana, September.

Mordellistena testacea Blatchley

*Mordellistena testacea* Blatchley, Col. Ind., 1910, 1321.

One specimen: Forest Hill, Rapides Parish, Louisiana, September 17-21, 1945, light trap (R. L. Wenzel). This is an extreme southern record, the species having hitherto been recorded only from Indiana.

Mordellistena nunenmacheri Liljeblad


Three specimens: one, Virden, Washington, May 4, 1935 (Hatch-Wilson) and two, Metiolus River, Oregon, June 1, 1936 (H. Lanphere). This species is now known to be found in the three Pacific Coast States.

Mordellistena y-notata Ray, new species

(Figs. 7, 8, 9)

Form narrow, elongate, subparallel, but slightly subcuneate. Derm black, head castaneous, vertex black; antennae black; pronotum castaneous, basal margin narrowly black, a fuscous, Y-shaped spot on posterior half of disc, the stem at the midbasal lobe and the arms extending to middle of disc. Basal two-thirds of anterior and intermediate femora castaneous, remainder black. Surface densely covered with fine, recumbent pubescence, partaking of ground color, except on head and pronotum, where it is yellowish and on ventral surface, where it is whitish.

Head strongly convex, eyes entire, densely covered with fine, erect hairs. Antenna 1.06 mm. long, reaching to middle of pronotum; segments 3-4 equal in length, the latter slightly broader; 5-10 each one-half longer and broader than 4, flattened, sub serrate, broadest at apex; 11 one-third longer than 10, broadest subbasally, sides and apex rounded. Terminal segment of maxillary palpi enlarged, form of a broad isosceles triangle, sides distinctly rounded.

Pronotum convex, broader than long (1.09 x .89 mm.), apex and sides rounded, basal angles obtuse, base arcuate, midbasal lobe broad, long, strongly rounded. Scutellum small, triangular, sides and apex rounded.

Eltyra narrow, two and six-tenths times as long as broad (2.83 x 1.09 mm.), sides subparallel to beyond middle, thence strongly curved, apices individually rounded. Anterior and intermediate tarsi filiform, as long as their tibiae. Posterior tibiae with three
equal, oblique ridges, each extending about one-third across outer face; basitarsi with three ridges, second segment with two. Anal style twice length of hypopygium (1.09 x .53 mm.), broad on basal half, narrow and acuminate from middle to apex.

Length: to apices of elytra, 3.81 mm.; to tip of anal style, 4.9 mm.

Holotype, female, Decatur, Michigan, July 18, 1942 (E. Ray); in the collection of Eugene Ray.

This species is most closely allied to tantula Liljeblad\(^{10}\) and may be distinguished by the presence of a Y-shaped, fuscous area on the basal half of pronotum, the castaneous head, the black antennae, the bicolored legs and the peculiar antennae, which have segments three and four equal, five to ten much broadened and flattened and almost twice as wide as four. In tantula four is as long as two and three together, five to ten are not flattened and are not much broader than four.

**Mordellistena ambusta LeConte**


One specimen: Seattle, Washington, July 16, 1927 (T. Kincaid). This is the first West Coast record for this Eastern species.

**Mordellistena conformis Smith**


Four specimens: Forest Hill, Rapides Parish, Louisiana, August 10-September 7, 1945, light trap (R. L. Wenzel). This species has hitherto been recorded only from Texas.

**Mordellistena malkini Ray, new species**

(Figs. 2, 14)

Form narrow, elongate, sides subparallel on basal half of elytra. Derm black, except two basal segments of antennae, which are fuscocastaneous. Surface densely covered with fine, recumbent pubescence, cinereous everywhere, except on elytra, where it is mixed with black.

Head convex, distinctly narrower than pronotum; eyes entire, densely covered with short, erect hairs. Antennae 1.38 mm. long,

reaching base of pronotum; segments 1-2 large, equal; 3-4 equal in length, the latter distinctly broader; 5-10 somewhat flattened, each one-fourth longer and slightly broader than 4; 11 one-third longer than 10, broadest postmedially, sides and angles rounded. Terminal segment of maxillary palpi enlarged, form of a broad, scalene triangle, mesal margin shortest, sides and angles rounded.

Pronotum as long as broad (1.32 mm.), finely but distinctly margined, apex and sides strongly rounded, basal angles right angles, base arcuate, midbasal lobe broad, short, rounded. Scutellum small, broad, subtriangular, sides and apex rounded.

Elytra elongate, narrow, two and six-tenths times as long as broad (3.4 x 1.32 mm.), sides parallel on basal half, thence broadly rounded to apex, apices individually rounded. Anterior and intermediate tarsi longer than their tibiae, penultimate segment shortest, distinctly broader than preceding segment and emarginate on apical margin. Posterior tibiae with three oblique, parallel ridges, middle one extending completely across outer face, others extending less than half this distance; basitarsi with five oblique ridges, second segment with three. Anal style elongate, more than three times length of hypopygium (2.14 x .7 mm.), abruptly narrowing one-third from base, thence narrow and attenuate to apex, the latter acute.

Length: to apices of elytra, 4.72 mm.; to tip of anal style, 6.86 mm.

Holotype, male, allotype, female, and a paratype, female, Tarpon Springs, Florida, April 18, 1943 (B. Malkin); holotype and allotype in the collection of Eugene Ray; paratype in the collection of Borys Malkin, to whom this striking species is dedicated.

This species is allied to *husseyi* Lilejblad11, described from Michigan, but may immediately be separated by the narrower form, larger size, the larger number of ridges on the posterior tarsi, the longer anal style, the black palpi and anterior femora and the narrower terminal segment of the maxillary palpi.

**Naucles tibialis** Champion


One specimen: Forest Hill, Rapides Parish, Louisiana, September 24-29, 1945, light trap (R. L. Wenzel). This species has hitherto been recorded only from Guatemala and California.

REDESCRIPTION OF AGENIOIDEUS HUMILIS (CRESSON)
WITH NOTES ON ITS BIOLOGY
(Hymenoptera, Pompilidae)

BY PAUL D. HURD, JR.
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The recent discovery of Agenioideus humilis (Cresson) on Mt. Diablo, Contra Costa County, California, by J. W. MacSwain and G. E. Bohart of the University of California is of particular interest because it sheds some light on the biology of the species. In addition, the discovery places this widely distributed species for the first time on our California faunal list.

Humilis was described by Cresson (1867:91) on the basis of a single female collected in New York (State?). The male was known to Ashmead (1902:85) when he erected the mono-basic genus, Agenioideus, since characters of both sexes were enumerated in the description. However, Viereck (1906:304), apparently unaware of Ashmead's treatment of the species, recorded a male from New Haven, Connecticut which he believed constituted the first record of the male and characterized it as such.

The four male and two female specimens which form the basis for the following redescription of the species were reared from pupal cases collected at Rock City, Mt. Diablo, California by MacSwain and Bohart on January 12, 1947. The pupal cases were found singly in pulverized sandstone detritus which had accumulated in small, weathered recesses at the base of a cliff. Of the eleven pupal cases uncovered and brought into the laboratory for rearing, six yielded adult wasps by early April, one pupal case was found to be parasitized by a bombyliid larva, another by a mutillid larva, and the remaining three were empty.

Agenioideus humilis (Cresson)


Male. Length, 4-6 mm. Head black, distinctly wider than thorax, clothed with numerous recumbent, silvery, pubescent hairs on face and clypeus and erect, silvery, pubescent hairs on vertex and hind margins of head; vertex sculptured with a few scattered punctures; eyes large, reaching to posterior margin of head, slightly convergent above; ocelli prominent; posterior ocelli much closer to inner eye margins than to each other; anterior ocellus about one and a quarter times diameter of a posterior ocellus; face medio-longitudinally traversed by a weakly impressed line extending from anterior ocellus to antennal bases; antennae black, clothed densely with minute, erect, black hairs; clypeus broadly and evenly rounded, swollen medially, anterior margin in some with a few scattered punctures; mandibles black shading to dark amber on apex (variable), clothed exteriorly with a few, erect, rather stout, black hairs; malar space between bases of mandibles and eyes distinct. Thorax black (pruinose in certain lights), clothed with recumbent, silvery, pubescent hairs particularly on propodeum; posterior margin of pronotum angulate; propodeal surface scarcely arched posteriorly; legs black, except for a dull white spot on upper posterior surface of each hind tibia; claws pale brown, unidentate within; intermediate and posterior tibiae armed with a few short, stout spines; inner posterior tibial spur nearly three-fourths length of basitarsus. Wings whitish-hyaline, refulgent with green, copper and rose violet iridescence (in certain lights), clothed with numerous, minute, black hairs; fore wing bifasciately fumose, outer fascia in form of an exterior marginal band, inner fascia more diffuse occupying area immediately below stigma; second submarginal cell nearly rectangular, first recurrent vein meeting the cell a little beyond the middle; third submarginal cell trapezoidal, second recurrent vein meeting cell about two-thirds from the tip; marginal cell acute at apex; hind wing with exterior marginal band similar to that of fore wing, inner fascia absent. Abdomen black (pruinose in certain lights) with a dull white spot on terminal tergite (though absent in some), subpetiolate, arched posteriorly, laterally compressed. Subgenital plate brownish-black, spatulate, attenuated basally, median portion elevated, forming a rather broad medio-longitudinal, carinate keel which when viewed in profile describes an arc extending from basal portion of plate nearly to apex; apical margin of plate rounded, armed with a fringe of rather long, stout, black bristles.

Female. Length, 4 mm. Similar to male in coloration and vesture, though dull white markings on hind tibia and on terminal abdominal tergite obscure or missing. Anterior tarsal comb composed of five rather long, stout spines, about equal in length except for most distal spine which is about three-fourths the length of the others. Third antennal segment fully twice as long as scape, instead
of being subequal as in the male. Tip of abdomen noticeably clothed with short, erect, ashy-white hairs (black in some lights).

*Pupal case* cigar shaped, smooth, papery, pale brown, except for smaller end which is black owing to the presence of a hard packed, grayish black deposit within that end of the case. Length, 4-6 mm. Emergence is effected by a complete excision of the large end of the case.

*Type locality.* New York.


*New records.* Mt. Diablo, Contra Costa County, California, 4 ɍ ɍ, 2 ɍ ɍ, reared from pupae collected on January 12, 1947, by MacSwain and Bohart.

*Humilis* is readily recognized by the bifasciate character of the fore wing, the dull white marking on each hind tibia, and the nature and color of the vestiture.

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**A SENSILLUM IN CARPOPILUS AND HAPTONCUS**

(Coleoptera, Nitidulidae)

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The chitinous invagination of the terminal segment of the antennae of certain Nitidulidae reported herein should properly and descriptively be referred to as a *sensillum ampulaceum*. The organ has been found in only two genera, *Haptoncus* and *Carpophilus*, although several genera in this family have been examined. It was clearly observed in all species of these genera examined with the single exception of *C. pallipennis* (Say.)

This sensillum was first noticed in slide material prepared during the description of a new species of *Haptoncus*. Although it can be observed with fairly low magnification, it is necessary to mount the segment upon a slide and use transmitted light because the organ is enclosed within the segment.

In the Nitidulidae the antennae are eleven segmented with a three segmented somewhat flattened club. The terminal segment is
generally roughly pentagonal in outline and often under low magnification has the appearance of two articulated segments. Upon the lower surface of the segment at the line of this apparent fusion is the circular or oval opening of the sensillum. The main part or body of the organ rests inside of the segment and is extended toward the base of the antennae. The structure is chitinous and might easily have been formed during the evolution of this antenial segment by the telescoping of a primitive twelfth segment into the eleventh.

Figures show the outline of the terminal segment and its sensillum ampulaceum. 1, Carpophilus sp.; 2, Carpophilus discoideus Lec.; 3, Carpophilus humeralis (Fabr.); 4, Haptoncus ochraceus Er.; 5, Carpophilus brachypterus (Say); 6, Carpophilus antiquus Melsh.; 7, Haptoncus luteolus (Er.); 8, Haptoncus californicus Gillogly, inset of an abberant form of the sensillum in H. californicus.

In different species the shape and appearance of the sensillum may vary greatly. It sometimes extends for nearly two-thirds of the length of the segment as in Carpophilus brachypterus (Say) (fig. 5) or for less than one-fourth of that distance as in C. antiquus Melsh. (fig. 6). Although it is usually a simple pear-shaped flask, it may be clubbed, convoluted, or even divided at the base as in Haptoncus ochraceus Er. (fig. 4). The neck of the flask is often ringed or reticulate for all or part of its length and these markings sometimes extend over the entire surface of the sensillum. This variation in the organ is often greatest between closely allied species and is very helpful in such cases as a specific character. Haptoncus luteolus (Er.) (fig. 7) and H. ochraceus Er. (fig. 4) are very similar in appearance but the sensilla quickly and definitely separate them. Carpophilus humeralis (Fabr.) (fig. 3) and Carpophilus sp. (fig. 1) can scarcely be separated on the basis of existing descrip-
tions but the sensillum of the latter is so remarkably different from the former as well as from all other species examined as to be definitely recognizable without examining the rest of the insect. In *Haptoncus californicus* Gillogly one antenna of one specimen had the sensillum bent to form a right angle. An inset of this sensillum is included although it is not typical of this or any other species examined. While this new character will be very helpful in many cases it must be remembered that in some species the sensilla are very similar in shape and appearance and it would be difficult, if not impossible, to identify all species merely by this character alone.

The genus *Haptoncus* was first placed in the Nitidulariae by Erichson (1843) when he described the species *Haptoncus (Epuraea) luteolus* (Er.); then Murray (1864) and Sharp (1891) placed the genus in Carpophilidae; and finally Parsons (1943) returned the genus to the Nitidulinae. It appears to me that there can no longer be any doubt as to the true position of this genus because the new character discussed in this paper appears only in the two genera *Carpophilus* and *Haptoncus*. Moreover, as Murray (1864) and Sharp (1891) have each separately commented, the genus actually keys out to the Carpophilinae in fresh material and the terminal abdominal segments only become retracted in dried specimens. Sharp (1891) writes, "no species of *Epuraea* has the elytra so short as *Haptoncus*" and adds, "that no good line of demarcation between the two groups, as at present defined, exists." I submit that the presence of the antennal sensillum in *Haptoncus* and its absence in *Epuraea* and the other Nitidulinae, indicates that the former genus is allied to *Carpophilus* and the other Carpophilinae.

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A NEW HOLLYHOCK APHID

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A maroon-red to reddish-brown aphid of the genus Macrosiphum has been observed to infest hollyhock, Althaea rosea, each season for a number of years, at Logan and elsewhere in Utah. Usually by late May the aphid had become so abundant as to be damaging. Some decrease in numbers ordinarily occurred during August; the aphid again became extremely abundant during early September and remained in damaging abundance until frosts had destroyed the foliage. Most of the individuals were observed to feed head downward, beneath the surface of leaves, on petioles, stems and beneath ovaries of flowers. They sometimes occurred from the apex of the plant to within an inch or two of the ground and were usually most abundant on the upper third. This species has been collected in injurious abundance by the writer, from Cedar City, in southern Utah, to as far north as Lethbridge, Alberta, Canada. When encountered, usually it has been present on at least some plants in conspicuous abundance.

The writer is indebted to Professors E. O. Essig and M. A. Palmer for their opinions concerning this pest, and to Merlin W. Allen who in correspondence called attention to its undescribed condition.

Macrosiphum eoessigi Knowlton, new species

General body color of living material, reddish-brown to maroon-red (occasionally a slight greenish or brighter red). Head, antennae except for small area at base of III, cornicles, cauda, anal plate, and most of legs beyond middle of tibiae black, or at least fuscous. Most dorsal abdominal hairs have a distinct blackish area surrounding the base; these sometimes tend to form a broken band across dorsum of segment preceding cauda. The dark areas become faded or lost when specimens are cleared too long in caustic. A dark area usually occurs behind each black cornicle. Cuticula of thorax and abdomen have tendency to be somewhat rugulose; minute spinose pattern often occurs along many of the ventral abdominal lines in apterous forms, especially noticeable in males. Ocular tubercles present; antennal tubercles prominent. Hairs on vertex moderately prominent and flattened at apex.

Stem mothers or fundatrices: Body 2.24 to 3.15 mm. long and 1.5

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to 1.62 across abdomen; antennae 3.32 to 4.19 mm. long; antennal III, .86 to .98 mm. long with 3 to 10 rounded sensoria of various sizes, mostly in irregular line on basal half of segment; IV, .65 to .9; V, .58 to .68; VI, .17 to .2 plus .97 to 1.11; rostral IV + V slenderly obtuse, .174 to .185, usually reaching abdomen; hind tibiae 1.98 to 2.48; hind tarsi .17 to .19; cornicles strong, .95 to 1.25 long with distal .26 to .32 mm. reticulated; total length of cauda, .54 to .57 long with 4 to 7 lateral hairs on each side, usually conical (rarely with slight constriction before base).

Alate: Winged females become abundant with maturity of the second generation, decreasing in number by mid-summer and scarce in fall. Spring alates have body 2.3 to 3.1 mm. long; antennae 3.66 to 4.26; antennal III, .83 to .91 with 8 to 19 sensoria; IV, .78 to .9; V, .65 to .74; VI, .17 to .19 plus 1.02 to 1.18; rostral IV + V, .18 to .19, usually reaches abdomen; hind tibiae 2.24 to 2.51; hind tarsi .18 to .19; cornicles black, .95 to 1.1 with distal .27 to .34 mm. reticulated; cauda .45 to .5 long with 4 to 8 lateral hairs, somewhat conical but not sharp at tip.

Aptera: Spring and summer aptera resemble fundatrices; body 3 to 3.25 mm. long; filament of antennal VI, .99 to 1.21; hind tibiae 2.33 to 2.81. Small fall sexuparae, which occur together with larger aptera, have body about 2.12 to 2.37 mm. long; antennae 2.78 to 3.12; antennal III, .64 to .68 with 1 to 5 sensoria; IV, .53 to .54; V, .47 to .49; VI, .14 plus .90; cornicles .72 to .85 with distal .17 to .2 reticulated; cauda .38 to .41 mm. long.

Males: Small aperous males occur during late September and October at Logan. Body 1.67 to 2.02; antennae 2.42 to 2.95; antennal III, .54 to .695 with 25 to 43 sensoria; IV, .49 to .6 with 13 to 25 sensoria; V, .43 to .57 with 9 to 15 secondary sensoria; VI, .1 to .14 plus .63 to .87 mm. long; rostral IV + V, .158, slenderly obtuse, reaching abdomen; hind tibiae 1.43 to 1.77; hind tarsi .14 to .16; cornicles .39 to .52 with distal .06 to .08 reticulated; cauda .19 to .252 mm. long.

Oviparae: Body 2.21 to 2.33 mm. long; antennae 2.56; antennal III, .68 to .77 with 1 to 8 sensoria; IV, .63 to .66; V, .52 to .56; VI, .15 to .17 plus .84; rostral IV + V, .16; hind tibiae, 1.78 to 1.91 with basal half somewhat swollen and armed with about 20 to 35 small rounded sensoria; hind tarsi .16 to .173; cornicles .73 to .82 with distal .11 to .22 reticulated; cauda .33 to .4 with 4 to 7 lateral hairs, usually without constriction before base.

Type: In the collection of the writer, the slide containing four alates, collected at Logan, Utah, May 25, 1946, G. F. Knowlton. Paratypes in the collection of Utah Agricultural Experiment Station, Professors E. O. Essig and M. A. Palmer, Doctors C. F. Smith and A. N. Tissot, and in the U. S. National Museum. Approximately 175 slides were available for the above study, containing more than 1000 mature individuals.
Taxonomy: Alate Macrosiphum eoessigi n. sp. runs to M. kiowwanepus (Hottes) in Gillette and Palmer’s key (Ann. Ent. Soc. Amer. 27:169, 1934) from which it differs in body having more of a maroon-red color and lacking pruinose covering, in having larger body and shorter antennae and cornicles. The hind tibiae of the eoessigi oviparae contain fewer and smaller sensoria than other Macrosiphum species infesting plants of the Mallow family.

Collections: Described chiefly from material collected at Logan, Utah, throughout 1946 and in fall of 1945. Type locality, Logan, Utah. Collections include: at Logan, Utah, October 16 and 17, 1945 (Knowlton), oviparae and males; September 9, 1945 (M. W. Allen—these in the E. O. Essig collection); May 1, 4, 6, 10, 12, 13, 15, 16, 25, July 14, August 30, September 4, 12, 15, 17, 18, October 22, November 8, 17, 1946 (Knowlton); May 24, 1946 (Knowlton and W. P. Nye). Collected elsewhere in Utah, during 1946 at: Farmington, May 16; Hyde Park, May 13 and October 22; Murray, June 28; Provo, July 16 and September 12; Aurora, July 5; Joseph, July 14; Cedar City, July 3 (Knowlton). Previous to 1945 specimens were taken at Salt Lake City, June 21, 1925, (Knowlton) and July 7, 1936 (C. F. Smith and P. T. Rigby); Ogden, July 31, 1935 (C. F. Smith); American Fork, June 29, 1936 (Knowlton), and Logan July 2, 1933 (Knowlton), in Utah. Collections also were made at Hollister, Idaho, July 27, 1936 (Knowlton); Franklin, Idaho, June 30, 1946 (Knowlton); Twin Falls, Idaho, July 20, 1946 (K. E. Evans); St. Marys, Montana, July 28, 1946 (Knowlton); Lethbridge, Alberta, Canada, July 26 and 27, 1946 (Knowlton); and Waterton National Park, Alberta, Canada, July 23, 1946 (Knowlton), all collected from common garden hollyhock.

Biological notes: Numerous reddish M. eoessigi nymphs were found on hollyhock at Logan during April of 1946. The first mature stem mothers appeared about May 1st. By May 6, numerous mature fundatrices and nymphs were present on apical growth and leaves. Parasitized individuals were found on the writer’s back yard hollyhock plants, from May 10 until late October when frosts destroyed most of the leaves; some aphids survived until late November on leaves protected from freezing by snow and other cover. On May 10, a mature female Nabis alternatus Parsh. was observed feeding on a mature M. eoessigi female, which it killed. Two-spotted ladybird beetles also were
present on the same plant; this beetle later fed on an aphid. The first alate eoessigi were collected at Logan on May 13, 1946, and were fairly numerous for the next three weeks. At this time, 3 Hippodamia convergens Guerin were observed to feed on this aphid, one of them for approximately 12 minutes, while mating. On May 25, a mature Anthocoris melanocerus Reuter was observed at Logan, feeding on a nymph on the lower surface of a leaf. At Logan, Provo, Cedar City, and Lethbridge, Deraeocoris brevis Uhler were abundant on infested hollyhocks, where they fed on eoessigi. Other predatism was observed by syrphid larvae, adult and larval Chrysopa, and by other species of ladybird beetles and larvae. Such seemed sufficient to account for much of the seasonal reduction observed in these aphids during hot weather.

———

NATIVE HOSTS OF THE MEXICAN CHICKEN BUG,  
HAEMATOSIPHON INODORA (DUGÉS)  
(Hemiptera, Cimicidae)  

BY ROBERT L. USINGER  
University of California, Berkeley  

This rather common pest of poultry in the southwestern United States and Mexico has never been recorded from a native host. Since the bug is evidently native to this section of the Western Hemisphere and since the chicken is not, the source or native host of the bugs has long been a matter for speculation.

I am now able to record a fine series of this species from a nest cave of the California Condor, Gymnogyps californianus (Shaw) in Ventura County, California, Sept. 16, 1939, collected by A. H. Miller and C. B. Koford. Records are more numerous from the nests of owls as follows: Many nymphs and one adult male, Caliente Cr., 25 miles S. E. of Bakersfield, California, May 18, 1941, G. E. Bohart collector; Several specimens, Corona, California, in an abandoned tunnel formerly inhabited by owls, April 25, 1939, L. E. Wilson collector, sent by R. C. Dickson; Many specimens in two lots, Freedom, Oklahoma, alt. 3000 ft., October 31, 1940, Bubordorf and Howell, Great horned owl, Bubo virginianus (Gmelin).

Chickens might easily become infested from these birds of prey but the occurrence of related genera of Cimicids (e.g. Hesperocimex, Cimexopsis and Synaxenoderus) on swifts and martins suggests that a passerine host may yet be found for Haematosiphon from which it may be picked up by birds of prey.
THREE NEW PSYLLIDS FROM COSTA RICA
(Psyllidae: Homoptera)

BY LEONARD D. TUTHILL
University of Hawaii, Honolulu

The three previously undescribed species of psyllids treated here are from a small group of Central American specimens borrowed from the United States National Museum some time ago. All three species belong to the subfamily Psyllinae.

Psylla bipartita Tuthill, new species
(Figs. 1, 1a, 2, 3)

Length to tip of folded wings, 2.5 mm.

Structure: Head small, narrower than thorax, strongly deflexed, nearly vertical. Vertex concave posteriorly, bulging anteriorly over median ocellus. Genal processes 0.66 as long as vertex, blunt, slightly separated, with numerous large setae. Antennae 2.5 to 3 times as long as width of head. Thorax strongly arched. Pronotum nearly vertical, long. Forewings 2.5 times as long as wide, broadly rounded apically; prominent setae on costa, Rs slightly sinuate, pterostigma short, broad. Hind tibiae with small basal spur.

Male proctiger flask shaped, flexed caudal in apical third. Forceps bipartite, lateral lobe spatulate, in lateral view sharply bent cephalad near base, parallel-sided to rounded apex, inner lobes arising near base, slender, sharply incurved apically, sharp apically, longer than lateral lobes. Female genital segment 0.5 as long as rest of abdomen; dorsal valve sinuate to attenuate spinose apex; ventral valve shorter than dorsal, deep narrow notch at apex.


This species is quite typical of the genus in general appearance, having somewhat the facies of P. striata Patch but is dis-
distinct from all previously described species known to the author in the peculiar male genitalia.

**Psylla multiplex** Tuthill, new species  
(Figs. 4, 5)

Length to tip of folded wings, 3 mm.  
*Structure:* Head short, narrower than thorax, strongly deflexed. Vertex broad, slightly emarginate on caudal margin, strongly bulging anteriorly, with numerous short heavy setae. Genal processes 0.5 as long as vertex, blunt, strongly divergent. (Antennae broken on unique specimen at hand). Eyes large, prominent. Thorax strongly arched. Pronotum strongly inclined, nearly vertical anteriorly, setate. Forewings 2.5 times as long as wide, broadly rounded apically, costa sparsely setate toward base, Rs slightly sinuate, pterostigma very small, marginal cells large. Hind tibiae with small basal spur.  
Male proctiger straight, narrowed in apical third. Forceps short, covered with long slender setae, bilobed; outer lobe broad and flattened, in lateral view broad, cephalic margin straight, caudal margin rounded, apex black, sharply bent mesad, second black projection below apex; inner lobe very flat, broad, twisted mesad apically to sharp tip, caudal and apical margins black.  
*Holotype,* male, no. 58221, United States National Museum, Villa Quesada, San Carlos region, Costa Rica, taken from *Crotalaria retusa* L., March 26, 1934, by C. H. Ballou.  
This species is similar to *P. bipartita* but is somewhat larger, the genal processes are markedly shorter and more divergent and the male genitalia are distinctive.

**Euphalerus certus** Tuthill, new species  
(Figs. 6, 7)

Length to tip of folded wings, 4 mm.  
*Color:* Ground color yellow, profusely spotted with small brown dots. Forewings hyaline except maculations as figured.  
*Structure:* Entire body finely rugose. Head much narrower than thorax, strongly deflexed. Vertex twice as wide as long, with deep transverse sulcus, overhanging large median ocellus anteriorly. Genal processes 0.5 as long as vertex, rounded, contiguous, somewhat depressed from plane of vertex, with numerous large setae. Antennae slender, slightly more than 2.5 times as long as width of head. Eyes large. Thorax large, strongly arched. Pronotum vertical medially, nearly horizontal at lateral margins.
EXPLANATION OF FIGURES

Fig. 1—Psylla bipartita, lateral view of female genitalia.
Fig. 1a—Psylla bipartita, ventral view of tip of ventral valve of female genital segment.
Fig. 2—Psylla bipartita, lateral view of male genitalia.
Fig. 3—Psylla bipartita, caudal view of male forceps.
Fig. 4—Psylla multiplex, lateral view of male genitalia.
Fig. 5—Psylla multiplex, caudal view of male forceps.
Fig. 7—Euphalerus certus, forewing.
Mesosternum very strongly developed, produced antero-laterally as prominent lobes. Metatibiae with small, blunt, basal spine. Forewings large, 2.5 times as long as wide, somewhat oblique apically, venation as figured, pterostigma large.

Male proctiger long, slender, tapered. Forceps large, nearly as long as proctiger; in lateral view stout, spatulate, with prominent caudal protrusion near base; in caudal view broad basally, incurved in apical half to touching apices, caudo-apical margin black, irregularly serrate. Female genital segment large; dorsal valve attenuate to acute tip, with scattered long setae over surface and numerous very short stiff retrorse setae on apical half; ventral valve shorter than dorsal, ventral margin almost straight from base to blunt apex, apical portion thickly set with small heavy spines.

Holotype, female, no. 58222, United States National Museum, allotype, male, MANZANILLO, COSTA RICA, Chaperno, April 29, 1933, Juan Bello.

This species resembles Euphalerus gallicola Ferris but the latter differs in color and structure as follows:

The general ground color cinereous, dorsum of thorax orange medially, legs and abdomen brown, veins of forewings almost uniformly brown; vertex impressed each side of medial suture but without transverse sulcus, pronotum quite flat, long, scarcely depressed anteriorly, spur at base of metatibiae larger and sharper, pterostigma smaller, about half as long, male forceps more slender, tapered to narrow apex, basal projection broader, less prominent, valves of female genital segment without retrorse spines and setae.

No indication of host accompanies these specimens.

Holotype and allotype in United States National Museum.

SOL FELTY LIGHT

Dr. Sol Felty Light, Professor of Zoology at the University of California, died at Clear Lake, California, June 21, 1947. He was 61 years old.

Dr. Light was a general zoologist with a broad knowledge of the comparative anatomy and ecology of all invertebrates. However, his greatest contributions to science were in the fields of taxonomy, biology and caste development of termites.

A full account of Dr. Light’s entomological work will appear in an early issue of this journal.
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NEW SPECIES OF OLIARUS STAL FROM SOUTHWESTERN UNITED STATES AND MEXICO
(Homoptera: Cixiidae)

BY JOHN S. CALDWELL
Circleville, Ohio

The following is a report on two small collections of cixiids; one received from the California Academy of Sciences through the courtesy of Dr. Edward S. Ross, the other from the Ohio State University through the courtesy of Prof. Josef N. Knull. The letters CAS after type designation signify that the types are deposited in the California Academy collection at San Francisco, California; OSU denotes that the types concerned are deposited in the Ohio State collection at Columbus, Ohio.

Oliarus eximus Caldwell, new species

Length, male 6 mm.; female 6.3 mm. Black with carinae faint orange in male, deep orange in female. Elytra and main veins white in male with the following markings black; all punctations, junction of cubital veins with commissural margin, all cross veins, stigma, radius and cross strut to media including furcation of media and termination of all veins. Elytra in female with dark markings of male broadened often forming irregular dashes apically.

Frons deeply inserted into clypeus. Vertex of broad type, broader in female than in male; lateral margins parallel in basal half, convergent apically. Intermediate carinae of pronotum not reaching posterior margin. Mesonotum with median tablet very broad; lateral carinae as well as intermediate carinae slightly curved.

Male pygofer with lateral margins produced extremely far caudad; medioventral process greatly enlarged, rounded in outline. Forceps very long, curved around medioventral process of pygofer; broadened apically with inner and outer angles equally produced in ventral aspect. Anal segment long, somewhat flattened apically.

Aedeagus of reduced type as found in the placitus group; periandrium with three long and one short basal process.

Resembling *placitus* Van D. but differing by the lack of bifurcate processes on the periandrium and other phallic characters as noted in the description.

**Oliarus eximus teximus** Caldwell, new subspecies

Length, male 5.3 mm.; female 7.3 mm. Dark brown with lighter carinae. Elytra milky with brown veins in male. Elytra in female with a tendency for fuscous color to spread over the entire surface.

Male pygofer not produced as far caudad as in typical form; medioventral process proportionately larger. Forceps with inner apical angles produced more than outer. Anal segment hood-like, not flattened apically. Periandrium with all basal processes about equal length or with medioventral process a little longer than others.

Male holotype from Bastrop N. P., Texas, May 1, 1941; female allotype and male paratype, Uvalde County, Texas, May 3, 1941; female paratypes, Uvalde County, May 11, 1946, and Brownsville, Texas, May 8, 1935 (D. J. & J. N. Knull), OSU.

Lighter colored than typical form with more markings on female; slightly different phallic characters in male as noted in the description.

**Oliarus forcipatus** Caldwell, new species

Length, male 5 mm.; female 5.5 mm. General color black with all carinae light brown to deep yellow. Mesonotum with area between lateral and intermediate carinae deep yellow; lateroposterior margins edged in yellow. Elytra whitish hyaline; veins light brown, darkening apically.

Vertex elongate; lateral margins greatly elevated; facets almost half as long as vertex. Intermediate carinae of pronotum reaching posterior margin. Intermediate carinae of mesonotum close to lateral carinae, especially basally.

Male pygofer with lateral margins greatly produced caudad, acute; medioventral process short, stout. Forceps long, broadened and recurved apically. Anal segment elongate, hood-like. Aedeagus with two apical processes, caliper-like. Periandrium with left ventral process very broad, trifid apically; right ventral process slender, straight; a slender, straight process present dorsally.

Male holotype and paratypes, July 23, 1946; female allotype and paratypes, June 2, 1937, from Davis Mts., Texas (D. J. & J. N. Knull), OSU.

Differing from other oliarids by the phallic characters as noted in the description.
Oliarius abacus Caldwell, new species

Length, male 7 mm.; female 7.6 mm. General color light fuscous with all carinae and median tablet of mesonotum light brown. Veins light brown with dark brown punctations. Female with most cross veins and furcation of main veins broadly blackened, giving a mottled appearance.

Vertex longer than broad, broadly trough-like; facets short, triangular. Intermediate carinae of pronotum far from posterior margin. Carinae of mesonotum prominent; intermediate carinae evenly arcuate, slightly nearer lateral carinae than median. Posttibiae each with one or two spurs well basad. Punctations on veins very small.

Male pygofer with lateral margins produced well caudad on either side; medioventral process elongate, roughened apically. Forceps not greatly broadened apically (left and right of different shape in type); inner teeth very elongate. Anal segment asymmetrical apically; left apex produced ventrad. Aedeagus with very elongate subapical process; right basal portion of periandrium with slender elongate process. Anal segment of female broadly elliptical with either end truncate.

Male holotype, female allotype, and thirteen paratypes from "REAL DE ARriba, TEMASCALTEPEC, MEXICO," May 22, 1933 (Hinton & Usinger), CAS.

Abacus resembles any other medium sized oliarid but differs by the phallic structure as noted in the description.

Oliarius catus Caldwell, new species

Length, male 5.6 mm.; female 5.9 mm. Black over all with red carinae. Elytra whitish hyaline with brown veins.

Vertex short, broad, more apparent in female because the lateral margins are less elevated. Frons much widened apically, concave on either side of prominent median carina; clypeus strongly convex. Intermediate carinae of pronotum not reaching posterior margin. Lateral and intermediate carinae of mesonotum slightly arcuate, not prominent. Posttibiae each with one large spur and several small basal spurs.

Male pygofer with lateral margins acutely produced caudad on either side; medioventral process short, thick. Forceps elongate, broadened and recurved apically. Anal segment hood-like. Aedeagus without direct apical processes; periandrium produced into a very large lobe on either side ventrally; lobes acute apically, divergent.

Male holotype "CARR CYN. ARIZONA, HUACHUCA MTS.,” June 23, 1932. Female allotype "Cave Crk. Arizona, Chiricahua Mts.,” June 20, 1932 (J. O. Martin), CAS.
Differing from other oliarids by the phallic structure as noted in the description.

Oliarus retentus Caldwell, new species

Length, male 4.5 mm.; female 5.4 mm. General color black. Median facial carina and mesonotal carinae red in male. Intermediate carinae of mesonotum and space between intermediate and lateral carinae yellowish in female. Elytra whitish hyaline with yellow veins; apical cross veins broadly fuscous; punctations brown; stigma lightly embrowned.


Male pygofer with lateral margins angularly produced caudad on either side; medioventral process short, triangular. Forceps long, slightly enlarged apically; apices recurved. Anal segment flap-like. Aedeagus with two apical and one subapical processes; periandrium with one long, straight process at right base and two curved processes at left apex.

Anal segment of female small, ovate, broader than long.

Male holotype, female allotype, and 11 paratypes from Nogales, Arizona, September, 1906, (Koebele), CAS.

Differing from other oliarids by phallic details as noted in the description.

Oliarus rarus Caldwell, new species

Length, male 5.7 mm. Fuscous with exception of brown face, yellowish legs, orangish mesonotal tablet, and light carinae. Elytra whitish hyaline with yellowish veins punctate with black.

Vertex elongate; median carina present for three-fourths length; apical facets short. Intermediate carinae of pronotum not reaching posterior margin. Intermediate carinae of mesonotum strongly arcuate. Posttibiae each with one large and one medium preapical spur. Furcation of Sc and R at about center of elytron.

Male pygofer with lateral margins broadly produced caudad on either side; medioventral process elongate, broadly rounded apically, keeled ventrally. Forceps broadly spatulate apically; inner tooth highly developed and bifid on right forcep, small and single on left. Anal segment broad, flap-like. Aedeagus with one apical and two subapical processes; periandrium with long basal process on right projecting to left and a subapical process projecting straight caudad, a small subapical spur present dorsad projecting cephalad.
Male holotype from Ceralbo Island, Gulf of California, June 8, 1921 (Chamberlin), CAS.

Differing from other oliarids by phallic characters as noted in the description.

Oliarus isolatus Caldwell, new species

Length, male 5 mm. Brownish fuscous with all cranial carinae and pronotal carinae light yellow; apex of mesonotum yellowish. Veins yellow becoming fuscous apically; punctations black, prominent; few light fuscous spots scattered over elytra.

Vertex narrow for full length, rounded rather than acute apically; lateral margins almost perpendicular. Intermediate carinae of mesonotum obsolete, median carina very fine. Fork of Sc and R in basal half of elytra.

Male pygofer with lateral margins greatly produced caudad on either side; medioventral process hemispherical, tipped with a small acute spur. Forceps short, stout, recurved apically. Anal segment hood-like. Aedeagus with one long apical process and two small subapical processes (one dorsal and one ventral). Periandrium with two large basal processes and two slender apical processes; no dorsal process present at apex.

Male holotype, from Maria Madre Village, Tres Marias Islands, Mexico, May 21, 1925 (Keifer), CAS.

Differing from most oliarids by the obsolete intermediate mesonotal carinae and from all others by the phallic characters as noted in the description.

Oliarus nanus Caldwell, new species

Length, male 4.5 mm. Black with cranial and pronotal carinae reddish-orange. Elytra slightly yellowed at base; veins brownish-yellow; punctations concolorous with veins.

Vertex very narrow, deep; facets very elongate. Frons elevated along median carina; clypeus flatter. Intermediate carinae of pronotum reaching posterior margin. Mesonotal carinae very fine. Posttibiae with one large preapical spur. Sc and R very long.

Male pygofer with opening flared; lateral margins notched on either side caudad; medioventral process short, stout. Forceps short, stout, recurved laterally and cephalad at apices in ventral aspect; with dorsal thumb-like projection in lateral aspect. Anal segment invert cup-shaped apically, apex split. Aedeagus with one long apical process at left; periandrium with one large bifurcate apical process at left, right base broadly lobate.

Male holotype from “Real de Arriba, Temascaltepec, Mexico,” May 23, 1933. Paratype (with tip of abdomen missing) same locality, May 21, 1933 (Hinton & Usinger), CAS.
Resembling *isolatus* but differing by the presence of intermediate mesonotal carinae and by phallic characters as noted in the description.

**Oliarus aztecus** Caldwell, new species

Length, male 5.8 mm.; female 6 mm. Black over all with dark orange carinae. Legs yellowish. Veins yellowish becoming fuscous apically, punctations scarcely embrowned.

Vertex narrow, trough-like, more acute in female than male. Face narrow, median carinae very prominent. Intermediate carinae of pronotum almost reaching posterior margin. Intermediate carinae of mesonotum little elevated, slightly nearer lateral carinae than to median. Posttibiae each with two large and several small preapical spurs, the latter near the base. Elytra narrow, elongate; punctations scarcely visible.

Male pygofer with lateral margins truncate caudad; medioventral process elongate. Forceps very elongated, greatly broadened apically, recurved; inner teeth elongate. Anal segment flap-like, straight, bifid apically. Aedeagus with three long and one short apical processes, a short process present at base of apical portion; periandrium with bifurcate apical process.

Male holotype, female allotype, and three paratypes from "TEJUPILCO, TEMASCALTEPEC, MEXICO," June 17, 1933 (Hinton & Usinger), CAS.

Differing from other oliarids by the phallic characters as noted in the description.

**Oliarus bispinus** Caldwell, new species

Length, male 4.4 mm. General appearance black; median frontal carina faintly orange; spots on vertex next to either eye white; pronotal carinae gray; tibiae and tarsi dusky yellow; elytra milky colored; veins brownish-yellow becoming fuscous apically.

Face greatly curved in profile. Vertex elongate; impressed on either side of short, basal, median carina. Intermediate carinae of pronotum not reaching posterior margin. Lateral and intermediate carinae of mesonotum very thin. Punctations on veins few, regular.

Male pygofer with lateral margins produced caudad, acute; medioventral process short, ovate. Forceps long, recurved, little expanded apically. Anal segment short, hood-like. Aedeagus without apical processes; periandrium with bifurcate process at dorsal apex in addition to three ventral processes.

Male holotype from CHISOS MTS., TEXAS, July 17, 1946 (D. J. & J. N. Knoll), OSU.
Bispinus differs from the other oliarids by the bifurcate process on the dorsal surface of the periandrium in addition to other phallic characters as noted in the description.

Oliarus uncatus Caldwell, new species

Length, male 4.8 mm. Face light brown with yellowish carinae. Vertex and mesonotum black. Carinae of mesonotum orange; area between outer and intermediate carinae orange. Elytra milky with yellow veins becoming darkened apically.

Face evenly ovate; median carina prominent. Vertex narrow, trough-like. Intermediate carinae of mesonotum broken, irregular. Punctations on veins regular, not prominent; stigma long, narrow.

Male pygofer with lateral margins acute caudad; medioventral process long, slender. Forceps spatulate apically, slightly recurved, appearing coiled. Anal segment relatively short, hood-like. Aedeagus with one apical and one subapical process; periandrium with short spur dorsally; with three processes ventrally, left process broad and slightly bifid apically.

Male holotype from Prescott N. F., Arizona, June 20, 1947 (D. J. & J. N. Knull), OSU.

Differing from other oliarids by the phallic characters as noted in the description.

Oliarus sylvaticus Caldwell, new species

Length, male 3.5 mm.; female 4 mm. General color black; all carinae brownish-yellow. Elytra whitish hyaline; veins black except costa; cross veins broadly fuscous; stigma in male yellow, black in female.

Face angulate in profile, strongly convex. Vertex about twice as long as broad, lateral margins parallel in basal two-thirds. Intermediate carinae of pronotum not reaching posterior margin. Median tablet of mesonotum broad, carinae equidistant apart. Punctations on veins close, evenly spaced, not prominent.

Male pygofer with lateral margins broadly rounded caudad; medioventral process short, acute. Forceps spatulate apically; apices appearing rectangular in ventral aspect. Anal segment flap-like. Aedeagus with three apical processes; periandrium produced into large plate-like process on left, right process thin; a long spine-like process present near dorsal apex.

Female valvulae very short, flat; anal segment small, rounded.

Male holotype and paratype, and female allotype from Oak Grove, California, June 3, 1946 (D. J. & J. N. Knull), OSU.

Differing from other oliarids by the phallic characters as noted in the description.
THE OCCURRENCE OF THE GENUS STETHYNIUM IN CALIFORNIA
(Hymenoptera: Mymaridae)

BY RICHARD L. DOUTT
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The mymarid genus Stethynium has previously been represented in North America only by a single species (faunum Girault) from Illinois. The finding of annulatum n. sp. is the first record of the genus occurring in California. No host records are available for this group, but the species are presumed to be parasitic in the eggs of other insects.

Stethynium annulatum Doutt, new species

Readily distinguished from faunum and the European triclavatum by the antennal characters, particularly the relative lengths of the funicle segments. In addition the basal dilation of the caudal margin of the fore wing is not so pronounced as in faunum and triclavatum, and there are fewer lines of discal cilia. The general body color and the presence of circular concavities on the scape further separate annulatum from the only other known American species, faunum. The posterior wings are not broadened as in the Australian species, peregrinum.

Female. Length 0.62 mm. General body color dark brown, the head, thorax, and posterior two-thirds of abdomen concolorous. Basal third of abdomen yellow. Legs very pale yellow except for apical tarsal segments which are dusky. Scape honey yellow; pedicel and funicle pale yellow, the same as the legs; club dusky. Compound eyes and ocelli very deep red, appearing black in transmitted light. Wings hyaline.

Fore wings somewhat narrow for the genus; not densely ciliate and bearing 9-12 lines of discal cilia across widest portion. Longest marginal cilia slightly longer than distance across greatest wing width. Marginal cilia short at apex of fore wing (Fig. 1, c).

Posterior wings narrow (about as in the type species, triclavatum). Single row of discal cilia placed somewhat caudad of wing

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Fig. 1. *Stethynium annulatum*, n. sp. A. Antenna. B. Thorax, dorsal view. C. Fore wing. D. Posterior wing.
blade center. Longest marginal cilia approximately four times greatest wing width (Fig. 1, d).

Antennal scape with about 10 distinct circular concavities. The specific name, *annulatum*, is derived from the ringed appearance of the sclerotized ridged areas between the concavities. Scape equal in length to pedicel and first two funicle segments combined. Pedicel longer than broad, subequal to funicle 3, the longest segment of the funicle. Funicle 1 barely longer than wide, the smallest funicle segment. Funicle 2 rectangular. Joints 4, 5, and 6 subequal in length. Segment 6 subovate. Club indistinctly three segmented. Club segment 2 distinguishable only with careful magnification. The structure of the two distal club segments together with the elongate sensorial areas of the third segment give the club a lamellate appearance. Antennal characters shown in Fig. 1, a. Pubescence inconspicuous. Mandibles quadridentate.

Thorax subequal in length to abdomen. Mesoscutum with reticulate sculpturing in anterior portion becoming longitudinally striate posteriorly. Parapsidal sutures complete, parapsides reticulate. Each parapsis bearing a single seta. Scutum bearing two setae near parapsidal furrows. Axillae widely separated, reticulate. Scutellum longitudinally striate. Transscutellar suture prominent. Metanotum with longitudinal median suture. Two distinct dorso-lateral scutellar areas present just caudad of axillae. Phragma extending into abdomen (Fig. 1, b).

Abdomen sessile, elongate, showing Anagrine affinities. Ovipositor and attendant valves exserted for a length equal to length of funicle segment 2.

Tarsi four segmented. Cephalic tibial spur bifid at apex, curved. Strigil present. Proximal segment of cephalic tarsi slightly longer than succeeding segment; distal 3 segments subequal in length.

Male. Unknown.


Type deposited in the collection of the Division of Biological Control, University of California. One paratype to be deposited in the collection of the California Academy of Sciences. One paratype to be deposited in the United States National Museum.
NEW SPECIES OF COLEOPTERA FROM WESTERN NORTH AMERICA

BY EDWIN C. VAN DYKE

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FAMILY CICINDELIDAE

Cicindela oregona navajoensis Van Dyke, new subspecies

Of the same general size and form as the usual oregona but conspicuously cupreous above, the pro-, meso-, and metapleurae brilliantly cupreous, the remainder of the ventral surface metallic green with a bluish tinge here and there; the elytral yellow markings all rather broad, especially the median which often has the oblique inner portion as broad as the outer transverse part, the humeral lunule generally broken and the apical lunule rarely complete. As extreme variants we may have the posterior portion of the humeral lunule connected with the outer portion of the median.

Holotype, male, allotype, female (Nos. 5864 and 5865, Mus. Calif. Acad. Sci., Ent.) and numerous designated paratypes from a series of forty specimens collected at Kayenta, 15 miles W N W, Arizona, June 17 and 24, 1933, and other dates in June, 1933, and at Betatakin and Nova Mt., July 13, 1933, all in Navajo County, Arizona. These were all collected by H. N. Hultgren of the Ansel F. Hall Expedition of 1933.

This subspecies resembles the race guttifera of oregona in having the pleurae cupreous whereas they are green in typical oregona. Superficially the cupreous upper surface contrasts with the usual chocolate brown of oregona as well as guttifera and marks it off as distinctly as does the brilliant color of the subspecies maricopa. In its color relationship to oregona it parallels arizonica as compared with carthagena.

FAMILY MELOIDAE

Lytta nevadensis Van Dyke, new species

Upper surface glabrous, dull blue, antennae, mouthparts, tibiae and tarsi black, and with a small red frontal spot. Head quadrate behind antennae and slightly broader than long, smooth, shining and sparsely punctured. Antennae slightly longer than head and prothorax, third segment a bit more than twice as long as broad, segments 4-10 moniliform, gradually broader or more robust outwardly and all somewhat longer than broad, the eleventh fusiform
and about three times as long as broad. Pronotum a little narrower than head, sides rounded, narrowed in front; disc moderately convex, finely alutaceous and somewhat dull, with a feeble median longitudinal groove at most and with a few fine punctures, chiefly towards the sides. Elytra finely rugose and feebly shining. Legs slender, anterior tibiae of males with two spurs, middle tibiae of males much bowed and the outer spur of hind tibiae stouter than inner, broader and concave at tip. Fifth ventral segment of male truncate, sixth emarginate and pygidium rounded at apex. Length: male holotype 9 mm., female allotype 11 mm.

Holotype, male, allotype, female (Nos. 5866 and 5867, Mus. Calif. Acad. Sci., Ent.), and numerous designated paratypes from a series of thirty-nine specimens collected by myself, July 3, 1941, in Kyle Canyon of the Charleston Mts. of southern Nevada. Most were feeding on Cowania stansburniana.

This species is related to stygica (Lec.) and runs to that in Fall's key (Trans. Amer. Ent. Soc., XXVII, 1901, p. 299) but it is eminently distinct. The variable stygica in all its color phases is always more shining, generally much larger, nevadensis varying from 6-11 mm. in length whereas stygica ranges from 7-14 mm., with longer antennae, the individual segments conspicuously longer, the upper surface often more or less pilose and the middle tibiae of males less bowed. The small size and supopaqueness of nevadensis are its most evident features.

Lytta sonorae Van Dyke, new species

Small, robust, head and prothorax shining, elytra somewhat dull; orange-yellow with antennae, palpi, eyes, tarsi, claws excepted, four spots on pronotum and a broad vitta, variable in length, extending from behind humeri towards the apex of elytra, black. Head quadr rate behind the antenna, broader than long and sparsely punctured. Antennae short, slightly longer than head and prothorax, third segment twice as long as broad, segments 4-10 moniliform, slightly broader outwardly except that in the male segments 4-6 are somewhat broader than seventh and eighth, the eleventh fusiform and about twice as long as broad. Pronotum narrower than head, comp anulate, smooth, sparsely and finely punctured, sparsely and finely pilose, and ornamented with four small black spots, two in the middle and one on each side, slightly in advance of the others. Elytra finely, densely rugose and clothed with a sparse, short pile. Legs moderately robust, anterior tibiae of males with two spurs, middle tibiae of males feebly bowed, and the inner spur of hind tibiae short and sharp, the outer longer, broader and concave at tip. Fifth ventral segment of males truncate, the sixth deeply emarginate. Length 8 mm . breadth 3 mm.
Holotype, male, allotype, female (Nos. 5868 and 5869, Mus. Calif. Acad. Sci., Ent.), the latter somewhat imperfect, and eight paratypes, collected at CARBO, SONORA, MEXICO, November 24, 1933, by H. S. Gentry and all in the Van Dyke collection of the California Academy of Sciences.

This species is closely related to *scitula* Champ., also from Mexico, but differs by being somewhat smaller, the head and pronotum being finely and sparsely punctured, not coarsely and densely punctured as in *scitula*, the elytra with but one black vitta to each elytron whereas in *scitula* there is both a submarginal and sutural black vitta and the males have the fourth and fifth antennal segments but little more robust than the following. The two species should be placed close to *Lytta biguttata* Lec. from our own Southwest though the latter has no vittae, merely a black subapical spot, and is much larger.

**Pleurospasta mirabilis** (Horn)

In the semiarid regions east of the Sierra Nevada mountains and extending from near Reno, Nevada, south to the Coachella and Imperial valleys of California and to southern Arizona, typical specimens of the above-named beetle may be found running over the desert sands. As defined by Horn in his original description, the most evident features are that the general color is “pale rufous, elytra pale yellowish,” and “oblong, broader behind, humeri moderately prominent, margin reflexed, suture elevated, and with four strongly elevated costae on the disc of each elytron, extending from base nearly to apex,” and with “four small brown spots at base, arranged in arc with convexity backwards, an irregular transverse band at middle interrupted by the costae, and a narrow subapical band.” These characters will apply to most specimens found in the territory indicated above. Farther to the east, as in New Mexico, Texas and Old Mexico, another race exists. This as shown by two specimens which I have from Loving, New Mexico, collected May 11 and June 3, 1945, by J. W. MacSwain, one specimen from Pecos, Texas, collected May 15, 1927, by J. O. Martin, and two specimens which I have received on loan from the Chicago Natural History Museum from Nuevo Laredo, Tamaulipas, Mexico, June 14, 1941 (Seevers and Dybas), which have the dominant color of the elytra almost a pure white, the four basal spots reduced to two, the post median band red rather than brown and black spots placed here
and there especially on the anterior and posterior margin of the bar. The costae as they cross the band are joined by transverse costae forming an irregular reticulation throughout the area. In addition the apical band is much more extensive than in typical forms and the prothorax narrower and with the disc more distinctly bituberculate and pitted. In the “Biologia Centrali-Americana,” the illustration is of this race.

This race I believe is worthy of a name, so I will designate it as Pleurospasta mirabilis reticulata Van Dyke, new subspecies, and indicate the LOVING, New Mexico, specimen collected on June 3, 1945, as the holotype (No. 5870, Mus. Calif. Acad. Sci., Ent.), the other specimens as paratypes, two in the collection of the California Academy of Sciences, and the Mexican specimens returned to the Chicago Natural History Museum.

**Family Scarabaeidae**

**Aphodius inyoensis Van Dyke, new species**

Of moderate size, nigropiceous, rufopiceous beneath, smooth and shining. Head without tubercles, rather evenly convex above, but little flattened laterally and with narrow side margins, the disc finely, evenly granulate throughout, the clypeus with a broad emargination in front, bounded laterally by obtuse angles, sometimes by a distinct tooth, genae prominent, the sides oblique, more or less straight and divergent. Prothorax one-fifth broader than long, sides arcuate, narrowing behind, hind angles broadly rounded, base feebly arcuate and with sides narrowly margined, the margin fading out at hind angles; disc moderately convex, finely, densely punctured and with a few larger punctures irregularly scattered though most numerous laterally. Elytra elongate oval, one-fourth longer than broad, feebly narrowed towards base, humeri well rounded; disc convex, distinctly striate, the striae finely punctured, intervals flattened forwards, feebly convex apically and each interval with a row of small punctures near their margins and a few irregularly scattered between the rows; wings rudimentary. Beneath finely alutaceous, moderately coarsely punctured in front and finely punctured on the abdomen, the punctures mostly placed transversely along the margins of the sclerites. Mesosternum with an acute carina between the legs which is laterally bounded by well developed episternal carinæ. Posterior femora finely sparsely punctured; the hind margin of the tibiae in fresh specimens fimbriate with short equal spinules; first segment of hind tarsi about equal in length to the two following. Length 6 mm., breadth 3 mm.

Holotype (No. 5871, Mus. Calif. Acad. Sci., Ent.) and numerous designated paratypes from a series of fifty specimens collected by
myself, from beneath cow manure, near Big Pine, Inyo County, Calif., March 27, 1937.

This species belongs in the cadaverinus group of Aphodius and according to the latest table of the group, that by Saylor (Proc. Biol. Soc. Wash., 53: 99-103, 1940) would run close to washtuca Robinson and rugoclypeus Hinton, both of which are definitely larger and more robust and with numerous coarse pronotal punctures. The distinctive features of inyoensis are the granulate head, the finely, densely punctured pronotum and the flattening of the elytral intervals with the double row of minute punctures. The gross pronotal punctuation so evident in all the other members of the group is lacking here.

Aphodius fenyesi Van Dyke, new species

Of moderate size, somewhat elongate and convex, piceous above, legs, under side and portions of head rufous. Antennae and palpi pale. Head moderately convex, without tubercles but with front somewhat gibbous, the occiput rather coarsely but not closely punctured, the sides finely and sparsely punctured; the clypeus very finely, somewhat obscurely punctured, feebly and broadly emarginate in front, the angles at the sides of the emargination distinctly dentate, the sides explanate, margins oblique, the genae rather prominent and obtuse angled. Prothorax about one-third wider than long, as wide in front as behind, sides feebly arcuate, the margins broadly explanate, a feeble impression near the hind angles which are well rounded, the base feebly arcuate and without marginal line; the disc moderately convex, with coarse punctures rather numerous over the basal two-thirds, denser at sides, and the apical portion and a median longitudinal space very finely and sparsely punctured. Elytra a little narrower at base than prothorax, gradually wider posteriorly, humeri obtuse; disc with striae well impressed and finely, closely punctured, the intervals flattened in front, feebly convex apically and finely punctulate. Beneath, the mesosternum coarsely, densely punctured, the mesopleurae more finely punctured, and the abdomen alutaceous and rather shallowly, sparsely punctured, the mesosternum not carinate. Anterior tibiae smooth in front, strongly tridentate externally but not crenate above, the first tarsal segment shorter than second. Posterior femora sparsely punctate, the hind margins of the tibia fimbriate with unequal spinules; and the first segment of the hind tarsi almost equal to the three following. Length 8 mm., breadth 3.5 mm.

Holotype (No. 5872, Mus. Calif. Acad. Sci., Ent.) and one paratype, collected at Flagstaff, Arizona, by Dr. A. Fenyes and now in the Fenyes Collection at the California Academy of Sciences.
This specimen belongs in the subgenus *Platyderides* Schmidt and is apparently somewhat related to *depressiusculus* Schm. (*marginatus* Lec.). The distinctive characters are in the head, especially the clypeal emargination with its lateral dentate angles and the pronotum with base without margin and the disc with its numerous coarse punctures, simulating in this regard many members of the cadaverinus group rather than most of its associates in *Platyderides*.

**Polyphylla nubila** Van Dyke, new species

Short and robust, reddish-brown, head and pronotum generally darker, the palpi, antennae and legs rufous, head and pronotum clothed with long, silky, light brown pile, sparser on basal portion of pronotum; the elytra irregularly clouded with patches of elongate white scales densely placed and with single scales peppered over the intervening areas. Head coarsely, densely punctured; clypeus with reflexed margins, densely, shallowly punctured, sides straight, diverging forwards, the front margin transverse and feebly bimarginate and with outer angles well rounded; the antennae (males) with a club that is 5 mm. long, 1 mm. longer than head, 2 mm. wide distally, and very much arched, and the terminal segments of maxillary palpi fusiform and at least three times as long as broad. Prothorax convex, apex emarginate, sides subangulate, the margin entire in front, feebly crenulate behind, the hind margin broadly lobed, the disc rather coarsely, irregularly punctured, a moderate longitudinal sulcus at middle, concealed to a certain extent by the stripe of white scales, and a large irregular impression on each side, also ornamented with scales, also numerous scales near the lateral and posterior margins. Elytra one-third longer than broad, with the surface irregularly, shallowly punctured and rugose and shining where not covered with scales, the apices broadly rounded and sutural angles right-angled. Pygidium densely clothed with white scales mixed with fine, short hairs except for a longitudinal line at middle which is naked and finely, transversely rugose. Beneath, fore body densely clothed with long, silky, light fulvous pile, the abdomen with white scales more or less densely disposed over the surface, especially near the posterior margins of the sclerites. Fore tibiae with a blunt tooth, near apex in male (mere knob in two specimens). Length 22 mm., breadth 10 mm.

Holotype, male (No. 5879, Mus. Calif. Acad. Sci., Ent.) and three male paratypes, collected at light, at ATASCADERO, SAN LUIS OBISPO COUNTY, CALIF., May 23, 1946, by George S. Mansfield, and kindly presented by him to the Academy.

This species stands well apart among Pacific Coast species because of its irregular, blotch like markings. Its ornamentation is even more irregular than in *variolata* Hentz and more pronounced.
Polyphylla diffracta arida Van Dyke, new subspecies

Rather small, rufous, head and pronotum generally darker, the palpi, antennae and legs somewhat lighter in color, head and pronotum rather sparsely clothed with long, fulvous pile; the pronotum with the usual three scaly vittae well marked, the elytra with the sutural vitta narrow and generally complete, the two discal and lateral vittae always much interrupted, so much in fact that the usual striped appearance is to a great extent lost, the intermediate areas irregularly peppered with scales. Head coarsely, densely punctured; clypeus with reflected margins, densely punctured though punctures generally concealed by densely placed scales, sides straight or feebly sinuate and divergent, the front margin transverse or vaguely bimarginate, with the outer angles well defined, blunt or feebly rounded at most; the antennae (males) with a club that is 4 mm. long, subequal in length with the head, 1 mm. wide distally and moderately arched, the terminal segment of maxillary palpi fusiform and about three times as long as broad. Prothorax convex, apex emarginate, sides subangulate, the margin entire in front, crenulate behind; the disc rather coarsely irregularly punctured, the median longitudinal sulcus and lateral impressions well marked and covered with densely placed scales, the rest of the area with scattered scales. A dense collar of long fulvous pile also projects from beneath the hind margin of prothorax as usual. Elytra 3 mm. longer than broad, with the surface irregularly shallowly punctured and rugose, the naked areas shining and the apices broadly rounded and sutural angles right-angled. Pygidium transversely rugose and with a uniform but not dense covering of elongated scales and fine pile. Beneath, the fore body densely clothed with long, fulvous pile, the abdomen irregularly covered with scales. Fore tibiae of males in general with two well developed lateral teeth (in about half of the specimens the upper tooth is abortive or absent). Tarsal claws all armed with a pronounced and acute tooth near base. Length 20 mm., breadth 9 mm.

Holotype, male (No. 5874, Mus. Calif. Acad. Sci., Ent.) and numerous designated paratypes from a series of twenty-two specimens, all males, collected at DUNS P.L.C., NAVAJO Mt., alt. 5580 ft., SAN JUAN COUNTY, UTAH, by H. N. Hultgren.

When first examined, I was inclined to consider the above a distinct species but upon further study have come to believe that it is only an extreme type or desert phase of Hentz; it is smaller, lighter in color, rufous as against reddish brown and has the clytral maculation as irregular as in variolosa Hentz whereas diffracta is quite regularly vittate in that regard. On the Ansel Hall Expedition, several quite typical diffracta were taken near Kayenta, Arizona, not such a great distance from the type locality of arida.
DISTRIBUTIONAL AND BIOLOGICAL NOTES ON THE SPECIES OF THE SUBGENUS MELANOPHILA OCCURRING IN WESTERN NORTH AMERICA (Coleoptera: Buprestidae)

BY W. F. BARR AND E. G. LINSLEY
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Melanophila (Melanophila) constitutes a unique group of Buprestidae because adults of this subgenus are attracted to fire, smoke and acrid fumes, frequently in large numbers and often from considerable distances. As a result they are popularly known as smoke beetles. A number of biological observations have been made on various forms, but since the species have not been easily distinguished and their distribution not understood, many such observations have either gone unpublished, or have been made on incorrectly determined material. Thus many of the early distributional and biological records concerning Melanophila (Melanophila) are questionable or incorrect.

Obenberger (1928) and Sloop (1937) have done much to clarify the status of the species in this subgenus and it is now possible to add to the distributional and biological knowledge of this group, as well as to summarize and correct certain previous records.

The data used in this report were gathered from material in the collections of the California Academy of Sciences, the University of California and those of the writers.

Melanophila (Melanophila) consputa LeConte


This species has been previously recorded from Oregon, California, and Arizona. However, it is apparently rather widely distributed over western North America, following the range of its host species of conifers. These hosts are recorded as Pinus ponderosa, P. murrayana, P. radiata, P. torreyana, P. attenuata, P. contorta and Libocedrus decurrens. Sloop (1937) reports a specimen "in the larval channel under bark of Eucalyptus globulus," but this record has not since been confirmed. Specimens have been
examined from the following new or more exact localities: Chiloquín, Klamath County, Oregon, July 23, 1922 (F. C. Clark); Esmeralda County, Nevada, June 12, 1908 (F. W. Nunenmacher) and Cananea, Dist. Arizpe, Sonora, Mexico.

Burke (1919), Chamberlin (1924), Van Dyke (1926, 1928), Linsley (1933, 1943), and Keen (1938) record this species as being attracted to fires and smelters.

**Melanophila (Melanophila) notata elegans** Sloop


This subspecies was described from specimens collected at Douglas, Arizona, which is located at the extreme southern border of the state. A specimen from Cananea, Dist. Arizpe, Sonora, Mexico, extends the range to the southwest for some 50 miles. Nothing is known of its host plants, but it is believed to breed in pines.

**Melanophila (Melanophila) acuminata** (De Geer)


*Melanophila acuminata* has had a number of species confused with it. It has now been established that *M. acuminata* is holarctic in its distribution, breeding only in coniferous trees such as pines, firs, and spruces. In western North America it ranges from Alaska at least as far south as Central California. Linsley’s record (1933) from Douglas, Arizona, was based upon *M. occidentalis* Obenberger (see below).

**Melanophila (Melanophila) occidentalis** Obenberger


This species was described from material which was merely labeled “California,” and has since been recorded more specifically from Orange County, California (Sloop, 1937), Southwestern Oregon (Beer, 1940), and Berkeley, California (Linsley, 1943). It appears, however, to occupy a rather wide range over western North America as may be seen from the following locality records:

Washington: Heartline, June 30, 1940 (H. P. Chandler).

Oregon: Klamath Falls, July 7, 1934 (Van Dyke); Grants Pass, June 2, 1939 (F. M. Beer).

Utah: Garfield, June 28, 1922 (Van Duzee).
California: Siskiyou County; McCloud, Siskiyou County, July 3, 1914 (Van Dyke); July 23, 1918; Castle Crags, Shasta County, July 19, 1921 (Van Dyke); Davis, September 19, 1930 (F. H. Wymore); Antioch, July, 1936 (E. S. Ross); Brentwood, July 28, 1936 (Van Dyke); Berkeley, September 27, 1921 (Van Duzeer), November 21, 1911 (J. C. Bridwell); San Francisco, October, 1918, October 6, 1931 (J. A. Kusche); Carmel, October 25, 1915 (L. S. Slevin); Dos Palos, Merced County, July 10, 1946 (K. S. Hagen); Los Angeles County; Claremont, October 22, 1927 (T. Craig); Lytle Creek, San Bernardino County, June 8, 1928 (Van Dyke); Needles, June 12, 1940 (W. F. Barr); Herkey Creek, San Jacinto Mountains, June 20, 1940 (E. G. Linsley); Idyllwild, June 29, 1928 (Van Dyke); Indio (E. G. Linsley, J. W. MacSwain); Blythe, May 16, 1937 (M. A. Embury); June 22-25, 1946 (W. F. Barr, E. G. Linsley, J. W. MacSwain, R. F. Smith), August 24, 1946 (W. F. Barr); Ripley, Riverside County, July, 1946 (W. F. Barr); Palo Verde, Imperial County, August 17, 21, 1946 (W. F. Barr, P. D. Hurd); Poway, San Diego County (Blaisdell).

Arizona: Jerome (Bruder); Ehrenberg, June 17, 1946 (W. F. Barr, E. G. Linsley, J. W. MacSwain, R. F. Smith), Douglas, June 7, 1930 (E. G. Linsley); “Arizona” (O. Dietz).


Sloop (1937) lists its host as “oak” and the specimen from Herkey Creek in the San Jacinto Mountains, Riverside County, California, was collected from Quercus kelloggi. Beer (1940) records Quercus garryana, Q. californica and Arbutus menziesii as additional hosts. Linsley (1943) has recorded the species on partially burned eucalyptus. Several of the specimens from Palo Verde, Imperial County, California, were swept from Larrea glutinosa tridentata and Tamarix. The specimens from Dos Palos, Merced County, California, and Ripley, Riverside County, California, were swept from alfalfa.

Apparently this is the only member of this subgenus known to breed regularly in broad-leaved trees and shrubs in western North America. This fact may explain some of the records of Melanophila (Melanophila) spp. from non-coniferous areas in this region. A factor correlated with the numerous hosts of M. occidentalis is the wide range this species occupies.

M. occidentalis was frequently observed in the Palo Verde Valley in southeastern California during the summer of 1946. On
June 21 a stockpile of creosoted railroad ties and poles in the town of Blythe caught fire and burned and smoldered for several hours during the afternoon. Large numbers of *M. occidentalis* were attracted to the area because of the fire and for the next few nights they were very abundant about lights in the town. At the extreme southern end of the valley, below Palo Verde, Imperial County, a number of specimens were taken at light on the nights of August 17 and 21. No known recent fires had occurred at this locality. Across the Colorado River at Ehrenberg, Arizona, examples were also occasionally taken at lights throughout the summer. The predominant trees and shrubs in this valley are *Tamarix, Acacia, Prosopsis, Parkinsonia, Larrea, Pluchea* and *Atriplex*.

Linsley (1933) has recorded this species (as *M. acuminata*) about lights at Douglas, Arizona, where it was attracted in considerable numbers by the fumes of a smelter plant.

*M. occidentalis* and *M. acuminata* are closely related. However, the general distribution and hosts of the two are quite distinct. *M. occidentalis* apparently occurs most commonly in southwestern United States although its range extends northward into the state of Washington; it breeds in broad-leaved trees and shrubs. *M. acuminata* occurs throughout the Holarctic Region and breeds in coniferous trees. The ranges of the two species overlap along the Pacific Coast from central California to Washington.

**Melanophila (Melanophila) atropurpurea** Say


Horn (1882) records this species from "Oregon to Texas in the mountain regions," Linsley (1933) from the San Francisco Bay Region, Doane et al (1936) from Kansas to the Pacific States, and Sloop (1937) from Arizona, Texas and Utah. Horn and Van Dyke were confusing two and probably three species: the Kansas, Texas and Arizona(?) specimens were undoubtedly *M. atropurpurea* while the others from Oregon and California(?) were either *M. acuminata* or *M. occidentalis* or both. Linsley's record also involves one or both of these latter species. The only specimens of the true *M. atropurpurea* seen by the writers were from Oracle, Arizona (Oslar), Texas (O. Dietz), and Fort Sam Houston, Texas.

Sloop lists the hosts of this species as *Pinus ponderosa*, Douglas fir and true firs. However, none of these trees extend their range.
into parts of Texas where *M. atropurpurea* is known to occur. It is reasonable to assume that this species has additional hosts and that some of the above records may be based on incorrectly determined material.

Doane et al (1936) list Monterey cypress, incense cedar, oak, and mountain mahogany as hosts. However, judging from the distribution of these plants two different species are probably involved, *M. acuminata* in the first two cases and *M. occidentalis* in the last.

**LITERATURE CITED**


The genus *Oplodontha*¹ Rondani apparently has its center of
distribution in tropical Africa, including Madagascar, where at
least fifteen described species are known to occur. Outside this
area, however, the genus is not well represented. Two species, *O. oasina* (Lindner) from North Africa and the widely distributed
*O. viridula* (Fabricius) are recorded from the Palaearctic Region,
but to date only one Oriental species, *O. rubrithorax* (Macquart),
which is also known from tropical Africa, has been referred to this
genus. A second Oriental species, *Stratiomys minuta* Fabricius, is,
however, clearly congeneric with *O. rubrithorax*, and in this paper,
I am describing a third, from the Philippine Islands.

*Oplodontha* was proposed by Rondani in 1863 for *Stratiomys
viridula* Fabricius. The character on which the genus was based,
namely, the absence of the "oblique venule (beyond the stigmatic
venules) uniting the marginal and costal veins" seems to be a good
one, provided that it is properly interpreted. The vein to which
Rondani refers is R₂₊₃, if the "stigmatic venules" are interpreted as
those forming the base and upper edge of the stigma; they cannot
include the one closing the stigma (that is, R₂₊₃), since that vein is
absent. Pleske² used the same interpretation (venis subcostali et
radiali junctis), but Lindner³, in adapting his key from Pleske's
work was apparently confused by that author's use of the
Schinerian system, although the resulting misstatement (sc und r₁
verschmolzen) was corrected in the diagnosis on page 84 (r₂₊₃ ist
mit r₁ verschmolzen). In this connection, however, I question the
correctness of Pleske's assumption that R₂₊₃ is united with R₁; I
think more probably that R₁ and Rs remain as two undivided
veins, rather than that the anterior branch of Rs coalesces with R₁.

¹The form *Hoplodonta*, as emended by Kertész, has been used by most authors.
Nevertheless, it is better to use Rondani's original spelling, even though it is not so
desirable from the standpoint of orthography.
³Die Fliegen der Palaearktischen Region, vol. 18, pp. 80, 84. 1938.
Another error into which authors commonly fall is to consider the vein mentioned by Rondani as R₂. Although this vein, like R₂⁺₃, is wanting, its absence is of no diagnostic value, whereas that of R₂⁺₃ seems to be.

Taken alone, this character is not a strong one; but the general wing pattern, along with other characters, is sufficiently distinct to be of generic importance. The following characters apply to all species known to me.

Genus Oplodontha Rondani

Flagellum of antenna six-segmented, the fifth segment minute and together with the sixth forming a short, blunt, style. Face protuberant. Eyes pilose or bare. Proboscis moderately elongated, when extended at least three-fourths head height, the labella rigid and slender. Scutellum semi-elliptical, with two distinct, though sometimes small, spines. Wing longer than abdomen; venation considerably reduced; vein Rₛ unbranched and distinctly bowed downward on its basal part, making the submarginal cell relatively broad; r-m sometimes wanting; discal cell sometimes wanting, when present small, its height less, usually considerably so, than the distance from its upper corner to the costal margin; vein M₁ wanting; veins M₁, M₂, and Cu₁ weak, often reduced to a stump and a fold, sometimes plainly evident throughout. Size usually small, most species being no longer than 6 mm.

Key to the Oriental Species

1. All femora largely black; all tibiae prominently black-ringed; venter black, except for a large yellow area on the second segment and narrow yellow posterior margins on the following segments........................................... luzonensis

   - At least front and middle tibiae entirely yellow; venter wholly yellow, or nearly so.................................................................2

2. Pleura without pale spots; scutellum wholly black; hind femur and tibia wholly yellow.........................................................rubriothorax

   - Pleura with conspicuous pale spots; scutellum yellow, except base; hind femur and tibia each with a black annulus.............minuta

Eulalia exigua Lindner,⁴ from Amboina, may belong to this genus as Lindner compares it with rubriothorax and minuta; however, his statement “D wohlentwickelt, mit zwei m-Asten” makes this disposition highly doubtful.

Oplodontha luzonensis James, new species

Female: Head chiefly yellow; a broad band on vertex, including ocellar triangle, another band above base of antennae, biareuate on its upper border and attenuated laterally, but narrowly reaching each eye, and the occiput, except its broad orbits, black; facial prominence, a small spot on each side and sometimes connected with it, and the larger part of the oral margin, brownish to black. Front rather strongly convex, its sides almost parallel; at vertex very slightly less and at base of antennae very slightly greater than half head width. Occipital orbit of moderate breadth, shining, bare. Eyes with rather dense, short, black hair; pile of head short, erect, rather dense, uniformly pale. First and second antennal segments, flagellum excluding style, and style in ratio of 18: 10: 32: 4; first and second segments yellow, flagellum, including style, brownish. Proboscis brownish to black.

Mesonotum black; humerus bright yellow; supra-alar callus brownish yellow; pleura chiefly black, on each side with four callus-like yellow spots, located one below humerus, one on mesopleuron anterior to wing base, one on pteropleuron below wing base, and one on upper part of sternopleuron; scutellum yellow, its base broadly black; spines short, blunt, yellow. Pile of thorax erect, rather dense, whitish; considerable whitish tomentum on mesonotum.

Coxae and trochanters black; femora black, except apices; each tibia with apical half mainly black; legs otherwise yellow, the tarsi darkened somewhat apically. Wing hyaline; stronger veins yellow; discal cell present; vein r-m wanting; veins M₁, M₂, and Cu, developed only at base, continued by a mere fold; Cu, and 2nd A weak.

Abdomen dorsally black, the very narrow lateral and apical margin and a small triangle at each apical angle of segments two, three, and four yellow; venter black, the narrow lateral and apical margin, the narrow apices of segments three and four, and a large trapezoidal spot occupying about the median half of segment two, yellow. Pile of abdomen short, inconspicuous, wholly pale.

Length, 4.5 to 6 mm.

Male. Eyes briefly subcontiguous above base of antennae. Occipital orbit not developed. Head black, except a prominent yellow triangle adjacent to the eye on each side of and below the facial prominence. Pile of thorax and abdomen as in the female, but longer and more conspicuous.

Oplodontha rubrithorax (Macquart)


This species shows considerable variation in the color of the legs; the front and middle femora typically have each a median black band, although the legs may be wholly yellow. The brassy to reddish pubescence of the thorax, which suggested the specific name to Macquart, is often obscure, and may be yellowish.

This species is widely distributed. Brunetti has recorded it from various parts of India, Ceylon, and Thailand, and Lindner has recorded it from the Belgian Congo. I have seen a number of specimens from Okinawa, Ryukyu Islands, May, 1945 (Richard Bohart); Mt. Makiling, Los Baños, Davao, and Biliran Is., Philippine Islands (Baker); and Bantar, Gebang, Java (Bryant and Palmer).

Oplodontha minuta (Fabricius), new combination


This species, according to Brunetti, is very widely distributed in India, and is extremely variable in the abdominal markings, which range from almost wholly yellow to almost wholly black.
A NEW SUBSPECIES OF MELITAEA
(Lepidoptera)

BY ROBERT G. WIND
Livermore, California

Discovery of a new subspecies of Melitaea leanira (F. & F.) was made by the author during a collecting trip to the Sierra in 1930. The butterfly was very local and several subsequent trips had to be made to obtain even a small series. In June, 1945, the author and Mr. T. W. Davies of Oakland visited Strawberry Lake, Tuolumne County, and managed to net a small series.

I take pleasure in naming this new subspecies after Mr. Davies.

Melitaea leanira daviesi Wind, new subspecies

**Male.** Fore wing ground color dark brown. Apical area extending over one-third of the wing bright orange russett, inner costal margin also bright orange russett. Hind wing as in leanira but with orange russett areas slightly more extended. **Female** as in male but with all colors brighter and slightly more extended. Beneath with black transverse bands more heavily black.

Holotype, male, Strawberry Lake, Tuolumne County, California, el. 5500 ft., June 26, 1945, and allotype, female, Strawberry Lake, Tuolumne County, California, el. 5500 ft., June 23, 1945, and eight male and eight female paratypes from the same locality and dates, also collected by Mr. Davies and the author.

For easy identification, I offer the following notes: *daviesi* is intermediate in coloring between *leanira* (F. & F.) and *wrighti* (Edw.). *Leanira* has both fore and hind wings of a dark black brown aspect, while *wrighti* has considerable orange russett on both fore and hind wings. *Daviesi* can be distinguished easily from these two species by the bright orange russett fore wings and the very dark black brown hind wings.

The types and some of the paratypes will be deposited in the California Academy of Sciences and elsewhere, while the balance of the paratypes will remain in the collections of Mr. Davies and the author.
THYSANOPTERA FROM NEW GUINEA, THE PHILIPPINE ISLANDS AND THE MALAY PENINSULA

BY DUDLEY MOULTON

Redwood City, California

This paper is presented as a partial report on the collections of Thysanoptera made by Dr. E. S. Ross in New Guinea and the Philippine Islands during 1944 and 1945 while serving in the Army. Most of the specimens were obtained on or under the bark of decomposing trees in rain forest areas. These collections are rich in material and the writer wishes to express his deep appreciation to Dr. Ross for the opportunity of examining them. There is also included the description of a new species from the Malay Peninsula which has been in the author’s collection for some time. Holotypes and allotypes of the new species, except as indicated, are deposited in the California Academy of Sciences. The numbers following records of specimens refer to slide numbers in the Moulton Collection.

Family Phlaeothripidae Uzel

Tribe Hoplothripini Priesner

Genus Agnostothrips Moulton, new genus

Body moderately stout, prothorax and fore legs heavy. Head approximately 0.33 longer than wide, flattened and not produced in front of eyes; with a distinct emargination between eyes and cheeks; cheeks slightly swollen behind eyes and then gradually reduced to base of head, roughened and bearing several small warts set with short spines; back of head faintly but distinctly reticulate; eyes prominent, semi-protruding, with numerous small facets; ocelli present; with one pair of long postoculars placed well back from eyes and near side margins of head. Antennae approximate at base, 7-segmented, 7 with a partial suture, segment 3 with three long sense cones. Mouth cone broad and strong, extending across pro- sternum, with pointed tip.

Prothorax heavy, 0.85 as long as head, with incomplete median thickening, sutures complete; all normal setae present, long, with pointed tips; fore legs strong, fore tarsus with a stout tooth; middle and hind femora also reasonably enlarged; wings with parallel sides, double fringes present. Abdomen normal, terga apparently
without sigmoid setae; tube approximately 0.75 as long as head, with parallel sides in basal two-thirds and reduced gradually in apical third; setae on segments 9 and 10 long.

Genotype: *Agnostothrips semiflavus*, n. sp.

This new genus is most closely related to *Symphyothrips* Hood and Williams but in *Symphyothrips* the cheeks are nearly smooth, without warts, the prothorax is relatively shorter, the tube shorter and shaped differently, also the third antennal segment has two sense cones.

*Agnostothrips semiflavus* Moulton, new species

Female: Prevailing color brownish yellow, head mostly yellow through the middle, darkened with brown at sides, prothorax more deeply shaded with brown, fore legs brownish yellow, middle and hind femora blackish brown, middle and hind tibiae and tarsi clear yellow; wings clear; antennal segments 1-4 colored like the head, 3 and 4 darkened apically and at sides, 5-7 blackish brown.

With characters as given for the genus; fore wings with 25 double fringe hairs.

Total length 3.8 mm.; head length 0.485 mm., width across cheeks 0.352 mm.; prothorax length 0.411 mm., width 0.602 mm.; pterothorax width 0.573 mm.; tube length 0.352 mm., width at base 0.117 mm. Antennal segments, length (width), III, 156 (66); IV, 146 (56); V, 120 (50); VI, 100; VII, 103 microns, total length 0.808 mm.; length of setae: postoculars 166, on anterior margin of prothorax 100, anterior angles 110, midlateral 156, outer on posterior angles 123, inner 133; on ninth abdominal segment 294, at end of tube 266 microns.

Type material and locality: holotype, female, No. 5879 (Calif. Acad. Sci., Ent.) taken at Maffin Bay, Dutch New Guinea, in June, 1944, by E. S. Ross (5657).

*Macrophthalmothrips flavafemora* Moulton, new species

Female: Prevailing color brown; occellar area, median portion of head behind eyes, abdominal segments 8-10 and all coxae black, sides of head and prothorax lighter, abdominal segments 2-7 each with a median dark blotch which extends to sides along anterior margin, otherwise mostly yellow; all femora yellow, middle and hind femora with a faint brownish shading in the middle, fore tibiae yellow, middle and hind tibiae yellow but each with a darkened band in the middle; antennal segments 1-3 yellow, 4-6 gradually shading darker but yellowish in basal portions, 7 and 8 blackish brown; wings nearly clear.
With all of the distinct characters of the genus; fore wings with 10 double fringe hairs.

Total length 2.27 mm.; head length 0.308 mm., width 0.191 mm.; prothorax length 0.191 mm., width 0.264 mm.; pterothorax width 0.338 mm.; tube length 0.147 mm., width at base 0.073 mm. Antennal segments length (width), III, 93 (26); IV, 76 (33); V, 43 (26); VI, 56 (23); VII, 33; VIII, 23 micron, total 0.426 mm.

Type material and locality: holotype, female, No. 5880 (Calif. Acad. Sci., Ent.), and one female paratype, taken on bark of a fallen tree, FINSCHHAFEN, NEW GUINEA, 1944, by E. S. Ross (5652, 5657).

This species is distinctive in having all femora clear yellow. The only other known species with all yellow femora, williamsi Hood, from Trinidad, has a narrower darkened band on middle and hind tibiae and the antennae are nearly white with segment 2 at the sides, all of 5 except pedicel and 7 and 8 dark brown.

Tribe HAPLOTHRIPINI Priesner

Dolichothrips fusipes Moulton, new species

Female: Color blackish brown except apical third of antennal segment 2, all of 3, fore tibiae and tarsi, which are brownish yellow; wings and setae clear.

Head 0.4 longer than wide, with straight cheeks, weakly reduced posteriorly; eyes moderately large, sub-ovate; postoculars long, pointed; antennae 0.6 longer than head, segment 3 with two sense cones; mouth cone reaching across prosternum, pointed; prothorax reasonably small, with an incomplete median thickening, all normal setae present, these long, pointed; wings narrowed in the middle, fore pair with 26-29 double fringe hairs; tube slightly longer than head, with straight sides, reduced gradually to apical end.

Total length 3.4 mm. with abdomen distended; head length 0.367 mm., width 0.259 mm.; prothorax length 0.19 mm., width 0.38 mm.; pterothorax width 0.47 mm.; tube length 0.41 mm., width at base 0.132 mm. Antennal segments length (width): III, 116 (46); IV, 120 (46); V, 110 (36); VI, 80 (33); VII, 66; VIII, 53 microns, total 0.676 mm.; length of setae, postoculars 161, on anterior margin of prothorax 103, anterior angles 83, midlateral 110, outer on posterior angles 156 microns.

Male: Similar in form and color to the female but with larger fore femora and fore tarsus with a short triangular tooth.

Type material and locality: holotype, female, No. 5881 (Calif. Acad. Sci., Ent.), and 14 female paratypes, allotype, and males, No. 5882 (Calif. Acad. Sci., Ent.), and 8 male paratypes, taken
at Maffin Bay and Finschhafen, New Guinea, during April, May, August and September, 1944, by E. S. Ross (5652, 5654, 5659, 5663 and 5666).

This species belongs in that group having dark brown middle and hind legs and is distinctive in its larger size, the greater number of double fringe hairs on fore wings and the relatively long tube.

**Tribe Phlaeothripini Priesner**

**Phlaeothrips claratibia Moulton**

This species was described from a single male specimen taken at Kipapa, Oahu, T. H. (Proc. Haw. Ent. Soc., 9, 3, 414, 1937), and now the female may be described as follows: general color almost identical with the male but somewhat darker; as in the male, the abdomen is nearly clear yellow with only the three terminal segments darkened, also all tibiae and tarsi are clear yellow; fore wings with 10 double fringe hairs. One specimen taken on bark, April 16, 1944, at Finshhafen (5652).

The only other species of *Phlaeothrips* known from New Guinea, *P. spinipes* Bagnall, has a relatively longer head with stronger spines and the fore femora have strong spines on the outside near the base, also antennal segments 3-8 are clear yellow.

**Genus Ecacanthothrips Bagnall**

This genus is richly represented in these collections from New Guinea and the following species, including two which are new, were found.

**Ecacanthothrips bagnalli** Priesner

Three females and two males taken on bark, April 16, 1944, by E. S Ross. These appear to be true to species as given in the description by Dr. Priesner (5652). There are two other series taken at Maffin Bay, in September, 1944 (5654), and in August (5659), which should probably be set up as a new variety due to the prevailing brown coloring of middle and hind tibiae, otherwise they are like the species.

**Ecacanthothrips sanguineus** Bagnall

Found in the 5654 series.
Ecacanthothrips coxalis Bagnall

Represented by five females and three males in the same series, along with *coxalis* var. *philippinensis* Priesner.

Ecacanthothrips leai Moulton, new species

Female: Color brown, with sides of head, second antennal segment and margins of all femora blackish brown, fore tibiae brownish yellow, lighter apically, these darker than middle and hind tibiae which are clear yellow, antennal segments 3-8 grayish brown, bases of 4 and 5 somewhat lighter, fore wings only faintly washed with light brownish gray.

Head short, relatively broad, only 0.2 longer than width across cheeks; cheeks broadened immediately behind eyes, roughened, with two or three minute spines on either side, these placed on barely visible warts; postocular setae long and like other prominent setae with dilated tips; prothorax normal, with all normal setae well developed; pterothorax approximately as wide as width across fore coxae; tube short, rather broad, 0.7 as long as head. Antennal segment 4 longer than segment 3, this with a single row of 12 sense cones; fore femora enlarged, fore tibiae smooth, fore tarsus with a narrow, pointed tooth; fore wings with 10 double fringe hairs.

Total length 1.85 mm.; head length 0.28 mm., width 0.235 mm.; prothorax length 0.16 mm., width 0.352 mm.; pterothorax width 0.382 mm., tube length 0.22 mm., width at base 0.073 mm. Antennal segments, length (width); III, 83 (46); IV, 90 (43); V, 83 (33); VI, (66); VII, 46; VIII, 36 microns. Length of setae, postoculars 113, on anterior margin of prothorax 66, anterior angles 106, middeltarsals 93, outer on posterior angles 100, inner 140 microns.

Type material and locality: holotype, female, taken at KUALA LUMPUR, MALAY PENINSULA, by A. M. Lea (No. 3421). Deposited in Moulton Collection.

This species resembles *E. crassiceps* Karny in general form but the fore femora are unarmed; it differs from *E. guineensis*, new species, in its shorter and broader head, the fourth antennal segment longer than the third and in the darker colored antennae.

Ecacanthothrips guineensis Moulton, new species

Female: Color blackish brown including antennal segments 1 and 2, and all femora except apical ends which are cleared to yellow; tibiae and tarsi clear yellow; antennal segments 3-5 brownish yellow, cleared to yellow at bases, 6-8 brown with 6 lighter at base; fore wings nearly clear, only faintly washed with light grayish brown.
Head 0.33 longer than width across cheeks, constricted neck-like at base, cheeks roughened, with two or three small cheek spines placed on inconspicuous warts; eyes large, with a distinct emargination at juncture with cheeks, these abruptly wider than width across eyes; postoculars prominent and like other body setae, with dilated tips; prothorax normal for the genus, with all regular setae; abdomen normal, terga 2-7 each with two pairs of sigmoid setae; tube short, approximately 0.6 as long as head, with straight sides. Antennal segment 3 with a single row of ten sense cones; fore femora enlarged, unarmed, fore tibiae unarmed and with almost smooth inner surface, fore tarsus with a short triangular tooth; fore wings moderately slender, with 12-16 double fringe hairs.

Total length 2.45 mm.; head length 0.294 mm., width across cheeks 0.22 mm.; prothorax length 0.147 mm., width 0.323 mm.; pterothorax width 0.367 mm.; tube length 0.176 mm., width at base 0.073 mm. Antennal segments, length (width): III, 106 (50); IV, 100 (43); V, 93 (33); VI, 90 (30); VII, 80; VIII, 40 microns; setae: postoculars 93; on anterior margin of prothorax 53, anterior angles 80, midlateral 50, inner on posterior angles 100, outer 60 microns.

Type material and locality: holotype, female, No. 5833 (Calif. Acad. Sci., Ent.), and two paratype females, taken on bark, April 16, 1944, by E. S. Ross at FINSHHAFEN, NEW GUINEA (No. 5652).

This species is distinctive with its unarmed fore femora, smooth fore tibiae and almost obsolete cheek warts, these being small and inconspicuous. *E. inernis* Buffa, also from New Guinea, has antennal segments 3-8 clear yellow; *E. inarmatus* Kurosawa has brown middle and hind legs; *E. bagnalli* Priesner has the fourth antennal segment longer than the third.

Subfamily Megathripinae Priesner

Tribe Megathripini Priesner

Bactrothrips (Bactridothrips) guineaensis Moulton, new species

Male: Color dark brown, abdomen mostly black; antennal segments 1 and 2 blackish brown, 3 and 4 grayish yellow with apical half of enlarged portion brown, 5 light brown with swollen end dark brown (other segments broken off) all femora blackish brown, somewhat lighter at bases, fore tibiae mostly yellow, shaded at sides, middle and hind tibiae like femora but yellowish in apical third, all tarsi yellow; wings washed with brown, darker along margins, cleared in apical fourth, median lines dark brown.

Head produced in front of eyes and including this process, 2.67 times as long as width at base; eyes prominent, with a slight emar-
gination at union with cheeks, these narrowed in median portion of head and widened again before joining with collar at base; anterior ocellus placed much farther in front of posterior ocelli than these are separated from each other; a pair of anteocellar setae, 160 microns in length, placed on a line midway between the anterior and posterior ocelli; postocellar setae (60 microns), placed midway between posterior ocelli and a line connecting posterior margins of eyes; first pair of postoculars small (40 microns), placed 23 microns behind eyes and 96 microns apart, second pair long (133 microns), placed 76 microns behind fore pair and 93 microns apart; a pair of cheek spines immediately behind eyes, these short, with blunt tips and two or three weak spines on either side near base of head. Antenna normal for the genus, fore wings with 48 double fringe hairs. Abdominal segment 6 with a pair of horn-like appendages, 0.514 microns in length, those on segments 7 and 8 about 88 microns in length. Tube long and slender, approximately eight times longer than width at base, clothed with numerous hairs standing up at about 45°.

Total length 6.75 mm.; head length 0.69 mm., width across eyes 0.28 mm., across lower cheeks 0.264 mm.; prothorax length 0.235 mm, width 0.47 mm.; pterothorax width 0.78 mm.; tube length 1.17 mm., width at base 0.16 mm.; antennal segments, length (width): III, 470 (50); IV, 367 (50); V, 338 (43); other segments missing.

Type material and locality: holotype, male, No. 5884 (Calif. Acad. Sci. Ent.), taken May 7, at FINSCHHAFFEN, NEW GUINEA (5667).

This species is close to B. furcatus Priesner from the Belgian Congo, but this species is larger and the wings are clearer with a dark median line which diffuses at its end into a brown colored area while in the new species the fore wings are strongly colored brown with lighter colored areas between the sides and the median streak.

Tribe Compsothripini Priesner

RHAEBOTHRIPS LATIVENTRIS Karny

One male specimen taken in May, 1944, at Finschhafen, (5666).

MACROTHRIPS PAPUENSIS Bagnall

sisted of only a few specimens. The present collections made by Mr. Ross in New Guinea include numerous specimens of all the species erected by Mr. Bagnall and all of the specimens which correspond to his *papuensis* are males while all of those which correspond to *intermedia* and *dubius* are females and we have concluded that *intermedia* is the female of *papuensis*. These specimens which could be referred to Mr. Bagnall’s *dubius* seem to be smaller and weaker forms of *intermedia*. Characters which were used to differentiate between the two species, the fore coxal projection, the inner tooth of the fore femora, position of the posterior ocelli as well as the teeth on the fore tibia show a blending variation between the stronger and larger *intermedia* and the smaller *dubius* but further material should be studied before including *dubius* also as one of the female forms of *papuensis* (5651, 5652, 5653, 5654).

**Machatothrips biuncinatus** Bagnall

Four females and 2 males taken April 16, 1944, at Finschhafen (5652).

**Machatothrips artocarpi** Moulton

This species was collected in great numbers, both male and female, at Maffin Bay, in August and September, 1944 (5654, 5659, 5652, 5653).

**Machatothrips quadrudentatus** Moulton, new species

Female: Color blackish brown, apical half of antennal segment 2, all of 3, also all tarsi brownish yellow; wings nearly clear at base and tip, brown through the middle and with a heavy brown line from near base to middle; prominent spines on head blackish brown, postoculars and setae on sides and end of abdomen clear yellow.

Head a little less than 0.5 times longer than wide, weakly narrowed behind eyes and at base; antecollar setae prominent, approximately half as long as postoculars, the second pair of postoculars reduced to minor setae; with three or four strong genal spines on either side. Prothorax normal, with an incomplete median thickening, all normal setae present. Abdominal terga 2-7 each with a pair of sigmoid setae near posterior margin; tube with straight sides, narrowed from base to tip, approximately 0.1 times longer than head. Antennae normal for the genus, segment 3 less than three times as long as its greatest width and shorter than segment 4,
3 with two and 4 with four sense cones; segment 8 constricted at base and shorter than 7; legs with thickened fore femora, these with four teeth on the inside, the first largest, placed just beyond the middle, the other three reduced gradually; fore tarsus with a stout triangular tooth; fore wings with 52 double fringe hairs.

Total length 3.85 mm.; head length 0.411 mm., width 0.279 mm.; prothorax length 0.205 mm., width 0.470 mm.; pterothorax width 0.617 mm.; tube length 0.441 mm., width at base 0.147 mm. Antennal segments, length (width : III, 143 (50); IV, 160 (50); V, 143 (46); VI, 93 (33); VII, 60 (30); VIII, 56 microns, total 0.779 mm.

Type material and locality: holotype male, No. 5835 (Calif. Acad. Sci., Ent.), taken in May, 1944, FINSCHHAFEN, NEW GUINEA (5666).

This species is most closely related to M. brevis Bagnall which however has a much shorter head, this being only slightly longer than wide and with straight cheeks, antennal segments 7 and 8 are closely joined and the fore wings have 30 double fringe hairs. In this new species the head is relatively longer, antennal segment 8 is constricted at the base and fore wings have 52 double fringe hairs.

**Dinothrips sumatrensis** Bagnall

This species is richly represented in these collections and is apparently one of the most common thrips in New Guinea. The specimens show many variations in size and the number of double fringe hairs on fore wings, some are much larger than those in my collection from India and the Malay Peninsula but there seems to be no single character that could be used to separate them even as a variety of the species (5651, 5652, 5654).

**Dinothrips monodon** Karny

Six males and one female, taken on bark of a fallen tree at San Jose, Mindoro, in the Philippine Islands (5655).

**Dinothrips jacobsoni** Karny

Nine males taken along with *D. monodon* Karny on bark of a fallen tree at San Jose, Mindoro, Philippine Islands (5655).

**Mecynothrips wallacei** Bagnall

One female taken on bark of a fallen tree April 12, 1944, at Finschhafen (5651).
EMPIMORPHA GENEATIS MELANDER, A BALLOON FLY FROM CALIFORNIA, WITH A CHEMICAL EXAMINATION OF ITS BALLOONS

(Diptera: Empididae)

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On several occasions during March, 1946, a number of conspicuous white objects which glistened in the morning sunshine were observed zigzagging back and forth through the air in small groups in the immediate vicinity of some Monterey pines (Pinus radiata Don) at Mill Valley, California. Scrutiny of the scintillating white objects from the ground revealed that they were carried by inconspicuous black insects which were difficult to observe closely or capture because they were flying at an altitude of 15 or 20 feet. Only by tying the net handle to a sturdy surf-casting rod and then mounting the top of a 6-foot stepladder was it possible to bring any of the specimens to net. They proved to be male flies belonging to the family Empididae and the white object which each carried was a delicate, frothy, balloon-like structure which invariably had a minute dipteran or hymenopteran adhering to its anterior surface. The flies were never numerous, but persistent collecting during the 1946 season resulted in the capture of about 30 of them, each with its balloon and prey.

Most of the specimens taken in 1946 were deposited in the collections of the University of San Francisco and the California Academy of Sciences, but three of them were sent to Dr. A. L. Melander who kindly identified them as Empimorpha geneatis, a species which he had described (Melander, 1902) from a single specimen collected by Baron somewhere in California. This holotype, a male apparently taken without a balloon, is now in the American Museum of Natural History. There seem to be no reports of further captures of this insect.

Inasmuch as during the 1946 season all the balloon flies possible were captured for museum specimens without much attempt to
observe their habits, little of interest concerning the biology of the species was learned at that time. It was resolved, therefore, to carry on a biological investigation if and when the flies returned in 1947. In the meantime a survey of the literature brought to light the following facts which are of interest in connection with other species of Empididae known to carry balloons or comparable structures.

History

The first mention in the literature of the balloon-making habit is to be found in the observations of Osten-Sacken (1877). During August, while visiting in the Swiss Alps, he had observed the air dances of a species which later was named Hilara sartor Becker. Between 9 and 10 o’clock each morning he noticed small swarms of this insect dancing in the well-known zigzag style among the sunbeams which penetrated the dense shadow of the fir forest. What attracted his attention to the flies was the brilliant white or silvery reflection which flashed each time one of the insects penetrated the sunbeam. He caught one of the specimens and found to his astonishment that it was an inconspicuous dull-colored fly, much smaller than he had anticipated. It was then that he noticed the white film-like balloon on the gauze of his net. It was so light that the slightest breath carried it away. As he caught specimen after specimen with the same results, it became apparent that the silvery sheen and larger apparent size of the flies were both caused by the packets of sparkling white tissue which they carried.

A number of entomologists studied H. sartor in the years that followed and there ensued a lively conflict of claims relative to the nature, function, and position of its balloons. Becker (1888) concluded that the males carry the balloons on their backs and that they serve as decorations to attract the attention of the females. Mik (1889) insisted that the flies carry the packets below their bodies where they are suspended by the legs. He advanced the idea that these somewhat flattened silken objects are used by the males as aeronautical surfboards. Handlirsch (1889) followed with a detailed study of the balloons during which he made some chemical tests. He found that they did not melt when warmed and were not dissolved by ether, benzol, or carbon bisulfide, although they were soluble in warm medium-concentrated potassium hydroxide, cold concentrated sulfuric acid, and in concentrated hydrochloric acid. Verhoff (1894) advanced the theory that the balloons, flashing in the sun-
light and never containing prey, served as warnings to predaceous insects and birds.

Meanwhile it had been discovered by Girschner (1889) and Mik (1894) that several other kinds of Hilara also carry glistening white objects in their aerial dances, balloon-shaped structures composed of definite silken threads which frequently held struggling prey. Some species use microdipterans exclusively whereas others utilize trichopterans and psocids as well. Hamm (appendix to Eltringham, 1928) added yet other species of Hilara to the list of those forms which bind they prey with silken threads and ascertained that one member of the genus, H. maura Fabricius, carries two quite distinct types of nuptial balloons. The common variety consists of the usual silken threads and ordinarily encloses prey, although the prey is sometimes replaced by a vegetable fragment and in rare instances the balloon is entirely empty. Hamm found the second type on only one occasion; numerous males and mated pairs were found carrying these balloons which consisted of sticky globules instead of silken threads. Prey was lacking in every case. Eltringham (1928), in discussing the material of these globules says, “So permanent are its qualities that the examples mounted on cards 15 years ago are still as viscid as when first obtained.” He adds that he found them to be soluble in water, rather slowly so in xylol, but insoluble in alcohol, ether, or chloroform. Hamm and Eltringham both suspected that the flies obtained these globules from some external source, possibly honeydew secretions.

Melander (1940) describes the aerial dances of Hilara granditarsis Curran, the first American species of the genus found to be a balloon maker. In Alberta during July he observed specimens of this fly dancing in small groups of 4 to 8 individuals among the spruce trees, a dozen feet or so above the ground. Some of the flies carried glistening oval balloons consisting of frothy matter. On drying, these very delicate structures collapsed and shrank to almost nothing. They quickly disintegrated when placed in alcohol.

The only balloon-making species of Empididae not belonging to the genus Hilara which has been recognized heretofore is Empis aerobatica Melander. This form was discovered by Aldrich and Turley (1889) during June near Moscow, Idaho. Their attention was first attracted to the glistening white balloons which were moving to and fro in the air some 8 or 10 feet above the ground. When some of these were captured it was revealed that each was carried by a male fly. The balloons were elliptical in shape, hollow,
and more or less open behind. Each was about twice the length of the fly which carried it and was composed of a layer of minute bubbles. The surface was sticky and in nearly every case there was a small dead fly pressed into the front end. The balloons were very delicate and collapsed and shriveled into flattened films within a few hours. One which was placed in alcohol disintegrated immediately.

1947 Observations

Returning to the observations of the writers on *Empimorpha geneatis*, it was February 22 that the first specimens for the 1947 season were seen going through their aerial balloon dance. The flies were in the same vicinity as in 1946, zigzagging to and fro among the Monterey pine trees, but this year they had moved the center of their activities to another tree. Since 1946, the one around which they had originally danced had been topped, thereby reducing its height by many feet. This change of location was a fortunate one because it facilitated observation in two important ways. For some reason, possibly a difference in prevailing air currents, the insects had reduced the altitude of the flight, frequently carrying on their dance not more than 6 feet above the ground in the new place. Furthermore, the new location provided a steady foundation for the stepladder when its use was required to study the flies at very close range.

The insects were observed to be active only in the early morning, appearing about 7:30 o'clock when the sun first struck the pine trees and continuing to fly until about 9 o'clock. On overcast days the period of activity was shortened, the dance beginning later and ending earlier. On rainy days, or if the fog was heavy, the flies did not even appear. The number of individuals seen dancing at one time varied considerably, ranging from a single individual at the beginning of the season or on overcast days to 20 or more on one sunny morning in the middle of March. The last flies were seen during the first week of April.

Specimens of *E. geneatis* are expert fliers and capable net dodgers, hence difficult to capture. A near miss sometimes causes a fly to drop his balloon which then either settles to the ground or is blown away by the wind. On other occasions a fly retains his grip on the balloon following a narrow escape from the net, but in doing so he loses both altitude and his balance and flies un-
certainly to a nearby shrub. Here he may rest for some minutes, allowing the observer to approach within a few inches and examine him closely. When swept roughly into the net the insects invariably drop their balloons, but when care is exercised and the stroke of the net is true and relatively gentle, they often hold tightly to their burdens and can be transferred with them to a breeding cage or other container. Imprisoned in vials they usually remain alive for 12 hours or so and in a screen-covered breeding cage provided with a fresh branch from the pine tree they sometimes survive as long as 24 hours. In both cases they frequently grip their balloons tenaciously until the very last. Invariably, however, they relax their hold when dying; this is also true when they are killed in cyanide bottles.

The balloons of E. geneatis vary somewhat in size, the larger ones averaging about 3 mm. in length or about half the length of the male fly. Sometimes, especially in the case of the smaller balloons which seem to lack the finishing touches, the shape is spherical, but typically it is somewhat flattened and elongated, suggestive of the likewise flattened type carried by the males of H. sartor. In most cases the width averages about 2 mm. and the thickness is approximately 1½ mm. The intensely white and glistening surface appears to be hard and dry but is actually quite viscid, so much so that when merely touched with a pine needle or insect pin it adheres thereto. Unfortunately, from the standpoint of ease in manipulation, subsequent release is difficult. The characteristic of brilliant and glistening whiteness seems to be possessed in greater or less degree by the balloons of all the species of Empididae for which they are described. Mik (1894), in writing of H. sartor, gives what is doubtless the best description of an observer’s reaction to his first glimpse of dancing balloon flies: “One thinks one sees snowflakes in the sunshine which seem to change at intervals into shooting silver sparks.”

The viscous quality of the balloon surface, although not mentioned in the literature for some species, is common to several. These include H. maura (the globular type of balloon without prey discovered by Hamm, 1928), H. granditarsis (Melander, 1940), and E. aerobatica (Aldrich and Turley, 1889). In many respects the balloons of the last form and of E. geneatis resemble each other most closely, in fact these seem to be the only two species known which have prey pressed into the sticky surface. The balloons of other prey-taking kinds seem to be composed invariably
of definite threads rather than of viscid globules, and in those cases where prey is present it forms the central nucleus of the balloon. In regard to E. geneatis, in every one of the approximately 130 balloons taken during the two seasons of collecting, the tiny prey was found attached to the anterior end with its abdomen and wings crushed into the surface. Never was there found to be more than a single prey to a balloon. For the 100 balloons examined during the 1947 season the prey represented three families as follows: Chalcididae 47, Tendipedidae 38, and Itonididae 15. The minute insects were always oriented so that the thorax and head projected free from the balloon, being directed forward and upward. It was always this projecting part of the prey's body that was grasped by the fly's middle feet when holding the balloon; never was an unmated male observed to grasp the balloon itself with his legs as described for E. aerobatica by Aldrich and Turley (1889). These authors illustrate the male of their species carrying his balloon by holding it with both the middle and the hind feet. In E. geneatis the only apparent contact between the feet and the balloon is where the middle tarsi are wrapped around the prey and in so doing touch the anterior surface. In this species the male sits, walks, and flies without relaxing his grip on the prey which he uses as a handle to hold the balloon.

In spite of its bulk the balloon inconveniences the male's flight in no apparent way. One fly easily took wing with six extra balloons adhering to the one he was carrying. The balloons of course are very light, 20 of them averaged only slightly in excess of 0.03 mg. each. Three male flies, by contrast, weighed 1.65 mg., 1.79 mg., and 1.88 mg. respectively, or more than 50 times the average weight of a balloon.

The question arises as to the length of time that a male carries the same balloon. It has been noted that caged specimens of E. geneatis sometimes live as long as 24 hours and that frequently they keep holding their balloons until they die. Certainly it is their instinct to retain the balloons indefinitely. In support of this conclusion it was discovered that uncaptured males do not discard their balloons when they retire from the morning dance. On several occasions males were found even in the late evening sitting among the pine needles and still holding their balloons. It seems, therefore, that a male which is unsuccessful in mating one day may keep the same balloon for another try the following day. However, the males are able to make new balloons when circumstances require
replacement of lost ones. This was determined when three of the flies which had dropped their balloons in the net were marked on the dorsum with a spot of yellow paint and released. One of the specimens captured the following morning had the yellow markings clearly visible. The balloon which he carried, although slightly smaller than the average, was otherwise normal, even to the pressed-in prey at the anterior end. Therefore, in order to avoid the depletion of the none-too-abundant *E. geneatis* population, it was decided that the considerable material needed for the chemical study should be collected by making use of this instinct to replace lost balloons. Subsequently, each male captured was immediately induced to drop his balloon and was then released to construct another one.

While no observations were made on the mating habits of *E. geneatis* during the 1946 season, considerable progress was made along this line in 1947. The only female taken during the first year was obtained quite by accident in company with a male which had been traced by following the path of his balloon as he floated away from the dancing group to settle high in the tree. The female, not heretofore observed, differs from the male by lacking the many, long, black, bristly hairs which occur in the latter sex on the face, cheeks, palpi, antennae, dorsum of the thorax, between the wings and halteres, and one the first abdominal segments. The occipital hairs of the female, although numerous, are much shorter than those of the male. Another sexual difference is the coloration of the occiput and the dorsum, both of these regions being noticeably less black in the female. The thoracic vittae are correspondingly more distinct in the female. Finally, the halteres and the proximal regions of the femora are definitely yellowish in the female instead of piceous black as in the male.

Because of the lower flight level of the insects during the 1947 season, it was possible for the observer to get very close to the swarm of males by standing on the stepladder. On several occasions he distinctly saw a female join the dancing group and zigzag in and out for a few turns among the balloon-carrying males. Then the blur of her black body fused with one of them, the mating flies with their balloon lost altitude for a moment, and the two floated off together to settle on the pine tree. Examination of the paired flies revealed that the male no longer held the balloon; doubtless he had transferred it to the female at their first contact in the air
and the preoccupation of the flies in this transfer was evidently responsible for the temporary loss of altitude of the mating pair.

As to the relative positions of the flies during copulation, the male is invariably astride the female, not the reverse such as Aldrich and Turley (1889) describe and figure for \textit{E. aerobatica}. In the case of \textit{E. geneatis} the male hangs to the pine needle by his front feet, his middle feet rest on the thorax of the female, and his hind legs straddle her abdomen, supporting her. The female holds the balloon with all of her feet touching its surface; never was she observed to grasp the prey as a handle for the balloon in the manner of the male, nor was she seen to make any attempt to keep the balloon orientated with the prey toward the front. Instead, she keeps turning the balloon from one position to another during copulation, apparently entirely unconcerned with the prey and certainly not trying to feed on it. This tiny insect is invariably unfit for food. Its abdomen is always ruptured and completely flattened against the balloon’s surface. Indeed it is doubtful if this species ever captures prey for food; never were the insects found to be in possession of prey other than the tiny one attached to the balloon. It is possible that both the males and the females feed exclusively on plant juices. On several different days representatives of both sexes were found feeding on the flowers of manzanita bushes (\textit{Arctostaphylos Cushingiana} Eastwood) which grow beneath the pine trees. They were found in company with two other species of Empididae which Dr. A. L. Melander kindly examined and found to be undescribed forms of \textit{Acallomyia} and \textit{Rhamphomyia} (Holoclera) respectively. Each of the flies observed was obtaining nectar by probing with its proboscis through a puncture which it had made in the base of the corolla. Here, as on all other occasions observed, the males of \textit{E. geneatis} were carrying their balloons with them.

**Discussion**

Since the female does not so much as fondle the prey and the balloon alone seems to be the stimulus which prompts mating, the question arises as to why the male goes to the trouble of capturing the prey. Why does he not present the female with an empty balloon as is done in the cases of \textit{H. sartor} and \textit{H. granditarsis}? The answer doubtless lies in the evolutionary sequence of the balloon-making
habit which was first suggested by Hamm although published by Poulton (1913). Hamm recognized three more or less distinct stages to which Melander (1940) has added a fourth. To elaborate this supposed sequence still further and to find the exact place of *E. geneatis* in the series, the following stages may be recognized:

1. Predaceous species in which the female is not averse to including the male among her victims.

2. Avoiding any cannibalistic attention on the part of the female, the male presents her with prey as a wedding gift which she sucks during copulation.

3. The prey, although still eaten by the female, has become the necessary stimulus for copulation.

4. The prey is presented in a simple gift package consisting of silk-like threads or viscid globules which serve to quiet its struggles.

5. The gift package is differentiated into a complex balloon which shares with the edible prey the function of stimulating mating.

6. The prey has become useless as food but continues to share with the balloon the function of stimulating copulation.

7. The prey, although still included, has lost its significance in courtship, the balloon remaining as the lone stimulus to copulation.

8. The balloon without prey is presented to the female.

It is apparent that *E. geneatis* represents the seventh stage in the above series. Observations on the epigamic behavior of *E. aerobatica* have been too limited to determine whether this species belongs in the sixth or the seventh category. The earlier stages in the sequence are represented by numerous species and the last one is illustrated by both *H. granditarsis* and *H. sartor*. It will be remembered that this second hilaran was the first balloon fly to be discovered, a fact which made the interpretation of the significance of its balloon a perplexing problem to the early workers.

In regard to the production of the balloon substance, the fact that *E. geneatis*, like other important balloon makers, seems to be restricted to the immediate vicinity of coniferous trees, may have some not yet understood significance. As for the actual source of the secretion, the vacuolated globules which comprise the balloons suggest that it is produced by the digestive system as froth-like bubbles coming either from the mouth or the anus. An examina-
tion of the other evidence favors the latter region, so that the process of balloon construction may be assumed to be somewhat as follows:

The male first catches his victim, an act doubtless prompted by an instinct dating back to his predaceous ancestors in an earlier stage of the balloon-making sequence. Inasmuch as the female of this species ignores the prey, it is apparent that its only function is to stimulate the male to construct the balloon. Of course it is possible that his instinct for predaceousness on this occasion is strong enough to cause him to suck the body fluids from the prey, thereby collapsing its abdomen. It may be assumed that the male overtakes the tiny insect in flight from behind, at least the head of the latter is always directed forward and upward. While still flying and while holding the thorax of the prey with the middle tarsi, the male apparently bends the tip of his body under and forward between his hind legs to press the first viscous globules firmly against the prey, flattening its abdomen and gluing down its wings. It is reasonable to conclude that the whole balloon is made by adding more and more globules, one at a time. Considering the shape of the entire structure, projecting backwards as it does from the insect which forms its starting point, it is apparent that such a balloon must be constructed from behind.

**Chemical Nature of the Balloons**

Turning now from theory to fact, not much has been written heretofore concerning the chemical nature of the balloons of Empididae and all the available information has been summarized in an earlier portion of this paper. As for the balloons of *E. geneatis*, these were prepared for chemical study by first removing the tiny insect which adheres to the surface of each. Macroscopic examination at this time revealed no obvious threads in the balloon substance, but a microscopic study showed semicrystalline threads of a white shiny material.

A number of preliminary solubility tests were performed; one balloon was used for each experiment. In fat solvents such as benzene, chloroform, or ether the material dissolved to a small extent since a white residue was obtained upon removal of the solvent. The balloons were insoluble in solvents such as water, 20% sodium hydroxide, concentrated and dilute hydrochloric acids, and also in 70% and 95% ethyl alcohol. They were soluble in
warm 2% sodium hydroxide. They gave a negative Liebermann-Burchard reaction (for sterols) but gave a positive Molisch test (for carbohydrates) and a positive Biuret test (for proteins) (cf. Hawk and Bergheim, 1937). The tests were performed on a micro scale using known sterols, carbohydrates, and proteins as controls. Ignition of several balloons gave a white ash indicating the presence of inorganic matter.

Twenty balloons were weighed on a micro balance and gave a total weight of 0.66 mg., each balloon weighing approximately 0.033 mg. The balloons were then transferred to a small test tube and extracted twice with 1 ml. portions of ethyl ether. The combined ether extracts gave a white waxy residue on evaporation. The insoluble balloons after extraction and drying appeared to have the same microscopic characteristics as the original balloons except that the shiny lustre was gone. The balloons now weighed 0.57 mg. so that the fat soluble (lipid) fraction of the original balloons amounted to 0.09 mg. or 14% of the total weight. In spite of their extraction with ether the balloons still gave a white ash on ignition. The Molisch and Biuret tests were repeated on 0.2 mg. of balloon material with confirmation of the positive results. A negative van Wisselingh's test (Wigglesworth, 1942) indicated that chitin was not a constituent.

A chemical examination of the balloons, therefore, revealed the presence of protein, carbohydrate, lipid, and inorganic matter. The insolubility of the balloons in the various solvents indicated that the protein and carbohydrate fractions are of high molecular weight. Solubility in dilute but not in concentrated alkali pointed to a mucoprotein, as did the other tests (cf. Levene, 1926). An attempt was then made to stain the balloons with toluidine blue which resulted in a violet coloration specific for sulfated polysaccharides (Lison, 1936; Jorpes, 1936). This indicated that the balloons are composed of a mucoprotein (a protein conjugated with a carbohydrate such as mucoitin sulfuric acid) coated with a small amount of lipid matter. The inorganic ash supports the data.

Mucoproteins and other carbohydrate-protein complexes are widespread through nature and have been shown to be constituents of such diverse substances as the protoplasm of jellyfish, serum, saliva, and gastric mucin (Meyer, 1945; Stacey, 1946). These findings are not incompatible with the assumption that the balloons of *E. geneatis* originate as secretions of the digestive tract.
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No. 1. April 9, 1947.
No. 3. October 30, 1947.
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