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PROCEEDINGS

OF THE

Hawaiian Entomological Society

VOLUME III

1913-1917
HONOLULU, T. H.

PROCEEDINGS OF THE HAWAIIAN ENTOMOLOGICAL SOCIETY.

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(* Indicates genera, species, etc., new to science.)

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ERRATA IN VOLUME III.

Page 67, line 19, for "1913" read "1912".
" 68, lines 6 and 8, for "1913" read "1912".
" 88, bottom line, for "*Cyrtaudra*" read "*Cyrtandra*".
" 90, line 24, for "*Trynoxylon*" read "*Trypoxylon*".
" 133, delete lines 16-20.
" 144, line 28, for "*Paralaptomastix*" read "*Paraleptomastix*".
" 170, line 1, for "revised" read "reviewed".
" 179, line 7
" 341, line 19
" 348, line 6 — "*Scaevola coriacea*" is a mistaken determination. It should be corrected to "*Scaevola frutescens*"=*lobelia*=*Koenigii*.
" 264, line 18, for "Forsorial" read "Fossorial".
" 288, line 1, for "*Attagnus*" read "*Attagenus*".
" 299, lines 14-15, for "ovipositor" read "ovipositors".

Page 301, line 9, for *"eleaocarpi"* read *"elaeocarpi"*.
" 302, line 2, for "phygophor" read "pygophor".
" 304, line 5 from bottom, for "gential" read "genital".
" 309, line 33, delete the comma after "ten".
" 314, line 5 from bottom, for *"lactepennis"* read *"lacteipennis"*.
" 340, line 7 from bottom, insert comma after "young".
" 341, line 6, for *"sandicensis"* read *"sandwicensis"*.
" 343, line 11, for *"alibdus"* read *"albidus"*.
" 346, line 17, for *"N."* read *"Nesodryas"*.
" 347, line 21, for *"myopoicola"* read *"myoporicola"*.
" 370, line 29, for *"Lucillia serricata"* read *"Lucilia sericata"*.
" 372, line 5, insert "along" after "bristles".
" 383, line 1, for *"lowesii"* read *"lewisi"*.
" 385, line 1, for "Hawawiian" read "Hawaiian".
" 389, line 12, after "about", insert " 6mm., the smallest being".
" 392, line 2, for the first "on" read "in".
" 411, line 13, for *companulata"* read *"campanulata"*.
" 412, line 3, for *"maritinum"* read *"maritimum"*.
" 428, In the Explanation of Figures, No. 2 should read "*D. erectus nigripennis,* aedeagus".
" 459, line 1, for *"Gryllus pacificus"* read *Gryllus oceanicus"*.
" 497, line 13, omit *"Cassia grandis"*.

ERRATA IN VOLUME II.

(Omitted from list in Vol. II Index.)

Page 58, line 45, for "(5)" read "(15)".
" 168, line 11, for "Lea" read "Froggatt".
" 196, second line from bottom, the authority for *Cremastus hymeniae* should be "Viereck" instead of "Crawford".
" 234, line 24, for *"aphoritis"* read *"aphoristis"*.

Vol. III. No. 1. SEPTEMBER, 1914.

PROCEEDINGS

OF THE

HAWAIIAN ENTOMOLOGICAL SOCIETY

FOR THE YEAR

1913

HONOLULU, HAWAII

PRICE 50 CENTS

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All correspondence should be addressed to the Secretary, Hawaiian Entomological Society, Honolulu, Hawaii, from whom copies of the Proceedings may be purchased.

Volume I of the Proceedings, for 1905-07 (in five numbers), contains 210 pages, 4 plates and 5 text figures. Price of the complete volume, $2.00. Volume II, No. 1, contains 35 pages, 1 cut and 1 portrait. Volume II, No. 2, contains 53 pages, 2 plates and 3 cuts. Vol. II, No. 3, contains 57 pages and 2 plates. Vol. II, No. 4, contains 45 pages and 1 plate. Vol. II, No. 5, contains 121 pages, 2 plates and 1 cut. Price of any single number, 50 cents.

JANUARY 2ND, 1913.

The ninetieth regular meeting of the Society was held in the usual place, President Muir in the chair. Other members present: Messrs. Ehrhorn, Giffard, Back, Swezey, Bryan and Warren.

Minutes of previous meeting read and approved.

Member elected—Alfred Warren.

PAPER READ.

Pseudococcus Species Found on Sugar Cane in Hawaii.

BY E. M. EHRHORN.

For many years there has been but one species of *Pseudococcus* or Mealybug reported as attacking sugar cane in the Hawaiian Islands. Mr. Albert Koebele, I believe, determined the species as *Pseudococcus calceolariae* Maskell, but I have not been able to find any authentic record of it. In the Fauna Hawaiiensis, a list of the Coccidae of the Islands is given by the late Mr. G. W. Kirkaldy, and *Pseudococcus calceolariae* is quoted as infesting sugar cane (Koebele and Maskell).

Again, in the Hawaiian Forester and Agriculturist, Vol. I, No. 6, June, 1904, Mr. Kirkaldy lists *P. calceolariae* under the genus *Trechocorys* and calls it Sugar Cane Mealybug, stating that it formerly caused considerable destruction to sugar cane, but is of little importance now, being controlled by *Cryptolaemus montrouzieri* and *Scymnus debilis*. Unfortunately nothing in the above papers gives us a clue as to the size and color of the insect and we are at a loss to know if it is the same species we find today on sugar cane.

The only attempt to clear up the mealybugs of sugar cane was in a paper read at the November meeting of the Hawaiian Entomological Society in 1909 by Mr. Jacob Kotinsky. At that time another species of Mealybug had been found by the late Mr. F. W. Terry, at Hilo, and the whole subject was taken up by Kotinsky, who after careful work settled on the two species as follows:

The large pink species which is found at the leaf bases on sugar cane he determined as *Pseudococcus calceolariae*, "The Pink Sugar Cane Mealybug". The small gray species which

Mr. Terry found at Hilo and which Mr. Swezey says he now finds at many other places on all the Islands, Kotinsky determined as *Pseudococcus sacchari*, "The Gray Sugar Cane Mealybug". I have always been in doubt about his determinations, especially about *P. calceolariae*, as I have specimens of material found on New Zealand flax in California which was determined for me by Professor T. D. A. Cockerell. Mr. Kotinsky had the loan of my slide of this species and says that on account of finding my species on New Zealand flax I took it for granted that it was *P. calceolariae*. However, he misunderstood me, for I told him that Mr. Cockerell was responsible for the determination. Again, the chaotic condition of all *Pseudococcus* species and the scattered literature prevented me from working over the species found here.

A short time ago while inspecting sugar cane at the H. S. P. A. grounds in company with Mr. O. H. Swezey, I found still another species attacking the sugar cane and I got interested and determined to settle the question if possible. After working over the different species for a few weeks I came to the following conclusion:

The large pink species determined by Mr. Kotinsky as *P. calceolariae* (Mask.), I determined as *P. sacchari* (Ckll.). The oblong gray species determined by Mr. Kotinsky as *P. sacchari* (Ckll.), I determined as *P. saccharifolii* Green, and the third species found by Swezey and myself I determined as *P. bromeliae* (Bouch.) although it would also fit Mr. Kuwana's *Pseudococcus ananassae* Kuw. of which I have no specimens but a copy of the description and figures. It might prove to be a synonym of *P. bromeliae*.

Not being satisfied with my own determinations I sent specimens of the three species to Mr. E. E. Green of Ceylon with a request to carefully go over the material. He has done so with the following remarks under date of November 20, 1912: "I determine your No. 1 as *Pseudococcus sacchari* (Ckll.). Cockerell's description of the species is, as you remark, very insufficient. But, so far as it goes, it fits your specimens well enough. Some of your samples show an eighth joint in the antennae, but this extra joint can be seen, in the making, from a transverse lacuna in the darker chitin of the normal 4th joint, to a fully developed division. The same variability occurs in the Indian examples that I have identified as *sacchari*. I have, unfortunately, no typical examples from Cockerell himself, for comparison. Your No. 2 differs from my *saccharifolii* in the following points: its smaller size; the very short 4th joint of antennae; the group of strong hairs between the antennae; the longer hairs on the abdomen and the much longer and stronger hairs of the anal ring. In other respects it is very like *saccharifolii*. It might be described either as a local variety of *saccharifolii* or as a new species, according to taste.

It is certainly not *sacchari* of Cockerell, nor will it fit *calceolariae* of which I have typical examples from Maskell himself.

Your No. 3 may very well stand as *bromeliae* (Bouché), but I have no other examples of that species with which to compare it. Signoret compares *bromeliae* with *adonidum*, and remarks that the marginal tassels of the former are smaller than those of the latter. If, as I believe, Signoret's *adonidum* is *longispinus* of Targioni, this description will fit in with your specimens. I have written to Kuwana to ask for examples of his *ananassae* which is not at present represented in my collection. *P. calceolariae* is a smaller and proportionately more slender species than *sacchari*. Moreover, it has normally eight jointed antennae."

It is clear that *Pseudococcus calceolariae* does not occur in the Hawaiian Islands as far as we know. The finding of *P. bromeliae* on sugar cane does not astonish me at all, as it is a very general feeder, being found on a great variety of garden plants and on the roots of cannas, and is a serious pest to pineapples.

In the discussion following, Mr. Swezey stated that in recently giving more attention to the mealybugs on cane, he had observed all three species in the cane fields of Oahu, Maui and Hawaii. Usually *sacchari* was most abundant, sometimes *saccharifolii*, while *bromeliae* was usually scarce when found.

NOTES.

Mr. Swezey exhibited two species of flies that were reared from decaying fruits such as papaia, tomato, etc., and called attention to an article by H. H. Severin in the December, 1912, number of the Journal of Economic Entomology, in which it was stated that specimens bred from decaying bananas had been identified by entomologists of the Bureau of Entomology at Washington, D. C., as *Notogramma stigma* Fab. and *Acritochaeta pulvinata* Grims. The latter had been going under the name *Charadrella* sp. among the local entomologists.

FEBRUARY 6TH, 1913.

The ninety-first regular meeting of the Society was held in the usual place, President Muir in the chair. Other members present: Messrs. Bryan, Ehrhorn, Fullaway, Swezey and Warren, and Mr. J. F. Illingworth, visitor.

Minutes of previous meeting read and approved.

The Committee on Common Names for Hawaiian Insects, after considerable discussion, was finally instructed to present a final report at the next meeting.

NOTES AND EXHIBITIONS.

Mr. Ehrhorn exhibited six nymphs of Cicadidae which he had recently found in soil amongst roots of plants (*Azalea,* etc.) imported from Japan.

Mr. Muir exhibited three male specimens of *Adoretus*: one the Japanese rose beetle of the Hawaiian Islands, one from Hongkong, and one from Malay Peninsula. In external characters they could not be separated, but their genitalia, which had been dissected out, showed distinct differences, thus indicating them to be three different species, and illustrating the difficulty often met with in distinguishing species unless the genital characters are examined.

Mr. Muir also exhibited specimens of two species of Trichogrammids recently bred from the eggs of *Draeculacephala mollipes.* The parasites had been found so abundant that of a few dozen egg-batches of this Jassid found in sedges in the swamps where it lives, no Jassids hatched, all of the eggs being parasitized. Mr. Fullaway had examined these Trichogrammids and pronounced them as belonging to the genera *Jassidophthora* and *Westwoodella* respectively.

Mr. Fullaway exhibited a collection of insects made on Laysan Island and French Frigate Shoals, Dec. 20-30, 1912. There were about sixty species in all, twelve of them being moths. Mr. Swezey had determined the latter and found two new species among them: a *Nesamiptis* and an *Omiodes.*

Mr. Bryan also exhibited a few Laysan Island insects, collected by him in April, 1911. These were mostly the same as those in Mr. Fullaway's collection, with one or two that were different species. Much interest was shown by all members in examining these collections.

MARCH 6TH, 1913.

The ninety-second regular meeting of the Society was held in the usual place, President Muir in the chair. Other members present: Messrs. Back, Bryan, Fullaway, Giffard, Swezey and Warren; and Mr. J. F. Illingworth, visitor.

Minutes of previous meeting read and approved.

The Committee on Common Names for Hawaiian Insects of Economic Importance presented a list which had been prepared. It was voted to accept the report of the committee, and that the list be printed in the next issue of the "Proceedings".

Mr. Swezey proposed the name of Mr. J. F. Illingworth for active membership.

ENTOMOLOGICAL PROGRAM.

Mr. Fullaway called attention to Dr. Perkins' description of *Trichogramma helocharae* in Bulletin No. 4, p. 58, Experiment Station H. S. P. A., and stated that the Jassid parasite which he had pronounced a *Jassidophthora* at the previous meeting seemed to agree very well with this description. Whereupon Mr. Swezey stated that specimens had been sent to Dr. Perkins for determination, and he had in a recent letter given *Trichogramma helocharae** as the name of the insect in question. Dr. Perkins had also stated that it should now be placed in the genus *Jassidophthora,* a genus more recently erected by him.

Mr. Swezey exhibited the adults, larvae, and their cases of *Hyposmocoma saccophora.* He had collected quite a number of the slender conical larval cases on rocks in Waimano Gulch a few weeks previously. A number of moths had already

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*In a later letter, after he had examined further material, Dr. Perkins pronounced this a new species. It was subsequently described by Mr. Fullaway as *Jassidopthora lutea.* See page 22.—Ed.

emerged and proved to be a species not previously collected by him, but described in the "Fauna Hawaiiensis" under the above name.

Mr. Giffard reported having this day received a cablegram from Dr. Silvestri at Cape Town, to the effect that he had arrived there with parasites of the Mediterranean fruitfly; that he would breed them there, then go on to Australia; breed them there, then finally proceed from there to Honolulu with them. Mr. Giffard was of the opinion that he had obtained these parasites in South Nigeria, where he had been searching for the Mediterranean fruitfly and parasites. Dr. Silvestri had found *Ceratitis capitata* at this place, but scarce. He had also found a Chalcidid parasite, specimens of which had been sent to Honolulu. In other parts of West Africa where he had been searching, he had found Braconids parasitic on various fruitflies. He had found a number of species of fruitfly of the genus *Ceratitis* in West Africa, but no *capitata* until he had reached South Nigeria. The new species that he discovered have been worked up and published by Dr. Bezzi.

Mr. Muir brought up the statement that an introduced insect sometimes drives out a competing insect which has been already present (probably native), and cited *Pontia rapae* as an example. *Pontia protodice* having become reduced in the United States after *P. rapae* had become introduced from Europe. Some discussion of the question followed.

APRIL 3RD, 1913.

The ninety-third regular meeting of the Society was held in the usual place, Vice-President Giffard in the chair. Other members present: Messrs. Back, Ehrhorn, Fullaway, Swezey and Warren; and Mr. C. E. Pemberton, visitor.

Minutes of previous meeting read and approved.

Dr. Back proposed the name of Mr. C. E. Pemberton for active membership.

Mr. J. F. Illingworth was elected to active membership.

ENTOMOLOGICAL PROGRAM.

Mr. Fullaway gave an interesting account of a trip up Opaeula Gulch in the northwest part of the Koolau Range, Oahu, March 30th, 1913. Besides himself, in the party were Messrs. Swezey, Kuhns, Wilder, and Messrs. Willet and Bailey, two men who had recently made a visit to the U. S. Bird Reservation at Laysan and Midway Islands. The party had spent the night at Mr. Goodale's mountain house, eight miles up the gulch, and were able to have a long day in the forest a little farther up the gulch, where fairly good collecting was found and a number of interesting captures were made.

Mr. Swezey exhibited some of the results of his collecting on the trip, among them being a new species of *Eupelmus* with an extremely long ovipositor, and a new Psyllid.

Mr. Swezey exhibited specimens and presented the following list of insects reared from Manienie grass:

Insects Reared from Manienie Grass.

BY OTTO H. SWEZEY.

On March 8th a small quantity of grass cut by the lawn-mower on my lawn in Kaimuki was placed in a large battery jar and the following insects have been collected therefrom as they appeared in the upper part of the jar, during a period of about three weeks:

17 *Isosoma* sp. Its larvae fed in the grass stems.

4 *Eupelmus* sp. A wingless species, parasitic on the *Isosoma*.

26 Encyrtids. An undetermined species. Habits not known.

10 *Adelencyrtus odonaspidis*. Parasitic on a Coccid on the grass.

9 *Perissopterus* sp. Four of them wingless. Probably parasitic on a mealybug on the grass.

4 *Polynema reduvioli*. Parasitic on eggs of *Reduviolus*.

3 *Cephalonomia* sp. A peculiar Bethylid lacking the usual wing venation. Habits not known.

1 Dryinid. Probably parasitic on a Jassid (*Phrynomorphus hospes*).

2 *Ceraphron abnormis*. Probably parasitic on the above Dryinid.

1 *Phrynomorphus hospes*. A Jassid that feeds in the grass.

2 *Scymnus debilis.* Probably fed on mealybugs.
2 *Hypothenemus eruditus.*
1 *Hypothenemus ruficeps.*
18 *Sericoderus* sp. A small Corylophid beetle.
1 Psocid.

MAY 1st, 1913.

The ninety-fourth regular meeting of the Society was held in the usual place. Members present: Messrs. Back, Ehrhorn, Illingworth, Kuhns, Pemberton, Swezey and Warren. In the absence of the President and Vice-President, the Secretary called the meeting to order and Mr. Ehrhorn was chosen chairman of the meeting.

Minutes of previous meeting read and approved.

Mr. C. E. Pemberton was elected to active membership in the Society.

Mr. Ehrhorn made some comments on a recent article in An. Ent. Soc. America on the loaning of "type" specimens, and gave some experience he had had in loaning "types" and their not being returned.

NOTES AND EXHIBITIONS.

Mr. Fullaway exhibited a lady-beetle (*Azya luteipes* Muls.) taken by Mr. Swezey a few days previously on a small avocado tree in the nursery at the Federal Experiment Station. By referring it to Mr. Ehrhorn, it was found to be a species introduced from Mexico by Mr. Koebele in 1907. It had been liberated at "Ainahau", Waikiki, where its larvae were subsequently found in 1908 by Dr. Silvestri and Mr. Kotinsky, feeding on Lecaniums. Mr. Ehrhorn reported it being found numerous at the same place in 1910 by himself and Mr. Kuhns.*

Mr. Ehrhorn remarked on the present abundance of *Hyperaspis jocosa* in Manoa Valley and other places. This lady-beetle was also introduced from Mexico by Mr. Koebele in 1907. It feeds on *Orthezia insignis.* It has spread to the tops of the

* More recently Mr. Bridwell has taken a specimen at the Government Nursery on King street.—Ed.

mountains near Honolulu. Mr. Kuhns reported recently finding it on the ridge above Waipio.

Mr. Fullaway exhibited specimens of the silk moth, *Bombyx mori.*

Mr. Swezey exhibited a Mymarid (*Anagrus,* probably a new species) bred from eggs of *Draeculacephala mollipes* collected April 8th. This makes four parasites that have been bred from the eggs of this Jassid in Honolulu, the others being: two undescribed Trichogrammids and *Ootetrastichus beatus.*

Mr. Swezey gave notes on recent observations on *Anomala orientalis*, and showed photographs of cane fields that had been severely injured by the larvae of this beetle. He also showed photographs of the beetles clustered on the flowers of *Leucaena glauca.* He had recently discovered this habit of the beetles, their feeding habits had not previously been known.

Mr. Swezey also exhibited three specimens of *Dyscritomyia* sp. reared from maggots which emerged from a snail (*Achatinella curta*) collected up the Opaeula Gulch far into the mountains, March 30th, 1913.

Mr. Ehrhorn reported on the roaches accumulating in great numbers in his fumigating room at the wharf during a period of several weeks that it had not been used.

JUNE 5TH, 1913.

The ninety-fifth regular meeting of the Society was held in the usual place, Vice-President Giffard in the chair. Other members present: Messrs. Back, Ehrhorn, Fullaway, Pemberton, Swezey, Warren, Wilder; and Dr. Silvestri and Mr. J. C. Bridwell, visitors.

Minutes of previous meeting read and approved.

Mr. Ehrhorn proposed the name of Mr. J. C. Bridwell for active membership in the Society.

ENTOMOLOGICAL PROGRAM.

At the request of the chairman, Dr. Silvestri, who had recently arrived with several species of fruitfly parasites from West Africa, gave a brief account of his itinerary with interesting incidents and discoveries at the places visited. He took ship at Bordeaux, July 25th, 1912; called at Teneriffe on the way; made investigations in Senegambia, French Guinea, Gold Coast, Nigeria, Kamerun, Congo, and South Angola. At these places he searched for fruitflies and parasites. Found several new species of *Ceratitis,* and several species of parasites at various places. He secured his supply of parasites at Nigeria and brought them via Cape Town and Australia, reaching Honolulu May 16th with a large supply of adult parasites. His complete report will be finished on his return to Italy, and in due season it will be issued as a Bulletin from the Board of Agriculture and Forestry of Hawaii.

Mr. Ehrhorn exhibited a large fly, *Ptecticus* sp. which he had reared from decaying substance in the soil of a plant shipment from Japan. The fly is related to our *Sargus.*

He also exhibited four specimens of a Cryptorhynchid, bred from seeds of *Heritiera littoralis* from Manila.

Also some specimens of a bug collected by Mr. Hosmer, April, 1913, at Parker Ranch, Kamuela, Hawaii. Mr. Swezey had examined the specimens and considered it either a variety of *Nysius lichenicola* or a new species of *Nysius.*

Dr. Back mentioned finding *Aleyrodithrips fasciapennis* on leaves of *Morinda.* probably feeding on *Aleyrodes,* and stated that this insect had previously been found only in Barbadoes and Florida.

Mr. Ehrhorn reported finding fifteen specimens of *Hister bimaculatus* in stable manure where housefly was breeding at the stable of the Board of Agriculture, May 16th and 18th, 1913. This is a beetle sent from Europe by Mr. Koebele the latter part of 1909. None had yet been taken except a single specimen by Mr. Swezey in December, 1909, at Waialae Dairy.

Mr. Swezey exhibited a female *Plusia pterylota,* recently collected by Mr. Giffard at his bungalow, Kilauea, Hawaii. The only previous record of this species is the description in the Fauna Hawaiiensis from a single male taken by Dr. Perkins in 1900 or 1901, in S. E. Koolau, Oahu. Mr. Swezey stated, however, that Dr. Perkins had informed him in a letter some months ago that some Plusias of his later collecting at Kilauea, and sent to the British Museum, had been pronounced by Hampson as this species. Mr. Giffard's specimen does not quite agree in coloration with the description of the male, but it is undoubtedly the same species.

Mr. Swezey also exhibited specimens of a small Chrysomelid beetle of the genus *Diachus,* which had not previously been noted here. He first found it in a flower head of *Leucaena glauca* growing along Makiki stream not far from the Experiment Station; later, on May 22nd, more specimens were found in the same place; and May 23rd one specimen was found in the same kind of flower in Honolulu Plantation above Pearl City.

From parasitized Aphids recently received from Mr. Muir in Japan, Mr. Swezey reported breeding a Braconid apparently the same as a species of *Aphidius* which he had reared from Aphids in Illinois in 1910. A few hyperparasites had also emerged which seemed to be the same as a species of *Pachycrepis* reared from *Aphidius* in Illinois.

Mr. Swezey read some extracts from a letter from Dr. Perkins replying to one in which Mr. Swezey had mentioned the list of Hymenoptera obtained from manienie grass and reported at the April meeting. Dr. Perkins stated in the letter that he had collected all of this list except the *Gonatopus* and *Ceraphron,* and the following others besides, from a certain yard on Bates street, Honolulu, about 1903-4: A second *Polynema, Dyscritobaeus, Pseudobaeus,* a black *Ceraphron,* one or two species of *Diapria, Westwoodella hilaris, Opisthacantha dubiosa,* two species of *Spalangia,* a very abundant wingless and ornamental *Aphelinus.* (The latter Mr. Swezey thought probably was *Perissopterus* as he had wingless specimens of this in his lot.) Later on *Sierolamorpha* and other things turned up in the same place. This yard was a rich collecting ground on account of the fact that the grass was allowed to grow uncut except as it was occasionally fed off by a Chinaman's horse.

AUGUST 7TH, 1913.

The ninety-sixth regular meeting of the Society was held in the usual place, Vice-President Giffard in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Kuhns, Swezey and Warren.

Minutes of previous meeting read and approved.

Mr. J. C. Bridwell was elected to active membership.

The resignation of Mr. C. F. Eckart, who had moved to Olaa, Hawaii, was presented and accepted.

The Secretary announced that Number 5 of Volume II of The Proceedings had been received from the printers and copies sent out in the mails: also that an index was being prepared for Volume II.

NOTES AND EXHIBITIONS

Mr. Swezey exhibited a male *Plusia pterylota* caught by Mr. Giffard at his bungalow, at Kilauea, Hawaii, July, 1913, which now makes a pair that Mr. Giffard has collected of this beautiful rare moth. The sexes are not exactly alike in color, the male is more ochreous suffused with vermilion red, while the female is more fuscous suffused with vermillion red.

Mr. Swezey also exhibited another moth caught by Mr. Giffard in the same place and which he considers a new species near to *Euxoa panoplias.*

Mr. Swezey also exhibited a specimen of the Mediterranean flour moth which he had caught in his house in Kaimuki, July 29th, the first record of this insect in the Hawaiian Islands.

Mr. Swezey further exhibited specimens of a small moth which he had reared from mines in the leaves of a sedge (*Scirpus maritimus*) occurring in the Kewalo swamps. It was first noted on May 14th, and again, on July 24th. The species had not yet been determined.*

Mr. Giffard related the capturing of a *Plagithmysus perkinsi,* a beetle that has seldom been taken. It was observed sitting on the bark of a "naieo" tree, but flew up quickly on being approached. It was fortunately secured by a quick sweep of the net.

Mr. Bridwell reported having observed a female *Stomorhina pleuralis* deposit an egg-mass in a glass tube. The eggs hatched the next day, and the larvae feeding on the dead adult had become quite large in but three days. Mr. Bridwell also reported having reared *Hydrotaea* from horse manure.

Mr. Swezey mentioned having reared *Chrysomyza aenea*

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* Later, specimens were sent to Mr. August Busck at the U. S. National Museum for determination. He pronounced it a new species and named it *Batrachedra cuniculator.*—Ed.

from maggots that were very abundant in a manure pile at Waialae Dairy.

Mr. Warren exhibited a Buprestid beetle with the following note:

Note on a Buprestid Beetle.

BY A. WARREN.

On July 1, 1913, a specimen of a Buprestid was found in the attic of the office building of the Experiment Station. The beetle when discovered was completely wrapped in the silk of a spider and lying on a piece of wrapping paper which had been placed on top of some shelves about two weeks before. Upon removing the silk, which was densely wound around the beetle, it was found that the legs were still flexible, and the specimen could be mounted without first relaxing it, the elytra showing no brittleness whatever. Even the antennae were very flexible, however one of them was broken off in the act of removing the mass of silk around the head. From this it may be inferred then that the beetle must have been entrapped and killed by the spider only a very short time before it was discovered.

So far the specimen has not been identified. The question naturally is, Where did it come from? In trying to trace it down in W. S. Blatchley's table of the Coleoptera of Indiana, it failed to agree with any of the descriptions. It may be, since boxes of all kinds from the Orient have been piled in the attic at various times, and since it takes some of the Buprestid larvae from one to three years to obtain their growth, that this specimen was transported in wooden boxes from some part of the Orient.

SEPTEMBER 4TH, 1913.

The ninety-seventh regular meeting of the Society was held in the usual place, Vice-President Giffard in the chair. Other members present: Messrs. Back, Bridwell, Bryan, Fullaway and Swezey; and Mr. H. T. Osborn, visitor.

Minutes of previous meeting read and approved.

Mr. Swezey proposed the name of Mr. H. T. Osborn for active membership.

ENTOMOLOGICAL PROGRAM.

Mr. Swezey exhibited a collection of insects made in July at Palmyra Islands by Messrs. Joseph Rock and Montague Cooke. The collection contained eighteen species, seven of which are known to occur in the Hawaiian Islands.

Mr. Ehrhorn exhibited a diminutive specimen of *Clytus crinicornis;* six specimens of a hitherto undetermined Tenebrionid, black with red spots, collected in decaying wood in Nuuanu Valley; a specimen of *Plusia pterylota* reared from a caterpillar found on hollyhock at Mr. Giffard's place at Kilauea, Hawaii; a Lepidopterous larva which had been handed to Mr. Kuhns by a doctor who reported it to have been vomited by a patient. This latter caterpillar was in good condition and on examination Mr. Swezey thought that it was probably *Anarsia liniatella,* and that it had probably been eaten in a plum or peach.

Mr. Ehrhorn also reported the finding of ants of the species *Technomyrmex albipes* in the blossom end of rose apple at Mr. Gartley's in Nuuanu Valley recently. His first record of this ant here was at Maunawili in 1912.

Mr. Fullaway exhibited specimens of four species of *Spalangia* obtained by himself and Mr. Bridwell in connection with their work of rearing the South African housefly parasite. Two species: *cameroni* and *simplex* were described by Dr. Perkins in the Fauna Hawaiiensis. The other two may possibly be undetermined species introduced by Mr. Koebele.

Mr. Giffard exhibited a collection of *Plagithmysus* taken by himself at Kilauea, Hawaii, and containing ten out of the twelve species known to exist there. He remarked on the ease with which one could collect a series of the species of these beetles by knowing where and how and by purposely going after them. He gave some general remarks about their habits and distribution, particularly in regard to their host trees and the fact that each species is confined to a single island.

Mr. Giffard also exhibited specimens of *Callithmysus koebelei* and *C. microgaster* from Oahu, both rare species; and two species of *Clytarlus*, illustrating generic differences from the other related genera.

Mr. Giffard further exhibited specimens of *Parandra puncticeps,* taken at light at his bungalow, Kilauea, Hawaii.

Mr. Bryan exhibited a Hippoboscid fly taken from a sea bird at the island Moku Manu, also a few other insects, one a *Sarcophaga* whose puparia were found under rocks, their larvae apparently having lived in the abundant accumulation of bird droppings close at hand. He showed numerous photos taken on his recent trip to this island, and reported collecting six species of plants, ten species of birds, and 112 species of marine mollusks.

Mr. Bridwell exhibited specimens and reported on the rearing of a *Sarcophaga* from larvae produced by female flies caught in the laboratory, a very interesting feature in connection with which was the fact that the larvae made cocoons in the sand in which to pupate. It was an undetermined species, commonly known as the red-tailed *Sarcophaga*. Mr. Terry had reared it on meat in 1910, as shown by specimens in the cabinets of the Experiment Station, H. S. P. A., but the habit of making a cocoon had not been noted.

Mr. Bridwell also remarked on the abundance of *Hockeria* sp.; and the taking of *Chaetospila elegans* and *Cephalonomia hyalinipennis* in a Chinese store on King street near Kalakaua avenue, being the first record for these two parasites in the Hawaiian Islands. They are supposed to be parasitic on some beetle in stored food products. The former was taken in Guam in 1911 by Mr. Fullaway, and described by him as *Spalangia metallica,* but it is now considered the same as the *Chaetospila* (*Cerocephala*) *elegans* described by Westwood in 1874.

Dr. Back exhibited a Kusai lime, or sour orange, showing a batch of eggs of *Ceratitis capitata* which had been killed by the oil escaping from the cells of the rind during the process of the formation of the egg cavity.

Insects from Palmyra Islands.

BY OTTO H. SWEZEY.

The following insects were collected by Messrs. Joseph Rock and Montague Cooke while on an excursion to the Palmyra Islands with Judge H. E. Cooper, the owner of the islands, July 12th to 28th, 1913. The party was chiefly engaged in the collection of the flora and the sea fauna of the islands and the collection of insects was a secondary matter. The small collection, however, is of great interest, as this is the nearest group of islands between the Hawaiian Islands and the South Pacific Islands, being almost in a direct line and nearly half way to Samoa. Of the eighteen species of insects collected, seven species, or over one-third of them, are known in the Hawaiian Islands; they are indicated by an asterisk.

Hymenoptera.

**Tetramorium guineense* Fab. This ant very abundant.

Diptera.

**Gnamptopsilopus patellifer* (Thoms.) 11 specimens.

2 species of Ortalidae. 3 specimens of each. 1 known in Honolulu.

**Hippelates* sp. 3 specimens.

Lepidoptera.

**Stagmatophora incertulella* (Walk.). The larvae feeding very abundantly in the male inflorescence of *Pandanus.*

Coleoptera.

2 species of Oedemeridae. 3 specimens and 14 specimens respectively.

**Melanoxanthus melanocephalus* Thunb. 1 specimen.

A brown Elaterid. 5 specimens.

A small black Coccinellid. 4 specimens.

Cossonid. 1 specimen.

Hemiptera.

Halobates wüllerstorffi Frauenf. 1 specimen taken on the open sea several miles from land.

Aphis sp.

Orthoptera.

**Anisolabis annulipes* Luc. 7 specimens.

Phisis pectinata Guer. 11 specimens.

2 species of small crickets. 1 specimen and 15 specimens respectively.

OCTOBER 9TH, 1913.

The postponed ninety-eighth regular meeting of the Society was held in the usual place, Vice-President Giffard in the chair. Other members present: Messrs. Bridwell, Fullaway, Illingworth, Osborn, Pemberton, Swezey and Warren.

Minutes of previous meeting read and approved.

Mr. H. T. Osborn was elected to active membership in the Society.

NOTES.

Mr. Fullaway reported finding the small ant, *Plagiolepis exigua,* spread all through Makiki and on the lower slope of Tantalus. It was very abundant at the Government Nursery, often getting into the ant-proof insectary. This ant was first recorded by Mr. Ehrhorn in January, 1912.

Mr. Pemberton said that he had observed the same ant abundant lately in Dr. Back's office on King street.

Mr. Bridwell related that a process called "sweating" takes place in all Dipterous pupae which have come under his observation in breeding fruitfly and hornfly parasites. He had noticed, however, a watery liquid exuding from the anus of a freshly formed puparium of a *Sarcophaga,* and that the freshly formed puparium of *Volucella obesa* exudes a whitish liquid from the anus. From these observations he inferred that the "sweating" was of a similar nature, occurring only when puparia were freshly formed.

Mr. Fullaway, in discussing this, stated that at first it was thought that this "sweating", or abundance of moisture that occurred when they had puparia in a mass, was an accumulation condensed from the air.

Mr. Bridwell called attention to the present abundance of the introduced wasp, *Trypoxylon bicolor.* Other members corroborated in this and Mr. Giffard related having first collected it as early as 1905.

A New Species of Oodemas from Laysan Island.

BY D. T. FULLAWAY.

Oodemas laysanensis n. sp.

Elongate oval, shining, aeneous black, antennae, trophi and tarsi reddish brown. Rostrum fairly long and broad, not widened apically; dull, subrugosly punctate. Eyes moderately convex. Antennae with the first funicle joint longer and stouter than the 2nd, the latter much narrower basally, 3rd and following joints round, moniliform, club greatly expanded. Pronotum moderately convex, strongly and closely punctured. Elytra conspicuously clothed with short, white setae, the serial punctures remote from one another, the interstices with very conspicuous and numerous fine punctures, the striae towards the apex of elytra deeply impressed. Beneath the metasternum is very coarsely punctured, the abdomen at the base between the hind coxae hardly less coarsely but not so closely, apical segment very finely and closely punctured.

Length 4 mm. Described from what is presumably a male specimen. The only other specimen taken has the rostrum considerably longer and is presumably a female.

Type specimen in Bishop Museum.

Habitat: Laysan Island.

Found under a piece of driftwood (ship timber) on the beach, Dec., 1912, (Fullaway). Quite a number collected in dead branches of *Scaevola koenigii,* April, 1911, (Bryan).

Two New Species of Moths from Laysan Island.

BY OTTO H. SWEZEY.

Nesamiptis laysanensis n. sp.

Male, female; 22-25 mm. Antennae ochreous, barred with fuscous above. Palpi ochreous, densely sprinkled with dark fuscous; in male short and rounded projecting about the length of head in front, in female elongate projecting three times the length of head in front. Head, thorax and abdomen varying from cinereous, to ochreous and light fuscous. Forewings cinereous or ochreous, irrorated or strigulated with brown or fuscous or whitish; first and second lines ochreous, sometimes almost obsolete, first line strongly curved outwardly, second line sinuate with a slight curve outward before middle and a strong curve inward below vein 2, included median band sometimes wholly and sometimes partially black-edged; often considerable whitish suffusion beyond second line; usually a series of blackish dots beyond second line extending from costa about half way across wing; orbicular represented by a black dot; reniform by a transverse blackish mark. Hindwings cinereous or pale greyish-fuscous; a faint darker discal mark. Legs cinereous-fuscous.

A variable species closely related to *N. obsoleta* (Butl.), but differing particularly by the first line of forewing being more strongly curved, and the second line strongly sinuate.

Hab.—Laysan Island, Dec., 1912, 12 specimens collected from Sporobolus grass (D. T. Fullaway).

Omiodes laysanensis n. sp.

Female; 19-22 mm. Antennae dark brownish-fuscous. Palpi dark brownish-fuscous, lower half white. Head whitish-ochreous. Thorax ochreous tinged with fuscous on base of patagia and on scutellum. Forewings light fuscous, darker on costa and dorsal portion of median band; with scattered ochreous scales and a suffusion of ochreous in the cell and on dorsal half of basal portion before first line; first line whitish, strongly outwardly curved in middle, costal half indistinct or obsolete; second line white bordered inwardly by dark fuscous, with a wide inward curve below cell; orbicular dot dark fuscous; a transverse dark fuscous discal mark. Hindwings light fuscous, basal half much suffused with whitish; postmedian line white, thick, nearly straight; a dark fuscous discal dot. Abdomen light fuscous, sprinkled with ochreous, segmental margins white. Legs whitish-cinereous.

Nearly related to *O. demaratalis* (Walk.), but differing particularly in being less ochreous, and in the strong sinuation in dorsal half of second line of forewing.

Hab.—Laysan Island, Dec., 1912; 3 specimens (D. T. Fullaway).

A List of Laysan Island Insects.

BY D. T. FULLAWAY.

This list includes those collected by Mr. G. P. Wilder in 1905; those collected by Professor W. A. Bryan in April, 1911; and those collected by myself on my trip to the island in December, 1912. It includes sixty species altogether, the most of which also occur on Oahu and the other large islands of the group. A few have proved to be new species.

Lepidoptera.

No. 1, *Euxoa* (*Agrotis*) *eremioides* (Meyr.). (Fullaway, Bryan).
2, *Euxoa* (*Agrotis*) *procellaris* (Meyr.). (Fullaway, Wilder).
3, *Agrotis dislocata* Walk. (Fullaway).
4, *Agrotis saucia* Hub. (Wilder).
5, *Nesamiptis laysanensis* Swezey. (Fullaway).
6, *Pyrausta dryadopa* Meyr. (Fullaway).
7, *Hymenia recurvalis* (Fab.). (Fullaway, Wilder).
8, *Omiodes laysanensis* Swezey. (Fullaway).
9, *Trichoptilus oxydactylus* (Walk.). (Wilder).
10, *Crocidosema plebiana* Meyr. (Fullaway).
11, *Hyposmocoma notabilis* Walsm. (Larval case only, and it had emergence hole of a parasite. Fullaway).
12,*Tineid, undetermined. (Fullaway).
13, Tineid, undetermined. (Fullaway).

Hymenoptera.

14, *Tetramorium guineense* (Fabr.). (Fullaway, Wilder).
15, *Monomorium gracillimum* (Sm.). (Fullaway).
16, *Monomorium minutum* Mayr. (Fullaway).
17, *Tapinoma melanocephalum* (Fab.). (Fullaway).
18, *Chelonus blackburni* Cam. (Fullaway).

* A species that occurs in Honolulu, and has recently been determined by Mr. August Busck of the U. S. National Museum as new, and named by him *Petrochroa dimorpha*.—Ed.

19, *Phaenopria* sp. (Fullaway).
20, *Tropidopria* sp. (Fullaway).
21, *Eupelmus* sp. (Wilder).
22, *Ectroma* sp.? Wingless ectromic Encyrtid. (Fullaway).
23, Mymarid. (Fullaway).

COLEOPTERA.

24, *Dermestes cadaverinus* Fab. (Fullaway).
25, *Attagenus plebius* Shp. (Bryan).
26, *Necrobia rufipes* De G. (Fullaway).
27, *Alphitobius diaperinus* (Panz.). (Fullaway).
28, *Tribolium ferrugineum* (Fab.). (Fullaway).
29, *Macrancylus linearis* Lec. (Fullaway).
30, *Oodemas laysanensis* Fullaway. (Fullaway).
31, *Rhyncogonus* sp. (Bryan).
32, *Calandra oryzae* L. (In food stores. Fullaway).
23, *Scymnus loewii* Muls. (Fullaway).
34, *Scymnus debilis* Lec. (Fullaway).
35, *Stephanoderes* sp. (Fullaway).

DIPTERA.

36, *Lucilia* sp.? (Fullaway).
37, *Musca domestica* L. (Fullaway).
38, *Hydrophorus* sp. (Fullaway).
39, *Lispe* sp.? (Fullaway).
40, *Scatella hawaiiensis,* var. *sex-notata* Terry. (Fullaway).
41, Tachinid. Undetermined. (Fullaway).
42, Drosophilid. Undetermined. (Fullaway).
43, Agromyzid. Undetermined. (Fullaway).
44, Phorid. Undetermined. (Fullaway).

HEMIPTERA.

45, *Reduviolus blackburni* (White). (Fullaway).
46, *Oronomiris hawaiiensis* Kirk. (Fullaway, Schauinsland).
47, *Nysius* sp. (Fullaway).
48, *Triphleps persequens* White. (Fullaway).
49, *Kelisia paludum* Kirk. (Fullaway).
50, *Aphis* sp. (Fullaway).
51, *Saissetia nigra* (Neit.). (Fullaway).

52, *Pseudococcus* sp. (Fullaway).

ORTHOPTERA.

53, *Periplaneta americana* (L.). (Fullaway).
54, *Polyzosteria soror* Brunn. (Fullaway).
55, *Phyllodromia* sp. (Fullaway).

EUPLEXOPTERA.

56, *Anisolabis annulipes* (Luc.). (Fullaway).
57, *Anisolabis maritima* (Bon.)? (Fullaway).

THYSANOPTERA.

58, Thrips. Undetermined. (Fullaway).

PSOCOPTERA.

59, *Ectopsocus fullawayi* Enderlein. (Fullaway).
60, *Kilaueaella* sp. (Fullaway).

Two New Species of Trichogrammidae.

BY D. T. FULLAWAY.

Jassidophthora lutea n. sp.

Lemon yellow, microscopically reticulate and roughened, almost opaque. Head large, transverse, more or less subquadrate; eyes round, front and cheeks broad, ocelli arranged in an equilateral triangle near the vertex; lateral members not close to margin of eye. Antennae 9-jointed, inserted on middle of face, scape rather slender, longer than the club, pedicel a trifle shorter and more or less obconic, all the funicle joints transverse, the 2nd the largest, club stout and distinctly three-jointed, all the joints outwardly from the scape bearing some stout setae. Pronotum narrow, mesonotum with distinct parapsides, scutellum transverse with a few short, bristly hairs. Abdomen ovate, the lateral margins marked with fuscous. Ovipositor only slightly exserted. Wings twice as long as wide, marginal vein though fairly long not reaching beyond the middle, also greatly thickened and somewhat curved basally away from the costal margin, stigmal vein short and broad, at right angles to the marginal with a short spur on outer face and contained in a fuscous cloud which reaches half way across the wing bending backwards in the form of an arch. A few bristles on costal margin proximally, the marginal fringe short but somewhat lengthened outwardly and about as long as a fifth of the greatest width of the wing on the posterior margin. Discal ciliation rather closely set, the linear arrangement more or less indistinct. Hind wings long and slender with two rows of discal cilia and a short costal and much longer anal fringe.

Length about 1 mm.

Westwoodella caerulocephala n. sp.

Lemon yellow, head with a bluish tinge, legs pallid. Microscopically reticulate, moderately shining. Head subquadrate, the face almost vertical, slightly concave, front wide between the eyes, the inner margins of which are almost straight. Ocelli just below the vertex in a small equilateral triangle, occiput curving gently on to the rather broad cheeks. Antennae 7-jointed, with a distinct ring joint, inserted on the middle of the face; scape long and slender, pedicel shorter and stouter, the single funicle joint as broad as the pedicel and club, about as long as the 1st joint of the latter and more or less obconic; club slightly swollen, nearly as long as the scape and acutely pointed at apex. Pronotum narrow, mesonotum broadly transverse, moderately convex, parapsidal furrows indistinct, scutellum small, convex. Abdomen short oval, the apex conically produced. Wings slender, with long marginal fringe and indistinctly hairy, 5 or 6 lines on the disc outwardly. Marginal vein a trifle shorter than submarginal but reaching middle of wing. There are three large setae and several smaller ones on its outer face. Stigmal vein short and capitate with an acute projection on its apical side and continued in a fuscous cloud almost to middle of wing.

Length .8 mm., expanse of wings 1.35 mm.; greatest width of forewing .18 mm.

This and the preceding species were bred from eggs of a Jassid (*Draeculacephala mollipes*) occurring in the swamps at Kewalo, Honolulu. Specimens were submitted to Dr. Perkins for determination, who pronounced them new species in their respective genera and turned them over to the writer for description.

NOVEMBER 6TH, 1913.

The ninety-ninth regular session of the Society was held in the usual place, Vice-President Giffard in the chair. Other members present: Messrs. Bridwell, Illingworth, Pemberton, Swezey and Warren.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Mr. Bridwell reported having swept from grass under guava bushes at Mr. Gartley's in Nuuanu Valley, recently, a small Curculionid hitherto unknown in the Islands. He also reported the finding of covered runs of the ant *Pheidole megacephala* on trunks of coffee trees, and also more or less of a similar covering amongst the coffee berries, and asked whether other of the ants here were known to make similar runs. Other members had observed at times these covered runs of *Pheidole,* but no one had ever observed any of our other species of ants making these runs.

Mr. Bridwell exhibited specimens of a Ponerid ant taken by Mr. Giffard that day at Moanalua, probably *Ponera kalakauae.*

Mr. Illingworth reported having observed *Pheidole megacephala* destroying large numbers of the maggots of the house fly in manure piles, or as they were crawling out to enter the ground to pupate; they were also taking the eggs as they were laid. This was followed by a general discussion of the prevalent conditions under which the house fly and the horn fly are breeding, and their parasites, predators, etc.

Mr. Illingworth exhibited a large collection of various orders of insects collected by him while in Fiji during the summer months.

Mr. Swezey exhibited eggs of *Prognathogryllus alatus* in midrib of a leaf of *Labordea membranacea,* found on Kaumuohona Ridge, Oct. 26, 1913. He also exhibited ten specimens of *Plagithmysus darwinianus* collected by him on a fallen *Sapindus* tree in a "kipuka", Kilauea, Hawaii, Sept. 28, 1913. This beetle is supposed to be associated only with the mamani tree, many of which occurred in the vicinity.

Notes on a New Ephydrid Fly.

BY A. WARREN.

On October 26, as I was walking through the taro and rice flats about a quarter of a mile Ewa of the Kapahulu Road church, I noticed in a flume, fed by an artesian well some little distance away, what at first appeared to be water bugs. Looking closer at these floating black creatures, it was observed that they were flies with undeveloped wings, i. e. being newly hatched. Soon two or three more came floating by, then some specimens with fully expanded wings, then again some more flies with wings not unfolded. The unwetable character of these flies and the still unexpanded wings of some of them, led me to believe that these specimens must breed in the water and that the emerging must take place near by. A little search proved this to be the case. It was found that the larvae of this fly feed upon, or at least in, the green algae common in flumes and fresh water anywhere, as both the larvae and the puparia were found in the algal masses in the flume. A number of puparia were also found hooked to the sides of the flume near the surface of the water.

This fly was traced down in S. W. Williston's tables found in his book, "The North American Diptera", to the genus *Ilythea* of the family Ephydridae. No record could be found of any species of this genus being found here. It is no doubt one of the many species of flies of these islands not yet described.

LARVA.—The larva is a slender, footless grub, ending posteriorly in a fork, the branches being about 1 mm. long. At the end of either branch is a whorl of four chitinous hooks. The length of the larva is about 6½ mm. long by ¾ mm. wide.

PUPARIUM.—As the puparium is the last larval skin, the pupal stage also possesses the hooked caudal branches. The puparium in general appearance, not including the caudal branches is roughly scalloped, or segmented, and spindle-shaped. The color is dark brown. Length, exclusive of caudal appendages, about 5 mm.; greatest width, about 1½ mm.

ADULT.—No further description will be given of the adult form until more is learned about this species.

DECEMBER 18TH, 1913.

The one hundredth regular and ninth annual meeting of the Society was held in the usual place, Vice-President Giffard in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Illingworth, Pemberton, Swezey and Warren.

Minutes of previous meeting read and approved.

Reports of the Secretary-Treasurer were read and voted to be placed on file.

Election of officers for 1914 resulted as follows:

President......................................OTTO H. SWEZEY
Vice-President................................W. M. GIFFARD
Secretary-Treasurer........................J. C. BRIDWELL

Appointed as Editor of the Proceedings—Otto H. Swezey.

NOTES AND EXHIBITIONS.

Mr. Giffard exhibited a cabinet drawer of Hawaiian Crabronids, collected by him on the several islands of the group. All the described species, numbering eighteen, were represented in the collection. There were large series of both sexes in the majority of the species exhibited, many of the latter showing the extreme as well as intermediate variations of color in certain of the groups. Among the collection were exhibited male specimens of what may later be determined as a new species of the genus *Melanocrabro,* from Kauai. Mr. Giffard also reported having lately captured several specimens of varieties of *Xenocrabro distinctus* and *Nesocrabro compactus* on the lava flows of Kau, Hawaii, at an elevation of approximately 2,000 feet. The first species is recorded from Oahu only, whilst the latter only from Kauai and Lanai. Neither has been previously recorded from the Island of Hawaii, where they are certainly not common.

Mr. Bridwell exhibited specimens of the larvae of the cabbage butterfly collected in Kalihi Valley, apparently showing the "flacherie" disease. He was in search of *Pteromalus puparum,* which was liberated in large numbers in 1910 by Mr. Ehrhorn and has never yet been recovered.

Mr. Swezey exhibited a fine specimen of *Buprestis aurulenta* Linn., taken by Mr. Speare of the Experiment Station staff, on his parlor table at his house on Prospect street, Honolulu. Mr. Ehrhorn suggested that it had probably bred out of imported lumber from the Pacific Coast of the United States.

Mr. Swezey also exhibited a single winged specimen of a very peculiar ant which he had taken on his desk at the Experiment Station, Nov. 17, 1913. It had probably flown in at a nearby window. Mr. Bridwell had examined it and traced it to *Epitritus,* or some other closely related genus to *Strumigenys,* these being ants with quite peculiar characters. The specimen will be sent to Dr. W. M. Wheeler for positive determination.

Mr. Swezey further exhibited specimens of *Coptotermes* sp., a species of termite not hitherto recorded in the Hawaiian Islands, and belonging to a genus several species of which occur in the Orient and in Australia. He had collected his specimens from the floor timbers of the Kamehameha Chapel, Dec. 5th, where they had been doing very destructive work, and had evidently been at it for a considerable time. They apparently had gained access to the woodwork by building mud-covered runs up the surface of the stone wall from the ground beneath the floor, a habit not observed in the other two species of termites recorded for Hawaii. This termite is quite distinct from these other species in its smaller size, and in the soldier possessing a round hole in the front of the head above the clypeus, from which it can emit a milky fluid. In the Fauna Hawaiiensis, Dr. Perkins stated that there were other termites in Honolulu besides the two species named. It may be possible that this species of *Coptotermes* is widely distributed here. A lookout should be kept for it and especially for the winged forms, which were not present in the colony in the Kamehameha Chapel.

PRESIDENTIAL ADDRESS

BY F. MUIR.

This meeting brings to a close the ninth year of our Society. The first meeting was held December 15th, 1904; since then we have held 100 meetings. During this period we have published two volumes, consisting in all of 521 pages and 11 plates, as well as many text figures. At no time has our membership been greater than 40, and then many are patrons rather than members, whose generosity enable us to publish our "Proceedings". Besides the many papers dealing with our local insect fauna, which will be invaluable to future entomologists in these Islands, we have published descriptions of many new species from other places in the Pacific. The results may appear small when compared with those of some of the larger Societies on the mainland; but when we consider the small, isolated community from which we have to draw our members, I think you will all agree with me in looking upon the achievements of our little Society as fully justifying its existence. Nor does this represent the entire activity of our members, for, apart from professional work, which is published by the respective Bureau or Station of the members, several of our members have published extensively elsewhere.

I do not make these remarks in a spirit of vainglory, but simply because pessimism will ofttimes attack our hearts, and we wonder if all the trouble of keeping our Society in existence is in a worthy cause. Well, gentlemen, I consider anything that brings us together to discuss the science which we are devoted to, and enables us to place on record our observations and opinions, is well worth the time and trouble expended upon it.

Several of our active members are professional Entomologists whose energies are directed to the study of the economic aspect of our science. Although it is not within the scope of our Society to deal with such questions from a practical point of view, yet so many of these questions are so bound up with questions of biology and evolution, that we must consider them together.

The work which has attracted the greatest attention in our Islands, but not the only work undertaken, as some, unacquainted with our Islands, maintain, is the use of natural enemies to control insect pests. In this work there is a good example of the dependency of "economic" upon "scientific" entomology. In attacking a problem from this point of view, the first thing to be done is to correctly identify the species of the pest in question, to study its geographical distribution, and to judge of the most likely locality for its original habitat. Thus we are dependent upon the work of the systematist, and require his very best work. Had a wrong determination been acted upon in the case of *Perkinsiella saccharicida,* Messrs. Perkins and Koebele might have proceeded to some other part of the world from which they did, and their efforts might not have been crowned with the success that they were.

Another case, now historic, which will demonstrate this point, is that of *Ceratitis capitata.* Several entomologists searched in various parts of the world for natural enemies of this world-wide pest, and it was given out by more than one that none existed; not one of them visited that region which the study of the systematic position of the insect, and the geographical distribution of the genus, indicated to be its natural habitat. The fact that both North and South Africa suffered from the ravages of this fly turned people's attention away from any other portion of that continent; the presence of natural land barriers between these two places and Central West Africa being forgotten. Mr. W. M. Giffard, when organizing the expedition last year, on behalf of the Board of Agriculture and Forestry, took these facts into consideration, and we know the success attending Professor Silvestri's researches.

The time is now passed for discussing the value of parasites in controlling insect pests, or whether parasites do control the increase of their hosts; success has demonstrated that, under certain conditions, the value of parasites is very great. That all cases of insect ravages cannot be controlled by this means is best recognized by those engaged in such work. That this method cannot be greatly extended is due to our ignorance, and we shall never attain to the success possible until our knowledge of insect biology, systematics and geographical distribution is very much greater than it is at present. It would be easy to state cases where wrong identifications have made the center of distribution of a genus appear to be in one hemisphere whilst, in truth, it is in the other.

These considerations show how "practical" entomologists are dependent upon the work of their "scientific" brethren, and how they require the very best work that can be given them.

But the debt is not all on one side. When the "economic" entomologist has discovered the chief death-factors of an insect, and, by introducing them into another region produces the same condition as exists in the original habitat, the evolutionist must take these facts into consideration, and not place the whole burden of the struggle for existence upon some more conspicuous, but less-important, factors.

The investigation of the various death factors which make up the struggle for existence of a species, and the transportation of certain of them to a new locality, naturally leads one to consider what part in natural selection they play. It is in the hope of turning attention towards certain aspects of these complex problems that I bring before you the following notes on:

The Effect of Parasitism on the Struggle for Existence and Natural Selection.

Darwin laid great stress upon the severe competition among closely allied organisms. These animals, living under the same conditions, and upon the same food, are brought into closer competition than those having different habitats and food. Among the higher animals an active, physical struggle is presumed to take place, while among the lower animals this struggle is presumed to be passive.

Among phytophagous insects it is difficult to follow all the stages of this competition, for there is never a direct struggle, and only on rare occasions, and as an abnormal phenomenon, is there a shortage of food which causes a direct competition.

The phenomenon familiar to every field entomologist, of two or more closely allied species of equal fertility, and living under similar conditions, standing in vastly different numerical ratio to one another, is bound up with this question of competition. If we study these allied species *separately* it is very difficult to find a reason for this numerical difference; but if they be studied *as a group* then the cumulative effect of the various death factors acting upon them, some of which, taken separately, may appear insignificant, may appear as a sufficient reason.

An allied phenomenon, of an introduced insect supplanting a native allied species, of which *Pieris rapae* in Canada is a good example, is also connected with the same question of the struggle for existence. In some such cases it is possible that the intruder upsets the balance of parasitism, and thus brings about the reduction or extermination of the native species.

In the following examples the figures are imaginary for the sake of convenienc, and should be considered as proportions rather than individuals; but the original observations and deductions that led to them were made on a genus of Delphacidae (*Perkinsiella*) during four years' observations, extending over the Western and Southern Pacific. My own observations, added to those of Messrs. Perkins and Koebele, have shown that the main death factors working upon the genus in China, Java, Borneo, the Moluccas, New Guinea, Australia and Fiji are similar; yet in those regions in which two or more species exist side by side there is often a great difference in the proportional numbers of the species.

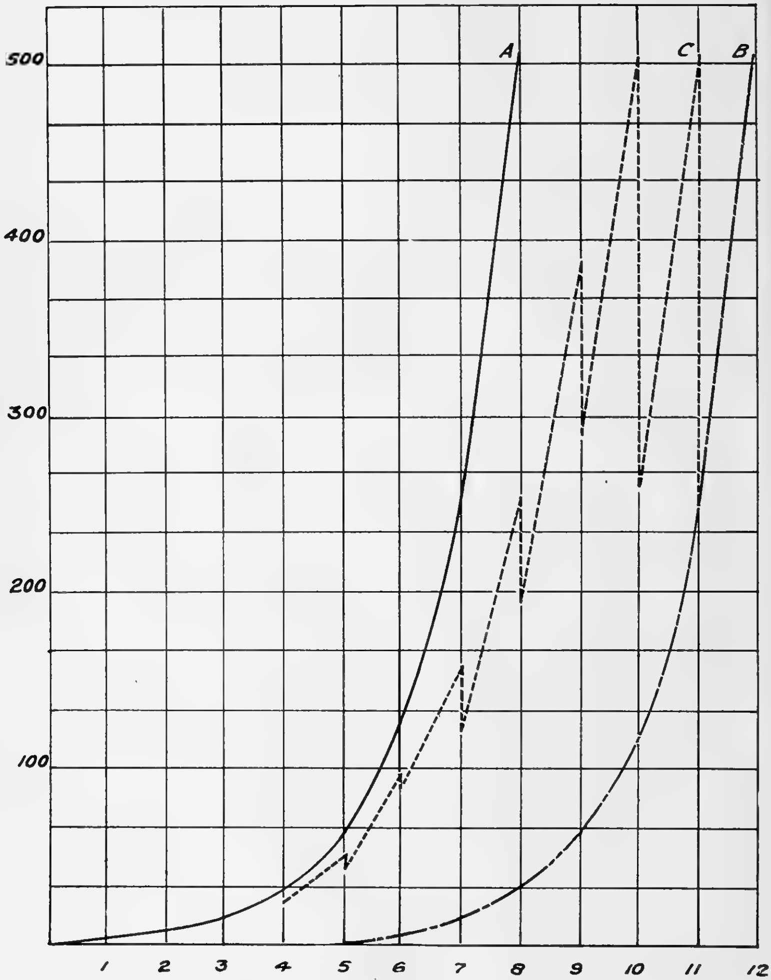
As my observations have been confined to tropical countries, where insects breed during the whole year, I have left out of consideration the effect of climate. Hyperparasitism has been left out of consideration, as it only complicates the ultimate results and shifts the question back a stage; fungus and other diseases have also been ignored, as they only retard, but do not alter, the final results.

"Constant" Number.

One of the facts upon which Natural Selection is based is the constant number of a species within a certain period and area. During the period the number may rise and fall, but eventually returns to the normal. The period between the two minimum points may comprise only one generation; in this case the eggs are the most numerous, the larvae less numerous, the pupae still less and the fertile imagoes least of all. Or the period between the minimum points may embrace several generations, in which case the host will increase until it appears likely to become a pest, then it suddenly drops off.

In Diagram I, I have shown the results of an imaginary case in which the numbers are kept low for convenience. The curve A represents the increase of a host-insect that produces four young, the sexes being in equal numbers. At the eighth generation, if nothing interferes, it will number 512 individuals. Curve B represents the increase of a parasite which also lays four eggs, the sexes being in equal proportion, and each young causes the death of one immature host; it will therefore have a curve similar to A. We will consider that it appears upon the scene at the fourth generation of the host; curve C

DIAGRAM I.



A=Host insect.
B=Parasite.
C=Effect of parasite on host.
Lower numbers are the number of generations.

will represent the effect it will produce upon A. The four eggs of the parasite will be deposited in four of the 32 hosts so that only 28 of them will come to maturity; these will give birth to 56 young, eight of which will be killed by the parasites and 48 come to maturity; these will give birth to 96 young, of which 16 will be killed by the parasites. This process will continue to the eleventh generation of the host, when it will only equal the parasite in number and so be totally destroyed. Right up to the last generation the host appears to be predominant and the final reduction is sudden. This is a feature that one often observes in nature.

Ratio Between Host and Parasite.

That the utter extinction of the host does not take place is a very difficult problem to explain. Hyperparasitism only pushes the question back one degree, and accidental death acts upon host and parasite alike.

Observations on several species of insects, extending over wide areas, indicate that there is a certain ratio between the numbers of the host and parasite. One would expect some such ratio from inductive reasoning: parasitism could not exist without it.

How this ratio is maintained it is difficult to tell. It is not through the birth rate, for many parasites are very much more prolific than their hosts, and the length of time occupied in their life cycle is often much shorter. It appears likely that the ratio is due to the capacity of the parasite to discover its host. In some species this capacity appears to be low, and the maximum rate of parasitism is therefore low; in other cases this capacity is high, and the maximum rate of parasitism is consequently high.

When living in Africa, I often accompanied a friend shooting; he was by far the better shot, but whether game was scarce or plentiful my bag generally stood in the same proportion to his. This would indicate that we each had a certain capacity for finding and bagging our game, and, within certain limits, acted up to it.

Uncivilized men, hunting with bow and spear, seldom, if ever, exterminated game. Where game was plentiful the family or tribe could increase till the district could not longer support it; then it would decrease or wholly or partly migrate.

This would not mean that the game in the district was exterminated, but that it was reduced so low that the amount the tribe was capable of securing was not great enough to support it. With the decrease or migration of the tribe the game would increase. Another tribe with higher capacity for hunting, or with better weapons, could have become still more numerous and have reduced the game to a lower number before being compelled to migrate. Even white man with his superior arms never exterminated game when he was wholly dependent on it for existence; it is only when he has other sources of supply that he can pursue it to extermination.

We do not expect uncivilized men to exterminate their game, so we should not expect insect parasites to entirely destroy their hosts.

Action of Predators.

Predators of many kinds attack the host at every stage of its existence; they also attack the parasitized and unparasitized in their relative proportions, so that they do not greatly disturb the balance. Such predators as mammals, birds and lizards are fairly liberal in their choice of food and seldom show a choice for one particular species. With those species on which they do feed they follow the line of least resistance and take them as they come, the most common forming the larger portion of their food.

Owing to their power of locomotion, especially birds, they cover large areas in search of food; as soon as their food in one district becomes scarce they move off to another. Bates has described how flocks composed of several species of insectivorous birds move about the country in Brazil, and I have observed the same thing in Africa and the Malay Islands. Thus predators act more as a movable death-factor; where the egg-parasites have been scarce there will they gather together to feed off the larvae, and where the larva-parasites have not been effective there will they feed off the adult.

In the following table I have confined the action of the predators to the adult stage, but this action would be felt on larva and pupa, but the results would be the same.

Death Factors Acting Upon Closely Allied Species

In studying the death factors of two or more closely allied species it is often very difficult to say why one should be common and the others scarce. Their fecundity may be similar and the chief death factors acting upon them identical. Close observation will often show that a very small percentage of the scarce species is killed by a factor that does not attack the more common. If we study the species separately this would not account for the difference of numbers, but if we consider them as forming one group then this small factor will make the difference.

Table I tries to illustrate this. What we have previously said must be borne in mind, viz.:

1 The number of an insect in a district is constant within certain periods.
2 There is a ratio between host and parasite.
3 That predators follow the line of least resistance when feeding, and, owing to their powers of locomotion, act as a movable factor to keep the numbers constant.

TABLE I.

	A	B	C	Aggregate
First generation	20	20	20	60
Eggs 80% killed	500	500	500	1500
Larvae 50% killed	100	100	100	300
Pupae killed: A nil; B 25%; C 50%	50	50	50	150
Adults hatched	50	37.5	25	112.5
Adults reaching maturity (2nd generation)	26	20	14	60
Eggs 80% killed	650	500	350	1500
Larvae 50% killed	130	100	70	300
Pupae killed: A nil, B 25%, C 50%	65	50	35	150
Adults hatched	65	37.5	17.5	120
Adults reaching maturity (3rd generation)	32	19	9	60
Eggs 80% killed	800	475	225	1500
Larvae 50% killed	160	95	45	300
Pupae killed: A nil, B 25%, C 50%	80	47.5	22.5	150
Adults hatched	80	35.6	11.2	126.8
Adults reaching maturity (4th generation)	37	17	6	60

In Table I, A B and C represent three allied species living in the same locality, feeding on the same food-plant and having similar fecundity and length of life. Let 60* represent the aggregate constant number in the locality. If the death factors acting upon each were absolutely identical then the constant number 20 for each species would not vary, but remain the same each generation. Let us suppose that 80% of the eggs are killed by a parasite and 50% of the larvae likewise killed by another parasite, of the pupae A has none killed, B 25% and C 50%. Then the number of adults hatching out would be 50, 37.5, and 25 respectively. Predators acting upon these to bring them to the constant number 60 would leave them in the proportion of 26, 20, and 14. At the fourth generation they would stand 37, 17 and 6. Theoretically this would lead to the extermination of C and then B, and it is possible that such has happened at times, but most likely the scarcer species have been able to maintain existence in small, favorable localities.

Immigrant Supplanting Endemic Species.

The figures in Table I could be used to illustrate this section but I prefer to present others. Let us take another imaginary case of a species D (Table II) whose constant number in a given area is 100, in which the sexes are in equal proportion and each female gives birth to one hundred eggs. Let the eggs and larvae be attacked by parasites, each to the extent of 50%, and the pupae to the extent of 25%. Under normal conditions there will be 837.5 adults for the predators to feed upon, leaving the constant number of 100 to carry on the race.

Into this area let us introduce an allied species whose fecundity, food, life-cycle, and susceptibility to parasites are the same, with the exception of the larva which, for one of the many causes easily imagined, escapes free. Let us imagine that this immigrant succeeded in laying her eggs without otherwise upsetting the balance of life. At the end of the first generation there will be 875 adults for the predators to take, leaving 96.15 D and 3.85 E to carry on the two races. In the following generation these proportions will be 92.59 and 7.41, and at the end of the sixth generation the immigrant species will be the pre-

* Here as elsewhere in this paper the figures should be considered as proportions more than individuals.

TABLE II.

Generation		Constant number	Eggs 50% killed	Larvae D 50% E nil killed	Pupae 25% killed	Adults hatched
1st	D	100	5000	2500	1250	937.5
	E	....	100	50	50	37.5
2nd	D	96.15	4807.5	2403.75	1201.87	901.40
	E	3.85	192.5	96.25	96.25	72.19
3rd	D	92.59	4629.5	2314.75	1157.37	868.03
	E	7.41	370.5	185.25	185.25	138.94
4th	D	86.20	4310	2155	1077.5	808.12
	E	13.80	690	345	345	258.75
5th	D	75.75	3787.5	1893.75	946.87	710.15
	E	24.25	1212.5	606.25	606.25	454.69
6th	D	60.96	3048	1524	762	571.5
	E	39.04	1952	976	976	732

dominant form. The remarks as to extermination made in the former example apply equally well here.

The difference in parasitism has been made great, and the constant number low to hasten the results, but with these figures altered the ultimate results would be the same.

There are two other results brought about by the introduction of this species; firstly the decrease of the larval parasite from 1,250 to 762; and secondly the increase of the adults of

D and E combined from 975 to 1,303. This latter result might lead to an increase of the number of predators in the area, or to an increase of the more cryptic forms of the food of the predators, owing to a greater amount of a more easily procured food.

I do not imagine that this is the only method by which an introduced species supplants an endemic form; many complex causes may lead to the same result. During a discussion on this subject at a former meeting, Dr. Back stated the case of two species of Aleyrodes in Florida attacking Citrus: *Aleyrodes citri* and *A. citrifolia.* When *citrifolia* is present in quantities in an orange grove and *citri* is introduced, the latter soon supplants the former as a pest. In this case, Dr. Back stated, there is no reason to consider that parasites, insect or fungus, play any part, but that the ascendancy of *citri* over *citrifolia* is due more to a slight difference in fecundity and life history. The elucidation of this, and similar problems, is of great interest, and of value to bionomics as well as economics.

Specific Characters and Mortality of Immature Individuals.

One of the chief things that has been impressed upon me during many years of observations of the death factors of insects, is that the mortality is highest in the immature stages. Natural Selection has but a limited field in the adult stage. It would be easy to quote figures to show this, especially among the Homoptera. Mr. J. C. Kershaw, after many years' study, came to the same conclusion in regard to the Lepidoptera of South China. This fact must be borne in mind when we consider the origin of adult specific characters by Natural Selection.

The vast majority of specific characters are such that we cannot conceive of them being selected on account of their utility and they have no connection with the earlier stages of the insect. We have only to take up a Monograph of some one large genus and note the characters which distinguish the species from one another; it is only by insisting upon our ignorance that we can maintain our belief in their vital utility. Take for instance our genus of *Proterhinus;* he would be a bold man who would try to maintain that each specific character was of a life-and-death value to its possessor. Or take the genus *Perkinsiella;* here are some fourteen species living on the same food plant, and in some places four or five species living in the same locality: their specific characters lie in the male genital organs, color of body and wings and granulation of tegmina. It is hard to conceive that these distinctions arose gradually, and were conserved by Natural Selection on account of their vital importance, especially when we remember that the greatest mortality is among the young, before these characters have appeared.

When considering the evolution of the characters of a group of allied species, whether these characters be colors or structures, we must remember that they are all the results of physiological processes, and that it is the changes in these processes which constitute the real evolution; the characters are the result of the physiological changes.

There are certain cases where it appears highly probable that internal physiological processes have had great effect upon the external characters. Kershaw, in his work on the anatomy of the "Candle fly",* and in a subsequent paper, has shown that in many families of Homoptera there is an enormous diverticulum of the stomach, just behind the aesophagal valve, which, filling up such space in the thorax as is available, proceeds into the head. In *Pyrops, Dictyophorodelphax,* and several (perhaps all) other cases where the head is greatly elongated, this diverticulum entirely fills this elongation**. Has this structure been brought about because a slight increase in size was of vital importance to the insect; or through direct use, such as pressure at all stages of development; or by some other means? At present I incline to the second belief.

The low percentage of nutriment in the liquid food of Homoptera makes it necessary for the insects to pass great quantities through their digestive organs, and the process of separating the wax and indigestible substances is of supreme impor-

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* A Memoir on the Anatomy and Life-History of the Homopterous Insect Pyrops candelaria (or "Candle fly"). Zool. Jahr. XXIX, Abt. f. Syst., pp. 105-124, Taf. 8-10, 1910.

** The knowledge that this elongated head of *Pyrops* is filled with stomach may help to settle the much-controverted point as to the luminosity of this structure. It has been suggested that the light is due to bacteria, and as there is a luminous bacterium which lives in the stomach of silkworm larvae, and makes the whole insect quite luminous, it is highly probable that bacteria in the stomach of *Pyrops* is responsible for the light seen on the head on rare occasions.

tance in their economy. The large diverticulum from the stomach is, no doubt, to this end. In certain Homopterous families a filter is formed between the aesophagus and the rectum through which the excessive juices pass, only the more nutritive substances passing through the whole alimentary canal. In the case of the "Frog-hoppers" the young stages are passed in some of the secreted liquids, and it has been suggested that this forms a protection to them, and has been brought about by Natural Selection. It has also been suggested that the liquid surroundings are necessary for the protection of the tender bodies against atmospheric changes. In reply to the first suggestion it must be remembered that the young insects are heavily attacked by their enemies, to whom the white mass of liquid only serves as a guide. In regard to the second suggestion there is good reason to believe that these insects descended from ancestors whose nymphs did not live in "spittle" and had normally hardened integuments. To me it appears more feasible that the secretion is due to the feeding habits, and the soft integument a direct result of those habits.

Isolation.

The Rev. John T. Gulick in his writings* on this subject, on which Romanes placed "a higher value than any other work in the field of Darwinian thought since the date of Darwin's death", has shown that geographical and topographical isolation has played the chief part in the evolution of Hawaiian land shells. These writings should be better known to Hawaiian entomologists than they are, as I believe still further evidence can be found for these theories among the insects. In this connection it is of interest to consider the numerous species in some of the flightless genera, a condition that facilitates isolation.

Romanes and Gulick have shown that Natural Selection without the aid of some other form of isolation leads only to monotypic evolution, but with the help of physiological isolation Romanes considers that it can lead to polytypic evolution. This is a point that I cannot agree with. If a variety arises with a character which gives it a better chance of existence than the parent species, and if the character follows the Mendelian law of inheritance and so does not become "swamped", it will

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* Journal Linn. Soc. (Zoology) XX and XXII.

eventually supplant the parent species, whether it be sterile with it or not.

Romanes placed very little stress upon morphological isolation, but he did not consider the case of the aedeagi of insects. This form of isolation, which we may term "phalic", is of such great importance that it will have to be given an important position in the final consideration of evolution. How far the sterility of allied species is due to "physiological" and how far to "phalic" isolation is a matter to decide by experiment.

Of the various problems that confront the student of insect evolution, none is more difficult than that presented by the male genital structures. It has been recognized for a long time that these sructures present the most definite characters upon which to base the species in many groups of insects. In many cases this is the reason to believe that correlated structures exist in the opposite sex, and this further complicates the problem. An organ of such vital importance to the life of the species must have been functionally adequate from the earliest period of insect physiology, so that it is highly improbable that a series of slight variations, each more advantageous than the former, could have been preserved by natural selection; still more improbable that a corresponding series of changes should have simultaneously taken place in the female. Again, natural selection would have led only to monotypic evolution. A comparison of the male organs of some of the allied species of Hawaiian beetles, especially in those cases where geographical isolation appears to be the chief factor of evolution, would be of great interest.

These brief remarks on very complex subjects are only to show how many important and interesting subjects await the investigation of the naturalist, and all the time such great questions await elucidation there is need for such societies as ours. We may not be able to answer the questions ourselves, but every correct observation is a new stone in the final edifice.

The labors of Blackburn and Perkins mainly, and of several members here present secondly, have placed the Hawaiian insect fauna on a systematic basis which enables us now to grasp and study the interesting problems connected with its evolution; to understand more thoroughly the causes which keep our insects from increasing in numbers; the various means which lead to their isolation; the adaptations that have taken place to enable them to fit their various present habitats and habits and to estimate how far isolation has been the cause of the origin of species.

Personally I believe that "isolation", together with the comparative absence of "Natural Selection", owing to the simple conditions of the biological environments, has been the chief agent in the production of species of our insect fauna.

NOTE:—The above notes were written before I had the pleasure of reading Dr. R. C. L. Perkins' "Introduction" to the Fauna Hawaiiensis. It was of great interest to me to read his conclusions, founded upon so detailed a study of the insect fauna, on several of the subjects that I have touched upon. One of the great values of this work is that it is the first time that an isolated tropical island, or group of islands, has been anything like thoroughly worked and then analyzed. The results are of great value, the volume forming the most important of recent contributions to biology. Those who have the pleasure of a personal acquaintance with the author regret that he has not more fully entered into many of the questions discussed, and drawn more fully from his wealth of observations, in a manner that makes his personal discussion of these subjects so interesting.

On Some Derbidae from Formosa and Japan.*

BY F. MUIR.

During a short trip to Formosa in December, 1913, the writer was only able to get three days collecting in the forest, one of which was wet. It was therefore not possible to do very much work, but several new Derbidae were among the Homoptera. Thanks to the kindness of Messrs. I. Nitobe, M. Maki and M. Ishida, he was able to procure several interesting specimens, and to examine others. Besides the species mentioned below there were also female specimens of three species of *Rhotana,* one *Goneokara* near to *pullum,* one *Sikaiana* and one *Herpis.* This indicates that when more fully worked the Derbidae of Formosa are likely to be numerous.

Thanks are also due to Prof. S. Matsumura for the loan of certain Japanese specimens.

The types of the following new species are in the collection

* This contribution from Mr. Muir was received at a later date, but it seems desirable to publish it at this time.—Ed.

of the Hawaiian Sugar Planters' Experiment Station, Honolulu, except where otherwise stated.

Klappan is in Northern Formosa, Horisha and Mt. Ari in Central Formosa.

Herpis.

(1) *H. brunnea* sp. n. (♂ ♀).

♂ Light brown, darker on scutellum, abdomen and genitalia. Tegmina light brown, veins slightly darker; wings light fuscous with brown veins.

Pygophor with ventral and lateral edges straight, ventral surface with a median, transverse, broad, depression making it concave in lateral view; anal segment fairly large, longer than broad, sub-lanceolate in dorsal view, the apex rounded, anus situated about middle *on ventral side*, anal style arising from beneath apex of segment, flattened, broadened from base, apex produced into two fine points with acutely angular emargination between, bent ventrally from about middle; genital styles large, narrowest at base, roundly emarginate near apex, a ridge running from the inner rounded apical corner to outer edge near base; penis very large and complex.

♀, The female I associate with this male is the same in size and color. The abdomen and styles darker brown. Pregenital ventral plate angularly and evenly produced from sides, with the apex rounded; anal segment small.

There is another female specimen larger and darker in color which may be the rightful spouse of this male. In it the pregenital plate is evenly and angularly produced, the apex rounded, a deep transverse constriction runs across the middle, the plate in the middle, anterior of the constriction, elevated into a rounded knob; anal segment small with anus *on ventral side*, anal style flattened, rounded at sides and angularly emarginate at apex. The shape of the anal segment and style would indicate that this is the true female, but the size and color is in favor of the other.

Length of type 2.5 mm.; tegmen 4 mm.

Length of second female 2.75 mm.; tegmen 5 mm.

Hab. Mt. Ari, April (I. Nitobe); Shinten, June (I. Nitobe); Klappan, December (F. Muir).

This species is congeneric with *vulgaris*, the tegmen being broad, the subcosta and radia separate from near base, the vertex short and wide and the subantennal keel large. The situation of the anus on the under side of anal segment and the development of anal style is peculiar.

VEKUNTA.

(1) *V. albipennis* sp. n. (♂ ♀).

Salmon color, abdomen and genitalia fuscous, a black spot on pleura, tip of labium fuscous. Tegmina and wings hyaline, opaque with waxy secretion, very slightly infuscate at end of costal cell, veins yellowish.

Ventral edge of pygophor very slightly and roundly produced, lateral edges produced into small angle, the lower edge of angle sinuous, the upper edge even; anal segment long, rounded at apex, anus in middle, lateral edges produced into a small blunt ventrally-turned spine slightly before middle; genital styles long, reaching to end of anal segment, basal two-thirds with straight, parallel sides, then slightly widened and curved upward, apex rounded, on inner side near base a bluntly-pointed process.

Posterior edge of last abdominal segment of female broadly and angularly produced, the apex rounded, the length of the production about same width at base, slightly asymmetrical on right side at base; anal segment small, little longer than wide, rounded, anus in middle.

Length 4. mm.; tegmen 6.5 mm.
Hab. Horisha (M. Maki); Mt. Ari (I. Nitobe).

(2) *V. nigrolineata* sp. n. (♀).

Yellow to light salmon; a round black spot on pleura, slightly fuscous on keels of face and clypeus, a brown mark down each side of scutellum, abdomen fuscous brown. Tegmina hyaline, opaquely white with waxy secretion, white veins, black along hind margin to end of clavus and along costa to end of costal cell, fuscous over tips of cubital and median veins, a black mark over subcostal and tip of costal cells, wings opaquely white with white veins.

Posterior edge of last abdominal segment broadly and angularly produced, apex rounded, length of production greater than width of base; anal segment round, little longer than wide, anus in middle.

Length 4 mm.; tegmen 6.5 mm.

Hab. Horisha, May (M. Maki); December, on sugar cane (F. Muir); Klappan, December (F. Muir).

Unfortunately, there is no male to compare with *albipennis*.

(3) *V. ishidae* sp. n. (♀).

Dark fuscous brown; legs, labium (except tip) and antennae yellowish, hind femora fuscous, a white, waxy secretion over head, thorax and tegmina. Tegmina dark brown with brown veins, a yellow patch along costa from base of radia to end of costal cell; wings fuscous, veins dark.

Last ventral abdominal plate large, swollen across the middle, the posterior process in side view at right angles to the swollen median portion; posterior edge produced into a flat, subangular, process with rounded apex, its length slightly less than its width at base; anal segment small, slightly longer than wide, subquadrate, apex truncate.

Length 2.5 mm.; tegmen 4.5 mm.
Hab. Daimokko, Formosa, on sugar cane (M. Ishida).

(4) *V. makii* sp. n. (♂).

Light reddish brown; legs and ventral surface yellowish, dorsal surface, especially of abdomen, fuscous, a round black spot on pleura, keels of face and vertex slightly fuscous; tegmina very light brown, veins slightly darker; wings light fuscous, veins darker.

Ventral edge of pygophor truncate or very slightly rounded, lateral edges roundly produced; length of anal segment slightly more than twice the breadth, subparallel-sided, apex truncate, anus a little before middle, lateral edges produced into a fine, downward-pointing spine about middle; styles reaching to end of anal segment, edges even, subparallel, slightly curved upward, apex pointed and turned inward, a rounded process on inner side near base.

Length 3. mm.; tegmen 5. mm.
Hab. Horisha, May (M. Maki).

(5) *V. okadae* sp. n. (♂ ♀).

♂, Stramineous to light brown; darker down each side of scutellum, a round black spot on pleura; abdomen fuscous, especially the male. Tegmina fuscous brown with lighter hyaline spot on costa at end of costal cell; wings fuscous, veins dark.

Ventral edge of pygophor truncate, lateral edges angularly produced, each side of anal segment; anal segment large, length three times the breadth, anus slightly before middle, sides subparallel, apex drawn to a small point; styles large, reaching beyond anal segment, widest about middle, upper edge nearly straight, lower edge curved outward about middle, apex slightly emarginate, two small protuberances on inner surface near base and a small curved spine near them. The shape of these styles is very near to *V. hyalina*, but the apices are not so broad and the protuberances on inner surface differ.

♀, Medio-ventral portion of last ventral abdominal plate swollen, ventral edge produced in middle, on left side edge of production even, right side angular at base, apex rounded; anal segment small, as wide as long, apex rounded, anus in middle.

Length 3.5 mm.; tegmen 5 mm.

Hab. Japan; Kamakura, September, common on oak; Okitsu, October, on oak.

I name this species after Mr. Okada, from whom I received the first specimen.

(6) *V. umbripennis* sp. n. (♂).

Light reddish brown; tip of labium and round spot on pleura black, a dark brown mark over each side of scutellum, abdomen fuscous, hind margin of ventral plates yellowish. Tegmina fuscous brown, a small lighter hyaline spot on costa at end of costal cell, veins darker; wings fuscous, veins dark.

Ventral edge of pygophor truncate, lateral edges angularly produced, apex pointed; anal segment large, length more than twice the breadth, a small projection in middle of base, apex slightly emarginate, sides sub-parallel, anus about middle; styles large, reaching beyond anal segment, widest about middle, upper edge straight till near apex where it curves upward, lower edge convex, turned upward near tip, apex deeply emarginate; two rounded processes on inner surface near base.

Length 3.5 mm.; tegmen 5.5 mm.

Hab. Horisha, Formosa, May (M. Maki); December (F. Muir).

Devadanda.

(1) *D. perplexa* sp. n. (♂).

The antennae of this species differs somewhat from the description and figure of the type of this genus. The first joint is very small, second joint consisting of two portions, a small sub-globose portion, from which the arista arises, and from the base of this a longer, cylindrical, portion bearing long, narrow "scales" or "sense organs" irregular in position. Face in profile not produced so much as in *D. pectinata*.

Edge of vertex and face black, a black mark from eye to edge of face, rest of face and vertex transparent; clypeus, pronotum, scutellum, abdomen and femora black tinged with red, especially on abdomen; labium, tibiae and tarsi yellow. Tegmina brown with red veins; a white mark across middle of costal cell; median, radial and subcostal apical veins lighter red and bordered with white, an irregular triangular dark mark on base of first and second apical and median cells; wings brown, veins dark.

Ventral edge of pygophor truncate, lateral edges slightly and roundly produced; anal segment large and broad, narrowed slightly toward the truncate apex, ventral surface excavate, anus near apex; genital styles extending slightly beyond anal segment, narrow, apices rounded, in ventral view the middle of the inner edge produced into a small point, which on the inner surface stands up as a small flattened process.

Length 2.5 mm.; tegmen 4 mm.
Hab. Horisha; Klappan, December (F. Muir).

NESOKAHA.

(1) *N. infuscata* sp. n. (♂ ♀).

In profile the angle at junction of vertex and face nearly obliterated.

Light yellow; keels on face and vertex tinged with brown, a brown mark from back of eye over the sides of pronotum and scutellum, tegulae dark brown, abdomen and genitalia brownish. Tegmen brown, veins red, apical half of subcostal cell, second and third median apical cells, the greater portion of clavus and between the cubital veins, yellowish. In the female the yellow is more extensive, spreading from clavus into cubital, median and radial cells; wings brown, veins dark.

Ventral edge of pygophor truncate, thickened; lateral edges very slightly and angularly produced; anal segment large, long, straight-sided, narrowing slightly towards apex where each corner is produced into a downward-turned point, anus at apex, ventral surface excavate; styles large, as long as anal segment, apices drawn out into upward turned point, in ventral view outer edges nearly straight to near tip where it curves, inner edge produced into a broad spine slightly beyond middle.

Last ventral abdominal plate produced angularly in middle, compressed laterally so that it appears longitudinally ridged; anal segment very short, apex truncate, each corner being produced into a small point.

Length 3. mm.; tegmen 5.5 mm.
Hab. Horisha, Formosa, December (F. Muir).

Kamendaka.

Nicertoides Matsumura, Schäd, und Nützl. Insec. Zucker. Formosa, p. 14, 1910.

Mr. W. L. Distant has kindly compared *N. saccharivora* with the type of *Kamendaka* and informs me that he cannot separate these two genera.

(1) *K. saccharivora* (Mats.).

♂ Pygophor laterally compressed; ventral edge produced into a long, pointed, median process about half the length of genital styles; lateral edges slightly rounded; anal segment nearly as long as genital styles, narrow, sides straight, slightly converging towards apex, anus near apex, apex rounded; genital styles large, broadest about middle, upper edge straight, lower edge convex, apex turned inward and upward slightly.

♀ Last abdominal ventral plate producd angularly in middle.

Nicerta.

(1) *N. flexuosa* (Uhler).

Otiocerus flexuosus Uhler.

This species has the median sectors in apical third of tegmen, the first cubital joining second, enclosing second cubital cell, therefore it comes into the *Nicerta* group and, except for the more flattened antennae, is congeneric with *N. cruenta*.

In Mr. Nitobe's collection there is a damaged male from Mt. Ari near to this species but quite distinct.

Mysidioides Mats.

Neocyclometopum Muir. H. S. P. A. Bull. Ent. 12, p. 61, 1913.

This genus is near *Heronax*. In female specimens of *M. sapporensis* the vertex is narrow but truncate at apex, a slight keel divides the vertex from face; in the male the keels of face meet at base, making the apex of vertex angular as in *Neocyclometopum;* the difference in the antennae of *N. sordidum* is not sufficient to establish a genus on.

(1) *M. ariensis* sp. n. (♂ ♀).

In structure this conforms to *Neocyclometopum* in both sexes, the vertex being sharply angular at apex and the keels of face contiguous from base.

Stramineous; tegmina hyaline, a fuscous mark from base of first median sector down median cross vein and up second cubital vein, forming a wide V mark, fuscous mark on vein in middle of subcostal cell, faintly infuscate in apical cells and over apical cross-vein between first sector and first cubital vein.

♂, Ventral edge of pygophor truncate, lateral edges dorsally curving to base of anal segment; anal segment with the apex produced into a long spine which is turned down at right angle to basal portion, basal portion a little longer than broad, subparallel-sided, anus near middle; genital styles reaching to the end of the broad portion of anal segment, apices rounded with a slight emargination, bent upward at a right angle near middle, a rounded projection on the lower edge near angle.

♀, Last ventral plate of abdomen slightly and angularly produced in middle; anal segment very small, narrowed towards rounded apex.

Length 2.5 mm.; tegmen 6. mm.

Hab. Mt. Ari, Formosa, October (Mr. Nitobe).

Type in Mr. Nitobe's collection. There are three other species of this genus, each represented by only a single female, so I have not described them.

Diostrombus Uhler.

(1) *D. politus* Uhler.

I have both sexes from Formosa, but have not been able to compare them with Japanese specimens.

Male pygophor very short, nearly hidden by preceding segment, anal segment long and narrow, reaching nearly to end of styles, apex drawn out into an acute point, anus about middle, a small, blunt projection over anus. Styles long, spine-like, irregularly curved inward, a small spine on inner side near apex, at base. The upper edge produced into a large quadrate process with a small curved spine at each upper corner. Aedeagus large, surrounded by the basal quadrate projection of styles.

In the female the genital styles are very greatly reduced, but from below them arises a pair of flattened processes, subparallel-sided till near their pointed tips, each side of the preceding segment is produced into a nearly semi-circular plate; anal segment very short. The female of this species is likely to be mistaken for the male on account of these style-like projections.

ZEUGMA.

(1) *Z. makii* sp. n. (♂).

Stramineous; vertex, face, clypeus, middle of pronotum and scutellum red, front legs fuscous; tegmina hyaline, pale, dirty yellow with lighter veins, media and bases of median sectors and cross-veins fuscous.

Ventral edge of pygophor produced into a small median rounded projection; on each side of the anal segment the sides produced into a triangular plate with the base half as long as the sides, the apex turned slightly inward and rounded; anal segment small, about one-third as long as the lateral projections of pygophor, apex roundly emarginate, anus in middle; styles slightly shorter than lateral projections, subparallel-sided on basal half, then slightly narrowing to the blunt apex. The long, narrow lateral projections look like a second pair of styles.

Length 5. mm.; tegmen 10. mm.

Hab. Horisha, October (Maki).

I have named this interesting species after Mr. M. Maki to whom I am indebted for the specimen.

At first I considered this as a distinct genus on account of the narrowness of the vertex and face, but having seen species from the Philippines and Java in which this character is intermediate between *vittata* and *makii* I have placed them together.

ZORAIDA.

(1) *Z. nitobii* sp. n. (♀).

Tegmen with five cubital veins and four median sectors; antennae about as long as head and thorax.

Light brown, slightly darker across base of pronotum and between keels of scutellum, some darker spots on abdomen, pronotum with light granules. Tegmina hyaline marked with fuscous brown, the marking proceeding from base between subcosta and cubitus, forming a broken band across middle of cubital veins to hind margin, and another broken band over bases of sectors and apices of cubital veins to hind margin, and through subcostal cell to apex of costal cell, another dark mark in middle of costal cell; veins all light brown. Wings fuscous, darker along veins which are light brown.

Hind edge of last ventral abdominal plate evenly produced into obtuse angle, the apex turned upward; anal segment slightly longer than wide, sub-lanceolate, reaching to middle of genital styles, apex round and slightly turned down; anus near base.

Length 5.5 mm.; tegmen 15. mm.

Hab. Mt. Ari, October (I. Nitobe).

Type in Mr. Nitobe's collection.

(2) *Z. pterophoroides* (Westw.) (♀).

The male of this may show it to be specifically distinct from the Indian species.

Hab. Mt. Ari, October (I. Nitobe).

PARAPROUTISTA.

(1) *P. variegata* sp. n. (♂ ♀).

Antennae about as long as face; six median sectors, third furcate; hind tibia with apical, median and basal spines.

Straw color tinged with green; tip of labium, apex of clypeus, dorsal and lateral portion of abdomen and front and middle tarsi fuscous. Tegmina hyaline, subcosta and radia veins yellowish, others mostly white; four or five small reddish spots at end of the transcostal veins; a fuscous spot on hind margin at the end of each vein; the transverse veins between sectors fuscous; a fuscous mark through end of radial cell, along the middle of fourth sector and the bifurcation of third sector, forming an irregular V mark; infuscate in cubital and middle of radial cell; wings hyaline with brown veins.

♂, Ventral and lateral edge of pygophor truncate; anal segment medium size, broadly round at apex, anus near apex, widest just before anus, ventral surface excavate; styles short and broad, irregularly rounded, a small angular emargination on lower edge near apex, and a small outwardly turned spine on upper edge near base.

In female anal segment very short, sunk into preceding segment, from below arises a pair of curved spines with upward-turned apices; styles abortive.

Length 3. mm.; tegmen 8. mm.

Hab. Horisha and Mt. Ari; May (M. Maki); October (I. Nitobe); December (F. Muir).

RHOTANA.

(1) *R. unimaculata* sp. n. (♂).

Stramineous, fuscous over pleurae of abdomen. Tegmina vitreus; veins yellow spreading into cells, especially over cross-veins; a fuscous mark through middle and another at apex of costal cell; slightly fuscous over cubital and third and fourth median apical cells, an irregular round, black mark on hind margin between cubital veins; wings white, veins yellowish, a round, black mark on apical margin with black over apical vein anterior to it.

Pygophor laterally compressed; ventral margin truncate, lateral margins acutely angularly produced; anal segment short, anus at apex; styles lanceolate, apex slightly rounded, lower edge more convex than upper, reaching beyond angular production of lateral edges of pygophor.

Length 3. mm.; tegmen 6. mm.
Hab. Mt. Ari; October (I. Nitobe).

MECYNORHYNCHUS.

(1) *M. stramineus* sp. n. (♂).

Stramineous; slightly tinged with red along facial keels, hind margin of pronotum and dorsum of abdomen. Tegmina hyaline, slightly opaque with white, waxy secretion, veins white, a small black triangular mark at base of fourth median sector, slightly infuscate over apical veins and cross-veins, and on hind margin at end of cubitus; wings white, slightly opaque with waxy secretion.

Pygophor compressed laterally, ventral edge truncate, lateral edges slightly convex; anal segment very short; styles sub-quadrate, reaching to end of anal segment, longer than broad, apex truncate, slightly constricted near base.

Length 2. mm.; tegmen 4. mm.
Hab. Mt. Ari; October (I. Nitobe).
The clypeus and labium not quite so long as in *kershawi*.

A Delphacid on Bamboo in Formosa.

BY F. MUIR.

Purohita taiwanensis sp. n.

♂ Light brown; antennae and keels of face and vertex speckled with darker spots, legs with longitudinal dark-brown stripes, keels of thorax tinged with green. Tegmina hyaline, veins white with small hair-bearing granules, veins bordered with brown, darker on apical half; wings hyaline, veins brown.

Pygophor slightly compressed laterally, ventral edge produced in the middle into two small flattened, pointed, processes, each with a smaller point on the outer side; lateral edges truncate; anal segment large, broad, dorsum flattened, apex truncate, anus near apex, sides turned down, making ventral surface excavate; anal style long, narrow, lanceolate; genital styles thin, pointed, having a half turn inward, reaching to anal segment, base broader and flattened, attached to inner margin of pygophor; penis chitinous, long, slender, sharply curved and sharply pointed, forming the most conspicuous portion of genitalia.

♀ Slightly larger, abdomen with tinge of green on sides, ovipositor dark brown; anal style narrow, lanceolate.

Length 3. mm.; tegmen 5. mm.

Hab. Horisha, Formosa, on bamboo; December (F. Muir).

Proc. Haw. Ent. Soc., III, No. 1, September, 1914.

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PARADISE of the PACIFIC
ENGRAVERS & PRINTERS
HONOLULU

Vol. III., No. 2. July, 1915

PROCEEDINGS

OF THE

HAWAIIAN ENTOMOLOGICAL SOCIETY

JANUARY, 1914—APRIL, 1915

HONOLULU, HAWAII
PRICE 50 CENTS

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PROCEEDINGS

OF THE

Hawaiian Entomological Society.

Vol. III. No. 2. Jan. 1914-April 1915. JUNE 1915.

JANUARY 8th, 1914.

The one hundred-first regular meeting of the Society was held in the usual place, President Swezey in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Osborn, Pemberton, and Warren.

Minutes of the previous meeting read and approved.

The president read a letter recently received from Mr. Muir, who is now in Formosa engaged in the search of parasites on the Anomala beetle. An interesting account was given of his work there.

On motion it was decided that the Library of the Society be assembled and retained at the Board of Agriculture and Forestry.

ENTOMOLOGICAL NOTES.

Mr. Ehrhorn reported the finding of a colony of the termite *Coptotermes* sp. in the Douglass fir timber supporting the band stand in the Capitol grounds. The timbers had been largely destroyed by them. Several of the timbers contained a cone about 18 inches long and 8 inches in diameter, composed of a composite material manufactured by the termites from the wood. One of these cones was being kept to secure adults if possible from the nymphs which were now present. Some timbers were sound while others had been completely destroyed. The same band stand had been repaired five years previously when it had been similarly affected, apparently by the same insct tho its identity was not made known at that time. In the present rebuilding of the stand creosoted timbers have been used. This termite is the same species that Mr. Swezey reported at the previous meeting as doing considerable damage in the floor timbers of the Kamehameha Chapel, and the work of which had not previously been noted as distinct from the other two species known here.

A general discussion of termites followed.

Mr. Ehrhorn reported successfully combatting the cypress roach (*Eleutheroda dytiscoides*) by means of roast paste spread on bread and protected from the weather by a pasteboard covering, placed in the trees frequented by the roaches. Mr. Bridwell mentioned finding this roach feeding on ripening mangoes and papayas; and Mr. Swezey reported it feeding upon oranges on the tree and on the outer covering of the pods of the glue bush (*Acacia farnesiana*).

A Note on "Technomyrmex Albipes".

BY O. H. SWEZEY.

Recently in looking over some unarranged material, I came across specimens of this ant collected at several widely separated localities in in Hawaii. At Laupahoehoe, Hawaii, May 11, 1911, I found a nest of them in the stem of a dead frond of a tree fern, growing in a gulch. At Kilauea, Kauai, July 14, 1911, but with no circumstances of collection. At Hauula, Oahu, August 9, 1913, taken on leaves of a mountain apple tree in a gulch. The only other records of capture of this ant in Hawaii are by Mr. Ehrhorn at Maunawili, Oahu, April 13, 1912, (recorded on page 237 of Vol. II, Proceedings of the Hawaiian Entomological Society) and at Mr. Gartley's, Nuuanu Valley, August, 1913. Apparently the species has been established for several years and widely spread already. My specimens were taken incidentally, no special attention being given to ants at the time.

FEBRUARY 5TH, 1914.

The one hundred-second regular meeting of the Society was held in the Library of the Board of Agriculture and Forestry, President Swezey in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Illingworth, Osborn and Pemberton, and Mr. M. Ishida from Formosa, visitor.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL NOTES.

Mr. Pemberton exhibited a microscope slide showing stridulating organ of the ant, *Pheidole megacephala*. It is an oval striated area on the anterior portion of the third dorsal segment of the abdomen, which is rubbed by hairs on the second segment of the petiole when the abdomen is raised and lowered quickly. The stridulation is not audible in the worker and only with difficulty in the female.

Mr. Bridwell exhibited a nest of *Trypoxylon bicolor*, and a box of North American Trypoxylonidae.

A Note on "Nesotocus giffardi" Perkins.

BY OTTO H. SWEZEY.

Seven males and six females of this large endemic Curculionid were taken by Mr. Montague Cooke from a *Cheirodendron* tree along the Castle Trail on the side of Kaumuahona not far above the Rest House, at 7 a. m., January 4th, 1914. More specimens were present but escaped being captured.

Very few specimens of this species have previously been obtained. I collected a single male in flight on the top of Kaumuahona, July 12th, 1908. There is but one specimen in the Bishop Museum, collected by Dr. Perkins on Tantalus.

The species is described by Dr. Perkins in Fauna Hawaiiensis, III, Part VI, p. 654, 1910, the male only being known.

Three other species of this endemic genus are known: one on Kauai, one on Maui and one on Maui and Hawaii. Dr. Perkins says that all of them live in the wood of the *Cheirodendron* tree.

MARCH 5TH, 1914.

The one hundred-third regular meeting of the Society was held in the Library of the Board of Agriculture and Forestry, President Swezey in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Illingworth, Osborn, Pemberton and Warren.

Minutes of previous meeting read and approved.

The Secretary reported that the publications belonging to the Society had been assembled in the entomologist's office at the Board of Agriculture, where they are now available for the use of the members.

The Secretary also proposed the preparation of a list of the periodicals pertaining to entomology in the various libraries of Honolulu, for publication in the Proceedings. Mr. Swezey agreed to become responsible for obtaining a list of those at the Bishop Museum, Mr. Illingworth from the College of Hawaii, Mr. Warren from the Sugar Planters' Experiment Station, Mr. Bridwell from the Board of Agriculture and the Society, and Mr. Fullaway (absent) presumably would supply a list from the Hawaii Agricultural Experiment Station.

ENTOMOLOGICAL NOTES.

Mr. Bridwell exhibited three species of Carabidae collected on Mt. Kaala among the bases of the leaves of the silver sword (*Astelia*) and in dry stipes of a tree fern (*Cibotium*). He also exhibited a series of North American Carabidae and gave notes on their habits and upon the variations of some of the species.

Mr. Swezey reported the finding of cocoons of the introduced Pompilus in an old cane stool in one of the fields of Honolulu Plantation.

Mr. Osborn reported finding an adult *Ceratitis capitata* upon the summit of Mt. Konahuanui (3000 ft.) on February 22nd. Mr. Pemberton expressed his opinion that it had not bred there but had probably been carried there by the wind from the windward side of the mountain range. Mr. Ehrhorn expressed his belief in the great importance of the air currents in the distribution of insects in these Islands, and described the effect of air currents in carrying insects up onto the snowfields of the Sierra Nevada Mountains. Mr. Bridwell recalled the habits of the Carabid beetle of the genus *Nebria*, which lives at the edge of the snowfields and feeds on the air-borne insects.

Mr. Swezey exhibited specimens and presented the following note:

Notes on "Orneodes objurgatella" Walsm.

BY OTTO H. SWEZEY.

On Feb. 8th, 1914, I collected a handful of fruits from a tree of *Plectronia odorata* in Palolo Valley. Since that time, 46 moths of *Orneodes objurgatella* have emerged from these fruits. This is a rather rare moth, Lord Walsingham having had but two specimens when he described the species. These were collected by Dr. Perkins in the Waianae Mountains. Later, Dr. Perkins reported the species having been bred in numbers, probably from drupes of *Plectronia*. I once reared a small specimen from flower buds of *Plectronia* in the same locality from which I have now reared so many from the fruits of the same tree.

Only two species of this genus have been found in the Islands, the other species being on Kauai and described from a single specimen.

APRIL 2ND, 1914.

The one hundred-fourth regular meeting of the Society was held in the library of the Board of Agriculture and Forestry, President Swezey in the chair. Other members present: Messrs. Back, Bridwell, Ehrhorn, Fullaway, Illingworth, Osborn, Pemberton and Warren; and Mr. Henry Tryon, Government Entomologist of Queensland, visitor.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL NOTES.

Mr. Ehrhorn read a letter from Mr. E. E. Green, reporting that the common injurious *Lepidosaphes* on Croton, previously determined as *L. lasianthi,* is properly identified as *L. auriculata* Green. (T. Linn. Soc. London, 12, p. 205, 1907.)

Mr. Ehrhorn further reported a curious find in quarantine inspection, being a shipment of pieces of wood containing large Cerambycid larvae, sent by a Japanese physician for a cure for consumption.

Mr. Tryon related the introduction of a Cerambycid from Australia to Cape Colony in Eucalyptus timber.

Mr. Fullaway called attention to a discussion by Dudgeon on the value of fungus disease of insects in the control of pests. A general discussion of insect diseases and their economic ultilization followed, participated in by nearly all of those present.

Mr. Tryon discussed the prickly pear pest in Queensland, and gave a brief account of his mission in the study of the diseases and insect enemies of cactus. He and Dr. Johnston were just now on their return from a round-the-world expedition sent out by the Queensland Government for this purpose.

MAY 7TH, 1914.

The one hundred-fifth regular meeting of the Society was held at the library of the Board of Agriculture and Forestry, President Swezey in the chair. Other members present: Messrs. Back, Bridwell, Ehrhorn, Fullaway, Illingworth, Osborn and Pemberton.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL NOTES.

Mr. Pemberton exhibited the introduced *Zelus reynardii* and a lady-beetle (*Rhizobius ventralis*) on which he had found it feeding. He reported having seen the first instar larvae of this bug feeding on thrips and red spiders. Mr. Bridwell reported having seen this bug very abundant in the Imperial Valley of California, and commonly feeding on lady-beetles.

Mr. Ehrhorn reported seeing a Pentatomid bug feeding on the live-oak caterpillar in California.

Mr. Illingworth remarked on the habit of the common centipede in brooding over her eggs. A general discussion of the habits of centipedes and scorpions followed.

Mr. Ehrhorn exhibited a yam from Manila, taken in quarantine inspection, infested with *Aspidiotus bartii,* a scale previously reported from West Indies and Central America.

Mr. Ehrhorn called attention to the description of *Euthrips hawaiiensis* Morgan, from material collected on cotton by Mr. Fullaway. (Proc. U. S. Nat. Mus. 46, 3, 1913.)

Mr. Fullaway reported finding an undetermined species of *Chirothrips* on daikon in Honolulu.

Prof. Illingworth gave some observations on recent damage by onion thrips. Dr. Back reported the killing out of about ten acres of onions by this thrips at Kailua on the windward side of Oahu.

Mr. Bridwell exhibited a frond of *Asplenium kaulfussii* infested by aphids, determined by Mr. Fullaway as *Idiopteris nephrolepidis* Davis, described from specimens from a greenhouse in Chicago.

Mr. Fullaway discussed the attacks of *Gelechia gossypiella* on the cultivated Hibiscus.

Notes on "Crocidosema marcidellum" (Walsm.) [Tortricidae].

BY OTTO H. SWEZEY.

This species was described by Lord Walsingham from a single female collected by Perkins in the Waianae Mountains in 1892, and provisionally placed in the genus *Adenoneura*—the absence of the male making it impossible to determine the genus with certainty. I have recently reared a series of 34 specimens, and find that the species belongs in the genus *Crocidosema,* the male having the characters distinguishing that genus. There is some variation in intensity of markings in my series, but many of them exactly match the figure given by Walsingham in the Fauna Hawaiiensis.

My series of specimens were all reared from larvae in fruits of the native Hibiscus (*H. arnottianus*) collected from a tree along the Manoa Cliffs Trail of Mt. Tantalus, March 15th, 1914. It was the first time that I ever found fruits on a tree of the native Hibiscus, and I noticed that they were much eaten, so took along about two dozen of them (about all that I could conveniently obtain) to rear the moth from the numerous larvae infesting them. My 34 specimens emerged April 3rd to the 16th.

Mr. J. F. Rock told me once that he had found the fruits of this Hibiscus and other related trees in the mountains of Hawaii badly eaten by insects. I have no doubt but what they were the larvae of this moth.

The eggs of the moth are laid on the outside of the enclosing calyx. On hatching the young larva eats through this, and feeds for a time between it and the fruit, finally eating inside of the fruit and destroying all of the seeds. In the lot of fruits that I collected there were but three seeds remaining uninjured when the larvae had finished with them.

The young larvae have the head and cervical shield black. The full-grown larva is about 12mm. in length, dirty whitish or yellowish with a rosy tinge; head very pale testaceous, eyes black, a black streak behind eyes and above this the posterior margin of the head is black; cervical shield concolorous, two submedian blackish spots at posterior margin; spiracles circular, black margined; surface of body minutely roughened except circular areas at base of setae.

The pupa is about 7mm. in length; yellowish brown; wing-sheaths and posterior leg-sheaths extend to apex of 4th abdominal segment, antenna-sheaths a little shorter; two transverse rows of small backwardly-directed spines on dorsum of abdominal segments 2-7, those of the anterior row the larger, one row on segments 8 and 9; cremaster blunt, with two lateral and two dorsal spines.

Notes on the Oviposition of "Diachus auratus" (Chrysomelidae).

BY OTTO H. SWEZEY.

The presence of this little Chrysomelid in the Hawaiian Islands was first discovered by me in May of last year and reported at the June meeting of the Entomological Society. In July, I found it at Kaimuki, Waialae, and in Manoa Valley, always in the flower heads of *Leucaena glauca.* Recently (April 26) it was found on koa in the south end of the Waianae Mountains by Mr. Bridwell and myself. They could be swept quite abundantly from some small trees. I found them on the

Diachus auratus. Adult and eggs, x 6. One of the eggs has the excrementitious case partially removed, showing the white oval egg within.

leaves, but did not find any in the flowers, tho they undoubtedly could have been with sufficient search.

I brought home a female alive, supplying her with koa leaves on which she fed at the edges as well as on the surface in small spots. On the following day I found that she had laid six eggs. These were cylindric-oval, .7mm. long and .4mm. thick, resembling pellets of excrement. They varied in color from greenish to yellow and brown, the surface being covered with lamellate projections spirally arranged. Breaking an egg, I found that the egg itself is white and smooth, enclosed by this outer rough crust, which mystified me somewhat until a few days later I happened to observe the female in the act of supplying an egg with this outer covering. She had already extruded the egg and was holding it between the hind tarsi while she deposited a covering of excrement on it from the anus. This was done bit by bit as she slowly revolved the egg from right to left, the whole process occupying about an hour. When entirely covered the egg was dropped. The excrement appeared like freshly chewed-up leaf material of which the beetle had been feeding only a short time before. In the course of a week, 30 eggs were produced.

JUNE 4TH, 1914.

The one hundred-sixth regular meeting of the Society was held at the library of the Board of Agriculture and Forestry, President Swezey in the chair. Other members present: Messrs. Back, Bryan, Ehrhorn, Osborn, Pemberton and Warren.

Minutes of previous meeting read and approved.

Owing to the inability of Mr. Bridwell to continue as Secretary and Treasurer of the Society, on account of his absence from Honolulu, Mr. Pemberton was elected to fill the office for the balance of the year.

On motion, it was decided to change the meeting place of the Society to the Sugar Planters' Experiment Station.

ENTOMOLOGICAL PROGRAM.

Mr. Ehrhorn exhibited a Syrphid fly which had become impaled on a sharp thorn in a rosebush, the thorn piercing the fly on the dorsum of the thorax between the wings. He suggested the probability of its having become caught as a result of its own exertions or by the wind.

Mr. Swezey announced having bred a species of *Ephedrus* from the rose aphis, the parasite not having been previously recorded here.

Mr. Ehrhorn exhibited a coconut containing within the stem-end a quantity of minute, active, hair-like worms.

Mr. Ehrhorn also exhibited a portion of a spineless cactus (imported from California and now growing at the Waialae Dairy), which was so heavily infested with the scale, *Diaspis echinocacti,* as to be almost entirely covered. He reported this scale to be very abundant in spots on the plants and in some cases completely absent from adjoining plants. The scale was well parasitized by a species of *Aphelinus,* the parasite attacking both male and female scales. Mr. Ehrhorn estimated that 75% of the scales were parasitized.

Mr. Ehrhorn further exhibited a thread-like worm, three inches long when alive, which had been working in pine seedlings from Maui.

Mr. Swezey reported the capture of a number of winged termites at night as they were swarming at lights on Hotel and Nuuanu streets. As they differed from the two well-known termites, he considered that they were the winged forms of the *Coptotermes* sp. which had been found so abundantly working in a fallen flag pole and in the bandstand at the Capitol grounds early in the present year. No winged individuals had been found in those colonies.

Mr. Swezey also reported that the female Chrysomelid, *Diachus auratus* whose egg-laying habits were reported on by him at the previous meeting, had now laid 164 eggs in the period of over two months which she had been in captivity. Dr. Van Dyke, who had dtermined the species, reports it as common thruout the United States.

Mr. Pemberton mentioned the rearing of four specimens of *Opius humilis* from about 2,000 fruits of *Bumelia* sp., heavily infested with fruitfly larvae.

Dr. Back showed that so far this represented but a small percentage of larvae parasitized, as about 3,000 adult fruitflies issued from this same lot of fruit.

New Hawaiian Microlepidoptera.

BY OTTO H. SWEZEY.

The following five species have recently been named by Mr. August Busck from specimens that I sent him for determination and description if new.*

Platyptilia lantana. This is the plume moth in the flower clusters and fruit of lantana. It was introduced from Mexico by Mr. Koebele about twelve years ago.

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* Published in Insecutor Inscitiae Mentruus, II, pp. 103-107, 1914.

Petrochroa swezeyi. A tiny moth that comes to lights at Kaimuki, and which I have also reared from small larval cases on the lava rocks in that region. It represents a new genus in the Family Cygnodiidae.

Petrochroa dimorpha. This also comes to light abundantly. I have reared it from larvae amongst dead leaves, also in dead grass.

Batrachedra cuniculator. A leaf-miner in sedges in the swamps of Kewalo.

Acrolepia nothocestri. A leaf-miner in *Nothocestrum longifolium*, a native tree occurring in the mountains.

List of Additions to the Lepidopterous Fauna of Hawaii Since the Publication of the Fauna Hawaiiensis.

BY OTTO H. SWEZEY.

In the Fauna Hawaiiensis were described or listed 310 species of Macrolepidoptera and 441 species of Microlepidoptera, a total of 751 species. I find that 65 species can now be added to this number, some of which are newly described endemic species; some introduced species that were not previously described; and others introduced species previously known elsewhere.

For convenience of reference I present this list which gives place of description of the new species and reference to records of the introduced species.

Endemic Species.

Family CARADRINIDAE:

Cirphis dasuta Hampson. Cat. Noct. British Museum, V, p. 493, 1905.

Agrotis coniotis Hampson. Cat. Noct. British Museum, IV, p. 426, 1903.

Euxoa (Agrotis) cremioides Meyrick. E. M. M., XXXVI, p. 257, 1900. (Laysan Id.)

Euxoa (Agrotis) procellaris Meyrick. E. M. M., XXXVI, p. 258, 1900. (Laysan Id.)

Euxoa diplosticta Hampson. Ann. Mag. Nat. Hist., 8th ser., IV, p. 368, 1909.

Family PLUSIADAE:

Hypenodes leptoxantha Meyrick. E. M. M., XL, p. 130, 1904.

Nesamiptis newelli Swezey. Proc. Haw. Ent. Soc., II, 5, p. 270, 1913.

Nesamiptis laysanensis Sw. Proc. Haw. Ent. Soc., III, 1, p. 18, 1914. (Laysan Id.)

Plusia giffardi Sw. Proc. Haw. Ent. Soc., II, 5, p. 270, 1913.

Family HYDRIOMENIDAE:

Hydriomena giffardi Sw. Proc. Haw. Ent. Soc., II, 5, p. 271, 1913.

Hydriomena roseata Sw. Proc. Haw. Ent. Soc., II, 5, p. 271, 1913.

Family PHYCITIDAE:

Genophantis leahi Sw. Proc. Haw. Ent. Soc., II, 3, p. 103, 1910.

Family PYRAUSTIDAE:

Omiodes meyricki Sw. Bull. Ent., Exp. Sta. H. S. P. A., 5, p. 24, 1907.

Omiodes musicola Sw. Proc. Haw. Ent. Soc., II, 2, p. 40, 1909.

Omiodes maia Sw. Proc. Haw. Ent. Soc., II, 2, p. 74, 1909.

Omiodes anastreptoides Sw. Proc. Haw. Ent. Soc., II, 5, p. 272, 1913.

Omiodes fullawayi Sw. Proc. Haw. Ent. Soc., II, 5, p. 272, 1913.

Omiodes laysanensis Sw. Proc. Haw. Ent. Soc., III, 1, p. 19, 1914. (Laysan Id.)

Nacoleia scotaea Hamp. A. M. N. H., (8), IX, p. 442, 1912.

Nacoleia hemiombra Hamp. A. M. N. H., (8), IX, p. 442, 1912.

Hymenia exodias Meyrick. E. M. M., XL, p. 130, 1904.

Pyrausta thermantoidis Sw. Proc. Haw. Ent. Soc., II, 5, 273, 1913.

Mestolobes sicaria Meyr. E. M. M., XL, p. 131, 1904.

Scoparia gymnopis Meyr. E. M. M., XL, p. 131, 1904.

Scoparia isophaea Meyr. E. M. M., XL, p. 132, 1904.

Scoparia lycopodiae Sw. Proc. Haw. Ent. Soc., II, 3, p. 104, 1910.

Scoparia nectarioides Sw. Proc. Haw. Ent. Soc., II, 5, p. 273, 1913.

Family GELECHIADAE:

Aristotelia gigantea Sw. Proc. Haw. Ent. Soc., II, 5, p. 274, 1913.

Thyrocopa sapindiella Sw. Proc. Haw. Ent. Soc., II, 5, p. 274, 1913.

Family TORTICIDAE:

Archips fuscocinereus Sw. Proc. Haw. Ent. Soc., II, 5, p. 275, 1913.

Archips sublichenoides Sw. Proc. Haw. Ent. Soc., II, 5, p. 276, 1913.

Tortrix semicinerana Sw. Proc. Haw. Ent. Soc., II, 5, p. 276, 1913.

Capua cassia Sw. Proc. Haw. Ent. Soc., II, 4, p. 183, 1913.

Capua santalata Sw. Proc. Haw. Ent. Soc., II, 5, p. 276, 1913.

Family HYPONOMEUTIDAE:

Euhyposmocoma akaha (Sw.). Proc. Haw. Ent. Soc., II, 3, p. 105, 1910.

Euhyposmocoma trivitella Sw. Proc. Haw. Ent. Soc., II, 5, p. 278, 1913.

Family CYGNODIIDAE:

Petrochroa swezeyi Busck. Insecutor Inscitiae Menstruus, II, p. 105, 1914.

Petrochroa dimorpha Busck. Insecutor Inscitiae Menstruus, II, p. 105, 1914.

Family TINEIDAE:

Gracilaria mabaella Sw. Proc. Haw. Ent. Soc., II, 3, p. 89, 1910.

Gracilaria hauicola Sw. Proc. Haw. Ent. Soc., II, 3, p. 106, 1910.

Gracilaria dubautiella Sw. Proc. Haw. Ent. Soc., II, 5, p. 278, 1913.

Gracilaria hibiscella Sw. Proc. Haw. Ent. Soc., II, 5, p. 279, 1913.

Bedellia oplismeniella Sw. Proc. Haw. Ent. Soc., II, 4, p. 184, 1913.

Bedellia boehmeriella Sw. Proc. Haw. Ent. Soc., II, 4, p. 185, 1913.

Acrolepia nothocestri Busck. Insceutor Inscitiae Menstruus, II, p. 106, 1914.

Introduced Species.

Family LYCAENIDAE:

Thecla agra Hewitson. Purposely introduced about 1902.

Thecla echion L. Purposely introduced about 1902.

Family PIERIDAE:

Pontia (Pieris) rapae L. Meyrick, E. M. M., XL, p. 132, 1904.

Family CARADRINIDAE:

Caradrina reclusa Walk. Swezey, Proc. Haw. Ent. Soc., II, 1, p. 3, 1908.

Family PLUSIADAE:

Adrapsa manifestalis (Walk.). Swezey, Proc. Haw. Ent. Soc., II, 3, p. 133, 1910.

Family PHYCITIDAE:

Cryptoblabes aliena Sw. Bull. Ent. Exp. Sta. H. S. P. A., 6, p. 24, 1909.

Myelois ceratoniae Z. Swezey, Proc. Haw. Ent. Soc., II, 3, p. 135, 1910.

Ephestia kuhniella Z. Swezey, Proc. Haw. Ent. Soc., III, 1, p. 12, 1914.

Family GALLERIADAE:

Corcyra cephalonica Stn. Swezey, Proc. Haw. Ent. Soc., II, 5, p. 212, 1913.

Family PTEROPHORIDAE:

Platyptilia lantana Busck. Insecutor Inscitiae Menstruus, II, p. 103, 1914. Purposely introduced about 1902.

Family GELECHIADAE:

Sitotroga cerealella (Oliv.). Van Dine, An. Rep. Hawaii Exp. Sta. for 1907, p. 43, 1908.

Family HYPONOMEUTIDAE:

Batrachedra rileyi Walsm. Bull. Ent., Exp. Sta. H. S. P. A., 6, p. 22, 1909.

Batrachedra cuniculator Busck. Insecutor Inscitiae Menstruus, II, p. 106, 1914.

Family TORTRICIDAE:

Crocidosema lantana Busck. Proc. Wash. En.t Soc., XII, 3, p. 132, 1910. Purposely introduced about 1902.

Amorbia emigratella Busck. Proc. Wash. Ent. Soc., XI, p. 201, 1909.

Family TINEIDAE:

Opogona apicalis Sw. Bull. Ent., Exp. Sta. H. S. P. A., 6, p. 17, 1909.

Opogona purpuriella Sw. Proc. Haw. Ent. Soc., II, 5, p. 280, 1913.

Ereunetis penicillata Sw. Bull. Ent., Exp. Sta. H. S. P. A., 6, p. 13, 1909.

Cremastobombycia lantanella Busck. Proc. Wash. Ent. Soc., XII, 3, p. 133, 1910. Purposely introduced about 1902.

Cyane terpsichorella Busck. Proc. Wash. Ent. Soc., 3, p. 134, 1910.

JULY 2ND, 1914.

The one hundred-seventh regular meeting of the Society was held in the library of the Board of Agriculture and Forestry, President Swezey in the chair. Other members present: Messrs. Back, Ehrhorn, Illingworth, Osborn, Pemberton and Warren; and Mr. Veitch, who was on his way to take a position as Entomologist for the Colonial Sugar Refining Co. in Fiji, as visitor.

Minutes of previous meeting read and approved.

On motion of Mr. Ehrhorn it was voted to change the hour of meeting from 3:30 P. M. to 2:30 P. M.

ENTOMOLOGICAL PROGRAM.

Mr. Ehrhorn exhibited a female Mediterranean fruitfly, the ovipositor of which had become stuck in a small Chrysophyllum fruit during oviposition and had died in this position, the juice of the fruit being very gummy. Dr. Back stated that he had also observed this often in the same fruit.

Prof. Illingworth reported that in some experiments in spraying squashes with Sodium Arsenite they were not free from the attack of the melon fly.

Mr. Ehrhorn stated that he had observed *Pseudococcus filamentosus* so prevalent on the orange trees in Judge Cooper's orchard in Manoa Valley that practically every terminal bud was badly dwarfed and curled thru the infestation of this mealybug.

Mr. Swezey exhibited a vial containing flea eggs and newly hatched larvae. The eggs had been taken from a man's hat which had been lain on by a dog in the home of a Japanese in Palolo Valley, June 28. Many of the eggs had hatched by July 2.

Mr. Swezey reported that a total of 247 eggs had been laid by the Chrysomelid beetle, *Diachus auratus,* mentioned by him at the previous meeting. The beetle had lived two months after being captured, laying from one to five eggs daily, and once as high as 15 on two successive days.

Mr. Swezey exhibited two specimens of *Isosoma orchidearum* bred from an orchid of the genus *Cattleya* from Dr. Lyons' orchid house. This is the first record of this insect in Honolulu, tho, now that the work of the insect is known, Mr. Ehrhorn stated that orchids showing similar infestation were known several years ago in the orchid house at the Moanalua Gardens, but no insects were found in connection with them at the time.

Mr. Swezey also exhibited specimens of an Ortalid fly, possibly of the genus *Paragorgopsis,* which were reared from maggots found in a coconut that had sprouted. They were found when the coconut was sawed in half for the purpose of making orchid baskets. The maggots were feeding on the partially decayed meat of the sprouting coconut. They were bluish in color and of the general form of fruitfly maggots. The habits of the fly had not previously been known, tho specimens had been taken now and then on windows by several of the entomologists in Honolulu. The first specimen was secured by Mr. Terry in 1904 at the entomological laboratory of the Board of Agriculture and Forestry.

Mr. Swezey further exhibited a single specimen of a Chrysidid which was recently caught by Mr. Potter in his studio on the second floor of the chemical laboratory at the Experiment Station of the Sugar Planters' Association. This is the first record of a Chrysidid caught in the Hawaiian Islands, and must be a recent introduction.

Prof. Illingworth exhibited two specimens of the Reduviid bug, *Triatoma rubrofasciata,* captured in Honolulu.

Some Hyperparasites of White Grubs.

BY OTTO H. SWEZEY.

In May, 1914, 56 cocoons of *Elis sexcincta* were received from Mr. George N. Wolcott. He had collected these at Urbana, Illinois, while collecting cocoons of *Tiphia* to send to Porto Rico. Not desiring to make use of the *Elis* cocoons, he forwarded them to the Experiment Station, where we expected to experiment with this species as a parasite on the grubs of *Anomala* and *Adoretus.* There were not many emergences from the lot and they were mostly males; only one female emreged. She lived for several weeks but failed to parasitize any of the grubs that were supplied her in the cage.

From this lot of cocoons one male and one female Mutilid emerged, and one Bombyliid. Careful examination showed that with each of them they had been parasitic on the *Elis,* and thus were hyperparasites of some white grub—presumably some species of *Lachnosterna.*

The Bombyliid was *Anthrax fulvohirta* Wied. I have not seen any reference in literature to its host relationships. In Dr. Forbes' 24th Illinois Report, 1908, on page 160, a Bombyliid (*Exoprosopa fascipennis* Say) is mentioned as a parasite on *Tiphia,* and is thus also a hyperparasite on white grubs. On page 161 of the same Report, another Bombyliid (*Sparnopolius fulvus* Wied.) is mentioned as a direct parasite on white grubs.

The Mutilids above were of different species, according to the best available literature on this family—the male being *Mutilla castor* Blake, and the female *Mutilla ferrugata* Fabr. From the fact of breeding them both from the same lot of *Elis* cocoons, collected in the same field, and that each was described only on the one sex, I am inclined to the opinion that these are the sexes of one and the same species. Further observations by those working on white grubs and their parasites in Illinois would be of much importance. I have not previously seen any reference to a Mutilid being parasitic on a Scoliid.

Dragonflies and Their Food

BY ALFRED WARREN.

During the latter part of 1913 and the first part of 1914 the writer carried on some research work* for the purpose of obtaining definite data on the range of food of the local dragonflies, particularly of the two common lowland species, *Anax junius* Drury and *Pantala flavescens* Fabr. The following is a brief summary of these investigations. The food habits of the above species of dragonfly were studied in both the nymphal and adult stages. With the nymph, examination of the contents of the alimentary canal was the chief method employd to ascertain what the dragonfly lives on during this period of its life; while with the adult, two methods were employed, viz., examination of the contents of the alimentary canal and field observation. In the pursuit of these investigations, it was aimed to cover as much territory around Honolulu as time and circumstances would permit, so as to include as many as possible of the varied conditions under which the dragonflies find their food on the lowlands.

Examination of the Contents of the Alimentary Canal of Nymphs.

In this connection 335 nymphs, 41 *Anax* and 294 *Pantala* were dissected for the purpose of examining the alimentary canal. Out of the 41 specimens of *Anax*, 6 were found to have

* This work was carried on in connection with a course in entomology at the College of Hawaii in partial fulfillment of the requirements for the degree of M. S.

the digestive tract entirely empty; and of the 294 *Pantala*, 76 had in their alimentary canal no traces of animal remains, being either entirely empty or containing some mud, gravel or algae. There were then left in all 253 specimens whose digestive tract contained some kind of animal remains.

The following list gives the different kinds of animal life preyed on by dragonfly nymphs as represented in the contents of the digestive tract of the 253 *Anax* and *Pantala* nymphs dissected. The figures in the table represent units, or the number of times a certain species or group appeared in the series of dissections; that is, each distinctive species or group of animal, as classified in the table, whether found in large or small quantities in the contents of a single digestive tract, is given the value of one unit.

TABLE SHOWING THE FINDINGS IN THE CONTENTS OF THE ALIMENTARY CANAL OF 253 NYMPHS.

COLEOPTERA			
Dytiscidae, the smallest of the three sps.			16
DIPTERA			
Chironomidae			
Chironomus hawaiiensis, larvae	167		
Chironomus hawaiiensis, adults	4		
Chironomid larva, undetermined	1	172	
Culicidae			
Mosquito larvae and pupae	12		
Mosquito adult	1	13	
Dolichopodidae		1	
Adult fly, undetermined		1	187
HEMIPTERA			
Myodochidae			
Merragata hebroides White		1	
Gerridae			
Microvelia vagans White		2	3

HYMENOPTERA		
Myrmicidae		
Pheidole megacephala Fabr.	2	
Ants, undetermined	11	13
ODONATA		
Libellulidae		
Pantala flavescens Fabr., nymphs		6
CRUSTACEA		
Cypris	108	
Shrimps	3	111
MOLLUSCA		
Spiral shells		14
PROTOZOA		
Euglena		30
ANNULATA		
Nereis		1
AMPHIBIANS		
Tadpoles		8
FISH		
Top Minnow (?)		1
Total		390

LAND INSECTS AS FOOD FOR NYMPHS.

It has been suggested that, since the Hawaiian streams and other bodies of fresh water contain so very few kinds of aquatic insects, and since the yellow and blue dragonflies are so numerous in many localities, the nymphs must obtain some part of their food from other sources than from the purely aquatic creatures. This outside food is thought to be derived from the occasional accidental dropping into the water of aerial insects; or, during freshets when extensive areas of vegetation are suddenly inundated, from the large numbers of insects that drown and are swept into the main water channels.

In order to find out if the nymphs really do feed on aerial forms if given a chance, a series of experiments was carried on by feeding the nymphs, both *Anax* and *Pantala*, in confinement only such forms of insects that were aerial or at least in that stage at the time they were used in the experiments. In these tests only half-grown or larger nymphs were taken. No other food than land insects was given them and these in most cases were dropped in the feeding jars alive. Some of the nymphs were carried through in this way for one or two moults, or until they finally emerged. In some cases this feeding period was carried on for from two to five weeks. All the different species of insects fed were readily eaten, except most of the ants, especially those strong in formic acid, and some aphids.

Beside adult insects, caterpillars, maggots and grubs of various kinds, also other small creatures, such as spiders, land Crustaceans (shrimps and sowbugs), millipedes, earthworms, and nematodes were fed to the nymphs. All these were eagerly snatched at and eaten up.

Often when no other food was available, small bits of fresh beef seemed to be relished.

That dragonfly nymphs do feed on land insects under natural conditions is borne out by the findings in the contents of the alimentary canal of the 253 nymphs dissected, as listed above. Out of this number, 20 nymphs were found to contain aerial forms, thus representing 7.9 per cent. of the number dissected; or, if this number is expressed in units, to conform with the tabulated statement, then the land insects consumed by these nymphs constitute 7.9 per cent. of their food.

Field Observation and Examination of the Contents of the Alimentary Canal of Adults.

In this series of dissections 218 *Pantala* and 24 *Anax* (excluding those whose alimentary canal was found empty) were taken. To these figures may be added a number of dragonflies that were caught with the victim still more or less intact in their mouth parts. As the mouth parts are really part of the digestive tract, the insects thus found will be included in the list of those found in the alimentary canal proper.

As there seems to be a slight difference in the food habits between the *Pantala* and *Anax*, as indicated by the observations so far made, the findings of the two species will therefore be given under separate tables, as follows:

TABLE SHOWING THE FINDINGS IN THE CONTENTS OF THE ALIMENTARY CANAL AND MOUTH PARTS OF 24 ADULT ANAX.

COLEOPTERA		
Scarabaeidae		
Psammodius sps.	6	
Undetermined sp.	1	
Undetermined beetle	1	8
DIPTERA		
Culicidae	3	
Undetermined flies	4	7
HEMIPTERA		
Fulgoridae		
Siphanta acuta Walk.		1
HYMENOPTERA		
Apidae		
Apis mellifica Linn.	11	
Formicina	5	16
LEPIDOPTERA		
Caradrinidae		
Cirphis unipuncta (Haw.)	1	
Pyraustidae		
Hymenia fascialis (Cram.)	1	
Undetermined forms	9	11
ODONATA		
Agrionidae		
Agrion sp.	1	
Libellulidae		
Pantala flavescens Fabr.	1	2
MISCELLANEOUS		
Mite		1
Total		46

TABLE SHOWING THE FINDINGS IN THE CONTENTS OF THE ALIMENTARY CANAL AND MOUTH PARTS OF 218 ADULT PANTALA.

COLEOPTERA		
Bostrichidae		
Rhizopertha pusilla Fabr.	1	
Scarabaeidae		
Psammodius sps.	22	
Undetermined sps.	2	
Staphylinidae	31	
Undetermined beetles	28	84
DIPTERA		
Chironomidae		
Chironomus hawaiiensis Gr.	1	
Undetermined sps.	5	
Culicidae		
Culex fatigans Wied.	1	
Stegomyia scutellaris Walk.	1	
Not determinable	3	
Drosophilidae	3	
Undetermined flies	140	154
HEMIPTERA		
Aphidae	24	
Corisidae		
Corixa blackburni White	4	
Fulgoridae		
Perkinsiella saccharicida Kirk.	4	
Undetermined sp.	1	
Jassidae		
Draeculacephala mollipes Say	3	
Nesophrosyne perkinsi Kirk.	3	
Lygaeidae	2	
Tingitidae		
Teleonemia lantanae Dist.	4	45

HYMENOPTERA		
Apina (not honey bee)	1	
Braconidae		
Chelonus blackburni Cam.	1	
Formicina		
Myrmicidae		
Pheidole megacephala Fabr.	6	
Undetermined Ants	11	
Mymaridae		
Paranagrus optabilis Perk. (?)	1	
Other Hymenopterous Parasites	3	23
LEPIDOPTERA		
Tineidae		
Cremastobombycia lantanella Busck. (?)	5	
Undetermined forms	72	77
ODONATA		
Agrionidae		
Agrion sp.		1
CORRODENTIA		
Psocidae		8
THYSANOPTERA		
Thripidae		9
MISCELLANEOUS		
Mite		1
Spiders		2
Total		404

SUMMARY.

The data obtained on the food habits of the two species of dragonfly during this research work and recorded above are by no means exhaustive or final, but they should be considered merely as a beginning of a study which has heretofore received little attention. However, as far as these data show we may gain some idea of the food habits of this group of insects and something of their economic importance to the rest of the insect fauna under Hawaiian conditions. The following is a summary list of the species or genera that have been found to contribute to the food of the two species of dragonfly in both the nymphal and adult stages.

NUMBER OF SPECIES OR GENERA IDENTIFIED.

COLEOPTERA

Dytiscid sp. (the smallest of the three local sps.)
Rhizopertha pusilla Fabr.
Psammodius sps.

DIPTERA

Chironomus hawaiiensis Grims., larvae, pupae, and adult.
Culex fatigans Wied., larvae and adults.
Stegomyia scutellaris Walk., larvae and adults.
Liancalus sp.

HEMIPTERA

Corixa blackburni White
Draeculacephala mollipes (Say)
Merragata hebroides White
Microvelia vagans White
Nesophrosyne perkinsi Kirk.
Oliarus tarai Kirk.*
Perkinsiella saccharicida Kirk.
Siphanta acuta Walk.
Teleonemia lantanae Dist.

HYMENOPTERA

Apis mellifica Linn.
Chelonus blackburni Cam.
*Muscidifurax vorax**
Paranagrus optabilis Perk. (?)
Pheidole megacephala Fabr.

LEPIDOPTERA

Agrotis dislocata Walk.*
Cirphis unipuncta (Haworth)
Hymenia fascialis (Cram.)

ODONATA

Agrion sps.
Pantala flavescens Fabr., nymphs and adults.

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* Added since writing the original article.

* Added later.

Life History of "Pantala flavescens" Fabr.

As far as could be learned the life history of none of the local dragonflies had been worked out. As the dragonfly is in evidence all the year round in Hawaii, it will be of interest to have some idea as to the length of development from egg to adult. A brief review of the results of some rearing experiments with the *Pantala* will therefore be given. There are three distinct stages in the life of the dragonfly,—the egg; the nymph, or growing period; and the adult, or mature stage.

Egg.—The eggs are whitish (later on they become quite yellow), subspherical bodies, about one-fifth mm. by one-third mm. in size. They are laid singly or a few at a time by the female as she flies close over a body of water striking the tip of her abdomen down on the surface. The eggs of this species are laid anywhere in the open where water flows or accumulates—from a small mud-puddle in the street to a large stream or pond.

The eggs for the purpose of carrying out the breeding experiments were secured by catching female dragonflies in the act of ovipositing, and collecting in a glass those eggs which were extruded from the bursa copulatrix in large masses. The number of eggs thus obtained varied from 50 to several hundred. In one case 816 were collected in this way from a single female, most of which proved to be fertile. Each batch was placed separately in a small Petri dish filled with water where the eggs hatched in from 5 to 7 days.

Nymph.—The newly hatched nymph is about two-third mm. long. Its first activity is to moult almost immediately after hatching, increasing its length by a fraction of a millimeter, when it is ready to start out on its life-long hunt for food,—food which is in all cases animal life. In these rearing experiments it was soon found that, on account of their strong cannibalistic character, the nymphs had to be placed in separate vessels. As an illustration of their cannibalism the following incident may be given: Seventy (69 *Pantala* and one *Anax*) nymphs of various sizes were placed in a small rearing tank and provided with no outside food, except a small top minnow. One week later there were left 7 *Pantala*, the one *Anax*, and the little fish, so that 62 nymphs were eaten by their fellows.

Four nymphs were successfully reared to maturity. The following gives in tabular form the life history of the four dragonflies from egg to adult:

TABLE SHOWING THE LIFE HISTORY OF FOUR SPECIMENS "PANTALA FLAVESCENS" FABR.

Egg or Instar	Average Length in mm. for the First Three	No. 1 Days	No. 2 Days	No. 3 Days	No. 4 Days	Average Days
Egg	..	5	5	5	7	5½
1st	⅔	—½*	—½*	—½*	—½*	—½*
2nd	1	4	5	4	3	4
3rd	1½	3	5	7	3	4½
4th	2⅓	2	8	6	2	4½
5th	4	3	8	6	3	5
6th	5	2	5	5	4	4
7th	6	3	6	5	5	4¾
8th	8	2	5	6	6	4¾
9th	10	5	4	9	5	5¾
10th	13	4	9	9	8	7½
11th	18	8	13	14	27	11⅔†
12th	24	19	30	30	..	26⅓†
Total No. of days for growth of nym.		55	98	101	66	80
		Female	Female	Male	Male	

From the above table it will be seen that the nymphs moult ten or eleven times; and that the length of time of incubation and especially the total nymphal period vary considerably in the different indiviudals. It will also be noted that the time of the last two or three instars gradually lengthens, the last, of course, being the longest, averaging (for the four) more than one-third of the life of the nymph. This long period is due to the great change that takes place during the last stadium,—a change from the nymphal water-inhabiting form, breathing chiefly by means of tracheal gills, to the adult form, breathing altogether by means of tracheae. We may say this period corresponds to the pupal stage of those insects possessing a complete metamorphosis. During this time many of the organs are greatly changed; and some are even completely reconstructed, such as the respiratory organs, labrum, wings, compound eyes, gizzard, etc.

In the above experiments the nymphal period varied from 55 to 101 days. It is doubtful if the nymphs complete their growth in nature in so short a time as No. 1 did in the above experiment, except in very rare cases, as their food supply is not always close at hand; and the amount of food, modified doubtless by climatic conditions, largely determines the rate of growth

* Less than ½ hr.
† For 3.

of the nymphs. In the above table nymphs Nos. 1 and 4 were fed daily with large amounts of food; while Nos. 2 and 3 were fed less often and in smaller quantities. The difference is brought out in that Nos. 1 and 4 completed their growth in about two months, while Nos. 2 and 3 required over three months for their development.

Other experiments conducted along this line proved still more strikingly the relation of food to growth. Two nymphs, hatching on the same day, were placed in separate vessels. One was fed liberally with mosquito larvae, and the other was given five or six mosquito larvae every four or five days. In nineteen days the former moulted seven times, and was well along the eighth instar when the latter cast its third moult, and at this stage was no larger than the other at its fourth instar.

The ability to fast for long periods of time also plays a great part in the length of nymphal life. Some experiments were carried on to see how long nymphs could go without food. The longest fasting periods, obtained in these experiments, were from 14 to 16 days. Under natural conditions, however, there is no doubt but that they can keep alive without food for much longer periods. Some species of dragonfly nymphs have been kept without food in confinement for a month and more. Specimens of *Aeschna cyanea* and *Agrion puella* fasted for 30 and 33 days respectively ("Entomologist", 33:211), and at the end of that time were still active and apparently not at all affected by the long fast.

From the above statements we may safely conclude then that the nymphal period varies from two to six or more months.

Adult.—No attempt was made to see how long the imago lives, as the very active nature of the dragonfly and the manner in which it procures its food would not permit of any successful feeding in confinement. It is reasonable to suppose, however, that its life does not extend over a great many weeks, if we can draw any inference from the very advanced stage of development of the ovaries in the later stages of the female nymphs, although this is no definite proof, and experiments on the life of the adult dragonfly would be of very great interest. In dissecting nearly full-grown female nymphs, it was found that the ovaries were full size, and the ovarian tubes practically as long and plump as those of the adult, but no signs of any egg constructions could be detected.

AUGUST 6TH, 1914.

The one hundred-eighth regular meeting of the Society was held in the entomological laboratory of the Sugar Planters' Experiment Station, President Swezey in the chair. Other members present: Messrs. Ehrhorn, Illingworth, Osborn, Pemberton and Wilder.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Mr. Ehrhorn stated that he had found *Hister bimaculatus* very abundant at the Waialae Dairy, hundreds occurring in small areas in manure piles. A number of cockroaches that were perfectly white were also found buried in the manure. Prof. Illingworth stated that this lack of coloring was due to their having very recently molted.

Mr. Wilder exhibited quite a number of water-striders of the genus *Halobates*, which he had captured in October, 1913, skipping over the surface of the ocean between the Island of Kahoolawe and the coast of Maui. This is the only record of the capture of any of this genus of bugs by any of the members of the Society.

Prof. Illingworth reported having observed a large number of larvae of the Syrphid fly, *Volucella obesa,* feeding within a decayed papaya trunk.

Mr. Swezey exhibited a small weevil which was caught on an orchid by Dr. Lyon. It was of a species not hitherto known here, probably near related to *Acythopeus nigerimus*, an orchid weevil that has been quite injurious in some orchid houses in Honolulu of recent years, tho much smaller than the latter.

Mr. Swezey spoke of having visited a canyon back of Hauula on the windward side of Oahu where he had never collected before, and exhibited a moth, *Hyposmocoma* sp. and a bug, *Acanthia* sp., which were probably new species. The moth was at rest on the surface of a rock and the bug was taken from the surface of the stream.

Mr. Ehrhorn reported that from two pounds of coffee gathered at random in Kona, Hawaii, 100 pupae of *Ceratitis capitata* were secured, and that from these pupae 90 specimens of *Opius humilis* were bred. He considered this very gratifying, inasmuch as only three females of the parasite were liberated in the district from which the coffee was taken, and only about a year had elapsed since the females were liberated. Mr. Ehrhorn also stated that he had observed *Opius humilis* ovipositing in fruitfly maggots in fruit, not only on the tree, but after it had fallen to the ground. He expressed the opinion that fruitfly larvae may be killed by the heat of the sun, when in certain fruits, after the fruit has fallen to the ground. He had found that all of the maggots in a mango, which was lying in the direct sunlight and which was much heated, were dead.

Prof. Illingworth spoke of the great importance, in parasite breeding, of confining the parasites for a sufficient length of time to assure mating before liberation; basing his arguments upon practical experience gained in the breeding and libertion of Tachinids in Fiji.

SEPTEMBER 3rd, 1914.

The one hundred-ninth regular meeting of the Society was held in the usual place, President Swezey in the chair. Other members present: Messrs. Back, Ehrhorn, Illingworth, Osborn and Pemberton.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Mr. Swezey exhibited a specimen of the mango weevil (*Cryptorhynchus mangiferae*) taken by Mr. C. M. Cooke at Lihue, Kauai, this being the first record of the presence of this beetle on that Island.

Mr. Swezey also exhibited two species of earwigs found in a box of apples from California; a small beetle found in a basket of plums from California; and an ant, determined by Mr. Ehrhorn as *Brachymyrmex* sp., taken by Dr. Lyon in his orchid house. All of these were of species not hitherto recorded in the Hawaiian Islands.

Prof. Illingworth, in reporting results of spraying experiments against the melon fly, stated that a spray-formula used elsewhere, composed of sodium arsenite, glucose, sodium borate, and borax used in certain proportions, was found to be injurious to young plants attacked by the melon fly, The spray solution when properly combined proved a good substance for retaining its original liquid condition. It showed no decided tendency however of attracting the adult flies.

Dr. Back stated that an important factor to consider in the control of the melon fly by spraying, is the lateness at which sexual maturity is reached; mating not taking place until at least three weeks after issuance from the pupa, and oviposition not commencing until about a month after issuance. He also stated that one great difficulty in the effective elimination of this fly in an infested region is the longevity of the adults, many then being alive at the Fruitfly Insectary which were nearly seven months old.

Mr. Ehrhorn announced the recovery of two females and six males of the Australian fruitfly Braconid (*Diachasma tryoni*) from infested coffee secured from Kona, Hawaii. This is the first record of the success of the introduction of this species, which has resulted from the liberation of only four females in Kona in June, 1913.

OCTOBER 8TH, 1914.

The postponed one hundred-tenth regular meeting of the Society was held in the usual place, President Swezey in the chair. Other members present: Messrs. Ehrhorn, Illingworth, Osborn and Pemberton.

Minutes of previous meeting read, corrected and approved.

The Editor reported the issuance of the first number of the third volume of the "Proceedings of the Hawaiian Entomological Society".

ENTOMOLOGICAL PROGRAM.

Mr. Ehrhorn stated that he had ascertained since the last meeting of the Society, that the samples of infested coffee from which he had bred *Diachasma tryoni*, as reported at that meeting, were secured at Kaaualoa, a point about six miles from the place where the original parasites were liberated last June.

Prof. Illingworth stated that he had recently seen the ant, *Pheidole megacephala*, excavate into three inches of soil and kill pupae of *Sphinx convolvuli;* and that he had also observed the same ant follow and kill the burrowing cockroach, *Nauphoeta bivittata*, and another roach, *Leucophoea surinamensis*, as they burrowed in moist soil.

Prof. Illingworth exhibited a living, active Dermestid larva and 15 molted skins of this larva, all of which had been cast between May 2, 1913, and Oct. 1, 1914. The larva was apparently full-grown in May, 1913, when observations began, and was confined during the entire period between two watch glasses, and having nothing for food but dried insects. He also exhibited a bottle of cayenne pepper badly infested with the beetle, *Catorama mexicana.* He also stated that he had found the beetle, *Tribolium ferrugineum,* feeding upon the paste in newly-bound books at the College of Hawaii.

Prof. Illingworth further stated that he had observed the nymphs of three species of cockroaches to be compressed laterally when first hatched, but that the dorso-ventral flattening takes place in a short time, the lateral compression being due to the position of the young nymphs while crowded together in the egg-mass before hatching.

Mr. Ehrhorn stated that he had noticed the fire ant, *Solenopsis geminata,* apparently not as abundant as formerly. Mr. Swezey said that he had noticed them as prevalent as usual at his home in Kaimuki.

Mr. Ehrhorn exhibited several living specimens of the wasp, *Polistes aurifer,* which were parasitized by Stylopids. In one case there were as many as three Stylopids between the abdominal segments of one wasp. These wasps were taken by Mr. Ehrhorn and Mr. Swezey from nests on the under side of palm leaves at the grounds of the Sugar Planters' Experiment Station; five of the parasitized wasps were taken from one nest, an unusual proportion of the wasps being parasitized.

Mr. Swezey exhibited a specimen of *Coniocompsa vesiculigera* (End.), this being the first record of any member of the family Coniopterygidae in the Hawaiian Islands.

Mr. Swezey also exhibited a portion of corrugated paper taken from a packing box under his house, in the folds of which were several cells of a nest of a wasp resembling *Trypoxylon bicolor* but somewhat smaller. Some of the cells contained cocoons of the wasp, other cells contained very small spiders. The nest was accidentally found by observing the wasp going to it with spiders. The wasp is an undetermined species not hitherto recorded in the Hawaiian Islands.

Prof. Illingworth exhibited some books and old papers which had been attacked by the termite, *Calotermes marginipennis.* The books were ruined, there being large cavities and galleries that had been eaten out by the termites.

A Leaf-Mining Cranefly in Hawaii.

BY OTTO H. SWEZEY.

Dicranomyia foliocuniculator n. sp.

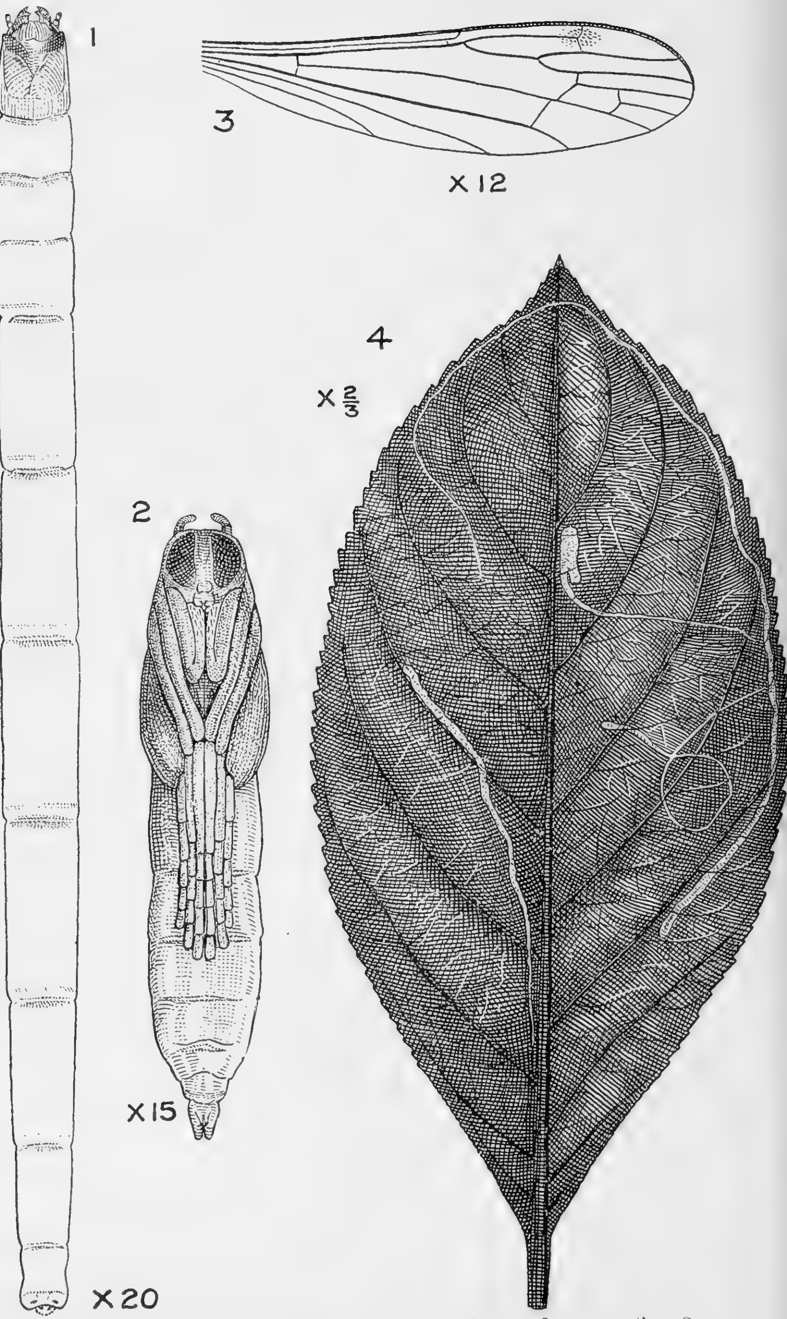
Head, antennae and mouth parts dark fuscous; thorax and abdomen fuscous above, ochraceous below, abdomen sometimes greenish below; halteres fuscous, the stem paler; wings fuscous-hyaline, not spotted except a spot of more intense fuscous at the termination of the first longitudinal vein; auxiliary vein for the last three-fifths running very close to the first longitudinal vein, terminating a little before the origin of the second longitudinal vein, connected with first longitudinal a little before termination; venation as shown in Fig.; legs slender, fuscous, femora paler towards base, coxae and trochanters ochraceous. Length of body, 4mm.; wing, 5mm.

HABITAT. Larvae mining the leaves of *Cyrtandra paludosa* and other species of *Cyrtandra*, in the mountains at Punaluu, on the windward side of Oahu. No adults collected. I first discovered the mines of this insect in the leaves of *Cyrtandra* bushes growing along the Punaluu Trail, June 11, 1911, and reared a few specimens. Later, on the following dates, I again collected mined leaves and reared a few more specimens: August 10, 1913; September 13, 1914. The adults proved to be different from any hitherto described species in Hawaii.

MINE. The mine is long and slender, more or less sinuous and wandering about the leaf, often following the margin, gradually widening as the larva increases in size. There may be as many as a dozen mines in one leaf.

LARVA. The full-grown larva is 10-11mm., elongate, slender, cylindrical, gradually tapering posteriorly, without setae, footless, anterior and posterior margins of segments (except 3 or 4 anterior and 2 posterior ones) minutely roughened on dorsal and ventral surface to assist in locomotion. Whitish, transparent so that the alimentary canal and tracheal system are plainly seen, the latter having two longitudinal tracheae connecting with two black spiracles above the anus. Head with brownish mouth-parts, mandibles working horizontally, the whole head retracting into the following segment which in turn retracts into the next. Segments 1-3 of moderate length, 4-10 elongate, remaining segments short.

PUPA. The pupa is formed within the mine, the larva



Dicranomyia foliocuniculator. Fig. 1, larva; fig. 2, pupa; fig. 3, wing venation; fig. 4, leaf of *Cyrtandra* showing mines.

sometimes receding somewhat from the terminal end of the mine before pupating. Some were found with the anterior end projecting thru a break in the dead epidermis of the leaf. 6-7mm. long, slender, nearly cylindrical; pale greenish, head, wing-sheaths and leg-sheaths dark fuscous to nearly black just before the emergence of the fly. Thorax with two yellowish brown dorsal horns, the respiratory processes, projecting forward with the tips curved ventrally. Leg-sheaths of equal length, extending along ventral side to the apex of the fourth abdominal segment; wing-sheaths placed laterally, extending to apex of second abdominal segment; margins of abdominal segments minutely roughened as in the larva, which enables the pupa to force itself half way out of the mine before the emergence of the fly; apex of abdomen slightly bifid.

This is apparently a very remarkable habit for a cranefly, as I have been unable to find any mention of such habits in literature. The larvae of those species that have been studied feed at the roots of plants, beneath dead bark, in rotten logs and other decaying vegetation, etc., some are aquatic, and others live on leaves like caterpillars. There are numerous species of *Dicranomyia* in the mountains of the Hawaiian Islands, many of which are yet undescribed, and the habits of the larvae are mostly unknown. It may be that other species may be found to have this leaf-mining habit when their habits are studied.

NOVEMBER 5TH, 1914.

The one hundred-eleventh regular meeting was held in the usual place, President Swezey in the chair. Other members present: Messrs. Giffard, Ehrhorn, Fullaway, Illingworth, Kuhns, Osborn, Pemberton and Potter; and Mr. C. F. Mant, visitor.

Minutes of previous meeting read and approved.

Mr. Swezey proposed the name of Mr. C. F. Mant for active membership in the Society.

ENTOMOLOGICAL PROGRAM.

Mr. Ehrhorn read from the October, 1914, number of Science, a paper by Fernando Sanford of Stanford University, giving results of the use of Cyanide of Potassium injected into holes bored in the trunks of trees as a remedy for scales and other sap-feeding insects.

Mr. Osborn in reporting on the present distribution of the Jassid, *Draeculacephala mollipes*, gave the following points on Oahu at which he had collected it on rice: Waipio, March 12, 1914; Honouliuli, April 26, 1914; Waiahole, July 9, 1914; Punaluu, August 9, 1914.

Mr. Osborn reported that on October 10, and for a week or more thereafter, he had observed at Waikiki Beach large numbers of the small fly *Scatella hawaiiensis* var. *sexnotata*. They had not previously attracted any attention.

Mr. Fullaway briefly summarized and mentioned certain interesting features of a recent paper by Professor V. L. Kellogg of Stanford University on the "Ectoparasites of Mammals." (American Naturalist, May, 1914.)

Prof. Illingworth stated that at present he could find no evidences of the activity of the palm leafroller (*Omiodes blackburni*), that on the trees previously infested by it none of the stages of the insect were to be found at the present time. Mr. Swezey expressed his opinion that this was remarkable for when he had previously made some studies on this pest he could find one or more stages of them present on the trees at all times, tho at certain seasons they were scarcer than at others.

Mr. Swezey exhibited adult specimens of *Trynoxylon* sp. which were reared from the nest in corrugated paper that he had exhibited at the previous meeting.

Mr. Swezey also exhibited male and female specimens of a species of *Tiphia* recently introduced from Japan by Mr. Muir, to attack the grubs of the beetle, *Anomala orientalis*.

Investigation of Spread of Fruitfly Parasites in Kona, Hawaii.

BY W. M. GIFFARD.

Investigations as to distribution of *Opius humilis* and *Diachasma tryoni* throughout the coffee fields in South and North Kona, either one or both of these having been collected by W. M. Giffard and Dr. E. A. Back in the following fields over a distance of twenty-six miles between October 28th and 31st both inclusive, viz.:

(In all these fields Dr. Back gathered samples of ripe berries and either saw or took parasites, whilst Giffard confined his work to collecting adult specimens on the wing or by sweeping. In all instances only a small number of parasites were taken, many of those captured having been liberated.)

South Kona.

No. 1. Oct. 31, 1914. At Kalahiki, one and one-half miles south from Hookena Church on main road. Field scarce of berries. Caught nine specimens (*Diachasma tryoni,* all ♂ ♂). Parasites plentiful.

No. 2. Oct. 31, 1914. At Hookena, opposite church on main road. Berries plentiful in this field. Saw many parasites. Caught six specimens (*Diachasma,* 4 ♂ ♂, 2 ♀ ♀).

Special. Oct. 28, 1914. At Honaunau, opposite Honaunau store on main road. In this field in which berries were plentiful six specimens of both species (2 *Opius* ♂ ♂ and 4 *Diachasma* ♂ ♂) were taken by W. M. Giffard, being the first taken during the period of investigation whilst Dr. Back was gathering berries from a field one mile mauka of the store where the original *Diachasmas* were liberated in June, 1913. Large numbers of parasites seen in this makai field by W. M. Giffard.

No. 3. Oct. 29, 1914. At Honaunau, one-half mile mauka Honaunau store. On this day Dr. Back took seven specimens while collecting berries (4 *Opius* 2 ♂ ♂, 2 ♀ ♀ and 3 *Diachasma* ♂ ♂).

No. 4. Oct. 29, 1914. One-half way between Honaunau and Kahaloa in coffee field opposite new Bishop Estate road junction with main road. Caught 5 specimens (4 *Opius* and 1 *Diachasma,* all ♂ ♂).

No. 5. Oct. 29, 1914. At Kahaloa near Michado store. Berries and parasites plentiful. Caught 10 specimens (all *Opius,* 2 ♀ ♀ and 8 ♂ ♂).

No. 6. Oct. 29, 1914. At Kealakekua, opposite Capt. Cook coffee mill. Berries fairly plentiful with many parasites. Caught 7 specimens (5 *Opius,* 4 ♂ ♂, 1 ♀ and 2 *Diachasma,* 1 ♂, 1 ♀).

No. 7. Oct. 28, 1914. On makai road to Napoopoo on land of Kahaloa. In field opposite school house. Berries not plentiful. Took 2 specimens (*Opius,* both ♀ ♀).

No. 8. Oct. 28, 1914. On same road in field opposite papaia grove. Berries not plentiful. Took 2 *Opius* ♂♂ and 1 *Diachasma* ♂.

No. 9. Oct. 28, 1914. On same road one-fourth mile nearer Paris ranch house. Took 1 specimen *Opius*, ♂. Berries not plentiful. *N. B.*—Parasites evidently scarcer in fields along lower Kealakekua or Napoopoo road than mauka, as fewer were seen.

North Kona.

No. 10. Oct. 30, 1914. At Kainaliu opposite Hiwashta grocery store about two miles north from Miss Paris', took 3 parasites (all *Opius*, 2 ♀♀, 1 ♂). Saw numbers of parasites. Coffee berries plentiful.

No. 11. Oct. 30, 1914. At Honalu about four miles north from Miss Paris'. Took two parasites (both *Opius*, 1 ♂, 1 ♀). Saw a few others but berries not plentiful.

No. 12. Oct. 30, 1914. At Keauhou about three-fourths mile south of Kailua road junction. Took 6 parasites (all *Opius*, 5 ♂♂, 1 ♀). Saw numbers. Coffee berries plentiful.

No. 13. Oct. 30, 1914. At Kahaluu (Bishop Estate land) in Oka's coffee field, about two miles south of Halaloa. Took 12 parasites (all *Opius*, 11 ♂♂, 1 ♀). Saw large numbers. Berries not very plentiful.

No. 14. Oct. 30, 1914. Lanihau, in field opposite store of Nakahara, about three miles north of Holualoa postoffice. Took 5 specimens (all *Opius*, ♂♂). Both berries and parasites plentiful.

No. 15. Oct. 30, 1914. At Holualoa, in field of Hyashihara, where a second tent containing *Opius humilis* were liberated, I took 1 *Opius*, ♀, and a small *Braconid* sp. The same conditions prevailed in this field as in that of Kimura.

No. 16. Oct. 30, 1914. At Holualoa, in fields of Kimura, where a tent containing original *Opius humilis* parasites were liberated. In field makai of Yokoyama store on main road I saw no *Opius* at all but Dr. Back says he saw two. Coffee berries were scarce, crop having been picked. On same land mauka of road I took 1 specimen (*Opius*, ♀), but there was likewise a scarcity of berries.

No. 17. Oct. 30, 1914. At Kalaloa, about 2½ or 3 miles north from third junction of road to Kailua beyond Honokohau. Took 12 specimens (6 *Opius*, 2 ♂♂, 4 ♀♀, and 6 *Diachasma*, 3 ♂♂, 3 ♀♀). Coffee in this small field was wild, overgrown and uncultivated, with berries only fairly plentiful. Saw many parasites.

NORTH KONA		SOUTH KONA	
From Kealakekua to and beyond Honokohau; 15 miles		From Kealakekua to and beyond Hookena; 12 miles	
Opius	*Diachasma*	*Opius*	*Diachasma*
3	6	2	9
2	....	4	6
6	....	4	4
12	....	10	3
5	....	5	1
1	....	2	2
1	....	2	1
6	....	1	....
36	6	30	26

New Species of Hawaiian Moths.

BY OTTO H. SWEZEY.

Epagoge urerana n. sp.

Antennae 3/5; brown. Palpi pale brown, terminal segment very short, not projecting in front of head. Head and thorax chocolate brown. Front wings chocolate brown, with numerous short dark fuscous strigulae; a whitish ochreous band across wing at 1/3, bent outwardly nearly to a right angle at middle; a similar somewhat indistinct band at 2/3, and a subterminal band from 7/8 of costa to tornus; in the female the dorsal half of wing beyond basal third is ochreous; cilia brownish; expanse 12-13mm. Hind wings and cilia very pale brownish. Abdomen light brown. Legs ochreous, fore and mid femora and tibiae brownish above, tarsi barred with brown.

HAB. Mt. Tantalus, Oahu, April 5, 1914. Four specimens reared from larvae boring in twigs of *Urera sandwicensis*, near growing tip of new shoots.

LARVA. Full-grown larva about 12mm.; pale greenish, head pale testaceous, eyes black, lateral margin of head with a black line beginning a little back of eyes; cervical shield fuscotestaceous, tubercles distinctly slightly infuscated, those of line *ii* wider apart than those of line *i*; spiracles circular, dark margined; skin minutely roughened; anal comb of five stiff bristles.

PUPA. About 7mm.; pale yellowish brown; wing-sheaths and posterior leg-sheaths extend to the apex of 4th abdominal segment; antenna-sheaths shorter; segments 3-7 with two transverse rows of very fine backwardly directd spines, one row on segments 2, 8 and 9; cremaster curved ventrally, with several hooked bristles; spiracles slightly raised. Pupa enclosed in cocoon made by rolled-over edge of dead leaf.

Semnoprepia fuscopurpurea n.sp.

Antennae and palpi fuscous. Head and thorax purplish fuscous. Forewings uniformly purplish fuscous, cilia light fuscous; expanse 21mm. Hindwings and cilia pale greyish. Abdomen light fuscous. Legs light fuscous, hind ones paler.

HAB. One male collected on Mt. Olympus, Oahu, January 30, 1913.

Semnoprepia ferruginea n.sp.

Antennae fuscous, basal joint ferruginous. Palpi ochreous, paler on their inner sides, terminal joint hardly as long as median. Head and thorax ferruginous. Forewings uniformly ferruginous with no markings, cilia ochreous and ferruginous mixed; expanse 25-26mm. Hindwings greyish ochreous, cilia ochreous. Both wings fuscous in disk below. Abdomen uniformly ochreous. Legs ochreous, fore and mid-femora and tibiae with a ferruginous tinge; hind tibiae with long ochreous hairs dorsally.

HAB. Mt. Olympus, Oahu, January 11, 1914. A male and female bred from pupae collected in dead branches of a Cheirodendron tree.

PUPA. 12mm.; pale reddish brown; antenna-sheaths, wing-sheaths and posterior leg-sheaths extend to near the apex of 5th abdominal segment; segments 4, 5 and 6 movable; cremaster blunt, with 6 or 8 hooked bristles.

Gracilaria ureraella n.sp.

Antennae 1¼, ochreous, fuscous on apical fourth. Palpi white, sometimes somewhat fuscous externally. Head and thorax white, sometimes ochreous. Front wings ochreous, an oblique whitish streak from 1/4 of costa to near middle of wing, connected with dorsum by two wide oblique whitish streaks, another outwardly oblique narrow whitish streak at 3/4 of costa not meeting a large whitish extension from tornus, a small whitish costal spot just before apex; all of these whitish streaks more or less bordered by fuscous, sometimes the whitish markings are pure white and sometimes they are ochreous concolorous with the other ochreous portions of the wing; cilia whitish ochreous, slightly fuscous at tips and a dark fuscous line at base; expanse 7-9mm. Hind wings greyish fuscous, cilia paler. Abdomen greyish fuscous. Legs ochreous, fuscous above and tarsi barred with fuscous.

HAB. Mt. Tantalus, Oahu, March 15, 1914; 13 specimens reared from mines in leaves of *Urera sandwicensis;* and again March 16, 1915, 20 more specimens reared from mined leaves of the same tree.

LARVA. Full-grown larva about 6mm.; slender, segment 2 much enlarged, head mostly retracted into it; pale greenish head strongly bilobed, testaceous with brown sutures, eyes black; cervical shield slightly testaceous and roughened on the disk; a similarly roughened area on ventral side between the legs, black lengthwise in middle; abdominal prolegs on segments 7-9.

PUPA. Pupa slender, 4mm., pale greenish; wing-sheaths extend to apex of 5th abdominal segment, free beyond 4th segment; posterior leg-sheaths extend to apex of abdomen; antenna-sheaths extend to apex of abdomen and curve up over the back to about middle of abdomen; cremaster rounded, unarmed.

MINE. The mine at first is a small roundish blotch becoming irregular as it becomes larger from the eating of the larva within. The larva emerges to spin its whitish cocoon on the surface of the leaf.

The moths emerged from the cocoons in about ten days.

PARASITES. From the lot of mined leaves collected March 15, 1914, 19 specimens of a new species of *Sierola* emerged; and from the lot collected March 16, 1915, two specimens of *Omphale metallicus* emerged, also 9 specimens of an undetermined Chalcid. Nearly as many parasites as there were moths.

Gracilaria urerana n.sp.

Antennae 1½, fuscous, paler at the apex. Palpi whitish, terminal segment fuscous externally. Head dull ochreous. Thorax pale brownish ochreous. Front wings brownish fuscous, apical fourth pale lemon yellow; three narrow white streaks extending inwards from the dorsum about equally spaced, wider at base, tapering to apex which is bent outwards, the third one of these meets a white line outwardly oblique from 2/3 of costa; some pale bluish scales preceded by a black spot at apex of wing. Cilia on apical fourth of costa alternating four white and four fuscous spots, terminal cilia fuscous, yellowish at base. Expanse of wings 9-11mm. Hind wings and cilia light fuscous. Abdomen greyish fuscous. Legs ochreous, fore and mid tibiae fuscous above, tarsi barred with fuscous.

HAB. Mt. Tantalus, Oahu, March 16, 1915. Eight specimens reared from mines in the leaves of *Urera sandwicensis*, at the same time and from the same lot of leaves as the preceding.

MINE. The mine is very slender where it starts from an egg placed on the under side of the leaf, it gradually widens as the larva grows, becomes serpentine and towards the last enlarges to a blotch. The larva emerges to spin its whitish cocoon on the surface of the leaf. The moths emerged from the cocoons in about ten days.

Philodoria pipturicola n.sp.

Antennae dark fuscous. Palpi whitish, median joint slightly fuscous externally. Head and thorax slaty fuscous. Forewings with basal portion fuscous to about one-third of costa and to two-thirds of dorsum, beyond this orange; a white line on costa from near base to about two-thirds, where it bends inward and extends a little farther to join a transverse white band at the end of the cell, this band widest in the middle where it has mostly pale-blue scales; an oblique white spot near middle of cell, sometimes reaching dorsum; cilia fuscous with two white spots in costal cilia, one of them at the end of transverse white band, the other smaller and a little nearer the apex; a large pale-bluish patch in apical cilia; expanse 6-7mm. Hindwings and cilia dark fuscous. Abdomen dark fuscous, it and thorax as well whitish below. Legs fuscous, whitish below.

HAB. Punaluu, Oahu, September 13, 1914; 10 specimens bred from mines in the leaves of *Pipturus.*

LARVA. 7mm.; pale yellowish; head with a dark brown or blackish spot in each lobe, deeply bilobed and mostly retracted into segment 2, which is wider than the rest, other segments gradually tapering backwards; distinct constrictions between segments; cervical shield somewhat roughened, two pale brownish longitudinal streaks; thoracic legs feeble; abdominal prolegs on segments 7-9.

PUPA. 3mm.; very pale brownish, abdomen yellowish;

wing-sheaths pointed, extending to 5th abdominal segment; posterior leg-sheaths extend to apex of abdomen; antenna-sheaths extend beyond apex of abdomen and curve over dorsally and forward about two segments.

MINE. At first serpentine, later a blotch. The larva emerges to spin a light brownish cocoon on some convenient surface.

Petrochroa trifasciata n.sp.

Antennae black, ringed with white. Palpi fuscous and white mixed. Head and thorax dark greyish fuscous. Forewings black, greyish fuscous at base; three white transverse bars at one-fourth, one-half and three-fourths respectively; a few white scales at termen; a small orange patch following and contiguous to the first white bar; a large orange patch occupying most of the space between second and third white bars; cilia greyish fuscous, black at base on apex and termen. Hindwings and cilia greyish fuscous, the cilia a little paler. Abdomen dark greyish fuscous. Legs black, spotted with white. Expanse 6mm.

HAB. Laupahoehoe, Hawaii, May 11, 1911. One female bred from a case found on rocks at the top of the sea-cliff.

LARVAL CASE. 3mm. long, oval, of white silk covered with minute particles of sand and dirt.

DECEMBER 10TH, 1914.

The postponed one hundred-twelfth regular and tenth annual meeting of the Society was held in the usual place, President Swezey in the chair. Other members present: Messrs. Back, Ehrhorn, Illingworth, Kuhns, Muir, Osborn, Pemberton and Potter; and Mr. Poole, visitor.

Minutes of previous meeting read and approved.

Mr. C. F. Mant was elected to active membership in the Society.

Treasurer's annual report rendered and accepted.

As the Treasurer's report showed a deficit, Mr. Muir moved that a committee be appointed to consider means of improving the financial condition of the Society. The motion carried and the President appointed Messrs. Giffard, Muir and Fullaway on the committee.

Mr. Ehrhorn stated that from some egg-clusters of the mantid, *Paratenodera sinensis*, which were sent him from Hawaii several months ago, he had succeeded in rearing an adult female, from which he had already secured one egg-cluster. In growing to maturity the nymph had been fed on a succession of insects composed of plant lice, fruit flies, melon flies, bees and grasshoppers respectively. He stated that the adult showed from repeated experiments, an instinctive tendency to avoid a bee's sting when capturing and holding it.

Mr. Swezey exhibited a specimen of the Megachilid, *Lithurgus albofimbriatus*, taken by him on Coconut Island in Kaneohe Bay, Oahu, November 15, 1914; where he had found it in its nest in a hole excavated in the pithy base of a dead date-palm leaf. It was the first observation of the nesting habits of this bee in the Hawaiian Islands, tho an occasional specimen has been taken during the past ten or twelve years. In the nest no cut leaves are used as *Megachile palmarum* does, but a mass of pollen is simply stored up on which the egg is laid quite similar to the large carpenter bee, *Xylocopa brazilianorum*. Mr. Swezey also exhibited a specimen of *Lithurgus albofimbriatus* taken from a nest in a dead tree at Suva, Fiji, July, 1912. The species was originally described from Tahiti.

Mr. Swezey stated that he had taken 5 more specimens of the Coniopterigid, *Coniocompsa vesiculigera*, since the capture of the first one mentioned at a recent meeting of the Society. They were attracted to lights at his house in Kaimuki. Mr. Pemberton stated that he had recently found them quite numerous about his lamp in Manoa in the evenings.

Insects from French Frigate Shoals.

BY OTTO H. SWEZEY.

The following insects were found on a collection of plants made by Dr. Wm. Kerr, surgeon of the U.S.S. "Rainbow", at French Frigate Shoals, October, 1914. The plants were collected on a sand island which had an elevation of about seven feet. They were collected just before departing from the island to return to Honolulu, and were still in fairly fresh condition when received a few days later:

(1) Ant, *Monomorium destructor* (Jerd.). A few dead

specimens found on the glandular stem of *Boerhaavia diffusa.*

(2) Noctuid Moth. Two small larvae found on *Boerhaavia.* Were kept alive to try rearing the moth.

(3) Plume moth, *Trichoptilus oxydactylus* (Walk.). Several larvae on *Boerhaavia.*

(4) Tineid moth, *Ereunetis* sp. A small larva in dead stem of grass, *Monerma repens.*

(5) Scolytid beetle, *Xyleborus* sp. ? A minute specimen in the same dead grass as No. 4.

(6) Mealybug, *Pseudococcus virgatus.* On *Portulaca oleracea.*

(7) Plant louse, *Aphis gossypii* Glover. On *Portulaca.*

The following officers were elected for 1915:

President	E. M. Ehrhorn
Vice-President	J. F. Illingworth
Secretary-Treasurer	H. T. Osborn

ANNUAL ADDRESS

A Preliminary List of the Hymenopterous Parasites of Lepidoptera in Hawaii.

BY OTTO H. SWEZEY.

While collecting and rearing larvae in my life-history studies of Hawaiian Lepidoptera during the past ten years, I have secured a good many records and notes on their parasites. Often when I have collected a batch of caterpillars in the mountains and brought them in for rearing, I would get no adult moths, but all specimens yielded parasites instead. I have thought it advisable to publish the list of parasites and any observations on their habits that I have thus far obtained. I have embodied also parasite records of other observers: Dr. R. C. L. Perkins, D. T. Fullaway, W. M. Giffard, E. M. Ehrhorn, F. W. Terry, and H. O. Marsh.

The parasites of cosmopolitan and introduced Lepidoptera are included with the others Most of the parasites treated of are native, but there are quite a number that have been purposely introduced. There are also a few that, tho originally described from here, are not to be considered as endemic, for they are also now known elsewhere. There are a few also that have made their appearance here the past few years thru the channels of commerce, at least not purposely introduced. Some of these have not yet been determined.

Other factors are also active in keeping the Lepidoptera in check, but it is very certain that the Hymenopterous parasites play an important part, and are largely responsible for the scarcity of many of the native species of moths in the mountains of the Hawaiian Islands. As proof of their scarcity one has but to spend a day collecting moths or caterpillars in the mountains.

Another indication of the scarcity of many species is found in the Fauna Hawaiiensis. With all the thoro collecting by Dr. Perkins, of the 310 species of Macrolepidoptera listed or described in the Fauna, 44 species or 14% were described from single specimens; and 36 species or 11% were described from but two specimens. Of the 441 Microlepidoptera, 106 species or 24% were described from a single specimen; and 71 species or 16% from but two specimens. Taken as a whole, 20% of all the species were described from single specimens, and 14% from but two specimens. If the introduced species were subtracted from the total number, and these percentages taken only on the native species they would be still higher.

Of course there are some species of moths that are known to be common or abundant in the mountains, so much so that sometimes their caterpillars are found defoliating the particular trees or shrubs on which they customarily feed. This may be due to the fact that usually the relationship between insect parasites and their hosts is such that there is a variable ratio in numbers between parasite and host, depending often on some conditions which are more favorable or more detrimental to one or to the other, the host or the parasite, sometimes the one being most affected and sometimes the other. Oftentimes, as with certain leaf-miners, from the appearance of the leaves on the trees it would seem that the moth should be numerous; but when the mined leaves are collected to rear the moths it is found that they had mostly been parasitized.

There are yet many parasites whose hosts and habits are unknown. The recording of all observations to date will furnish a basis for further research in this line. The systematic arrangement used in the Fauna has been followed. It is to be regretted that a number of species have not been specifically determined, and those that are new species are yet undescribed. The greater number of these records of rearing of parasites are from the island of Oahu, and chiefly from Honolulu and the mountain ridges near Honolulu.

Family Bethylidae.

Sierola molokaiensis Ashm.—Reared from the sugar cane bud-moth, *Ereunetis flavistriata* Walsm. In one lot of cocoons collected, it was found that one-third of the larvae had been parasitized. The female *Sierola* stings the host larva and deposits one to several eggs on it, which soon hatch. In one instance 9 larvae were found on one host caterpillar. The larvae obtain their growth in a few days, feeding externally on the host; they then make their cocoons close together, often connected and without distinct form. Probably the habits of other species are similar, tho I have not had definite observations on any of them.

Sierola dichroma Perk.—Reared from a larva of *Nacoleia scotaea* Hamps.

Sierola flavocollaris Ashm. and *Sierola* sp.—Reared from *Aristotelia elegantior* Walsm., a Gelechiid occurring in the fruits of *Gouldia coriacea.*

Sierola n.sp.—Reared abundantly from mines of *Gracilaria ureraella,* a leaf-miner in *Urera sandwicensis.*

Sierola sp.—I have reared undetermined specimens of several species of *Sierola* from *Archips capucinus* (Walsm.), *Capua cassia* Sw., *Epagoge infaustana* Walsm., *Batrachedra* n.sp. on *Elaphoglossum, Philodoria splendida* Walsm. and *Gracilaria mabaella* Sw.

Scleroderma sp.—Reared from cocoons found in dead wood near the dried remains of larvae of *Hyposmocoma chilonella* Walsm., which is a dead-wood feeder. I presume that the larvae feed externally on their host the same as those of *Sierola* do, tho I have not actually seen them. The cocoons are similar to those of *Sierola.*

Parasierola sp.—Reared from *Gelechia gossypiella* (Sandrs.) by Mr. Fullaway.

Cephalonomia sp.—Reared from *Ephestia elutella* Hb. (Ehrhorn).

Family Chalcididae.

Chalcis obscurata Walk.—This parasite was introduced from Japan by Mr. Koebele in 1895, to prey upon the palm leaf-roller (*Nacoleia blackburni* Butl.) and the sugar cane leaf-roller (*Nacoleia accepta* Butl.). Besides these hosts it attacks quite a number of moths. I have reared it from *Plusia chalcites* Esp., *Simplicia robustalis* Guen., *Phlyctaenia despecta* (Butl.), *P. nigrescens* (Butl.), *P. stellata* (Butl.), *Archips postvittanus* (Walk.), *Amorbia emigratella* Busck., *Crocidosema plebiana* Zell., *Cryptophlebia illepida* (Butl.), and *Ereunetis simulans* (Butl.); and it has been reared from *Nacoleia monogona* Meyr. by Fullaway. The Tortricid *Amorbia emigratella* has of late years been its favorite host. The adult parasite stings and oviposits in the pupa of its host, where the parasite grows to maturity. It gnaws its way out at maturity. It is found to vary greatly in size, according to the size of its host. The species of *Nacoleia* and *Plusia* furnish food enough for a normal-sized adult, but such small hosts as *Phlyctaenia despecta* and *Crocidosema plebiana* furnish hardly enough food, and the parasites emerging from pupae of these species are often very small. There is never more than one parasite per host pupa. It is occasionally reared from the puparium of a Tachinid (*Chaetogaedia monticola* Big.) in the pupa of *Plusia*. This may be called an accidental hyperparasitism.*

Chalcis polynesialis Cam.—Reared from pupa of *Homoeosoma humeralis* (Butl.). Probably parasitic on other Phycitids such as flour moths, as it has been collected under circumstances which would lead one to infer this.

Hockeria sp.—This is an accidentally introduced parasite which has become abundant of late years. I have reared it from pupae of *Ephestia elutella* Hb. and *Corcyra cephalonica* Stn., cereal moths; *Pyralis mauritialis* Boisd., the Pyralid feeding in old *Polistes* nests; and *Stoeberhinus testaceous* Butl., a Gelechiid whose larva feeds in dead grass and other decaying vegetation. Mr. Fullaway has reared it from *Gelechia gossypiella* (Sandrs.), the pink cotton boll-worm.

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* Recently this chalcid has been bred from *Gelechia gossypiella* by Mr. August Busck. [Ed.]

Family Encyrtidae.

Eupelmus dysombrias Perk.—Reared from *Phlyctaenia ommatias* Meyr. by Fullaway.

Eupelmus spp.—I have reared three undetermined species of this genus from pupae of three different hosts respectively: *Aristotelia elegantior* Walsm., *Aristotelia mendax* Walsm., *Aristotelia n.sp.* in galls on *Gouldia, Heterocrossa subumbrata* Walsm., *Batrachedra sophroniella* Walsm., *Semnoprepia* sp. There is a large number of native species of theis genus. Among them different species have hosts among several different orders, and there is no doubt but what several more species will be found to parasitize Lepidoptera when their habits are studied.

Family Eulophidae.

Omphale metallicus Ashm.—Reared from *Aristotelia* n.sp., a leaf-miner in *Kadua; Heterocrossa subumbrata* Walsm.; *Heterocrossa inscripta* Walsm.; *Heterocrossa* sp. in fruit of *Suttonia; Gracilaria epibathra* Walsm., leaf-miner in *Dubautia; Gracilaria mabaella* Sw., leaf-miner in *Maba; Gracilaria marginestrigata* Walsm., the leaf-miner in *Sida; Cryptophlebia vulpes* Walsm. in koa pods (Terry); *Bedelia orchilella* Walsm., the sweet potato leaf-miner (Fullaway); *Hyposmocoma liturata* Walsm. (Fullaway). The larva of this parasite feeds singly, externally on the host larva and pupates by the remains of the latter. It and other species of the genus kill an enormous number of leaf-miners and other Micros. I have reared a number of close-related parasites from leaf-miners and other Micro larvae.

Omphale sp.—Reared from the larval case of *Hyposmocoma liturata* Walsm.

Melittobia hawaiiensis Perk.—This minute insect is normally a parasite on Aculeate Hymenoptera, having been found parasitizing *Sceliphron caementarium* (Drury), *Pison hospes* Smith, *Megachile palmarum* P., and *Odynerus nigripennis* (Holm.). I have also found it breeding on the larvae of the sugar cane bud-moth, *Ereunetis flavistriata* Walsm. In a lot of 50 cocoons of this moth collected in cane at the Experiment Station, H. S. P. A., 12% were parasitized by this insect. At another time, of 27 cocoons there was a parasitization of 77%. The eggs are laid externally on the host larva after it has made its cocoon. They soon hatch, and become full-grown in about a week. I have found as high as 45 per host. (In some Hymenoptera I have found several hundred per host. Once I reared 338 from one larva of *Megachile palmarum.*) Pupation takes place where the larvae have fed, and where they have been numerous the pupae lie in a mass. The pupal stage is about two weeks.

Family Trichogrammidae.

Pentarthron flavum Perk.—This tiny egg-parasite I have reared from eggs of *Vanessa tammeamea* Esch., *Deilephila lineata* Fab., *Nacoleia accepta* (Butl.), *Nacoleia blackburni* (Butl.), *Nacoleia meyricki* (Sw.), *Archips postvittanus* (Walk.) and *Amorbia emigratella* Busck. From one to several parasites develop in a single egg of the host, depending on the size of the egg. From *Nacoleia* eggs I have had usually about three per egg, while from the larger egg of *Vanessa tammeamea,* 24 emerged. This is a very beneficial parasite. It often destroys a large proportion of the eggs of *Nacoleia blackburni* and *Archips postvittanus,* and recently *Amorbia emigratella*—many egg-masses of the latter being found entirely parasitized. It has a very short life-cycle. I bred a generation in 10 days.

The eggs of *Bactra straminea* are also parasitized, and Mr. Fullaway has bred it from eggs of *Heliothis obsoleta* Fab.

Pentarthron semifumatum Perk.—Reared from eggs of *Herse cingulata* Fab. (Fullaway). I have reared it from the egg of *Deilephila lineata.* One one occasion I reared 7 of this species and 7 of *P. flavum* from one egg of the latter.

Family Ichneumonidae.

Ichneumon koebelei Sw.—This parasite was introduced from America by Mr. Koebele about 15 years ago. It parasitizes *Cirphis unipuncta* (Haw.), the army-worm, *Agrotis ypsilon Rott.,* the black cutworm, and probably other related caterpillars, but does not accomplish much good, as it does not appear to be very prolific. The parasite stings an egg into the caterpillar, where the egg hatches and the larva grows while the caterpillar is obtaining its growth. The host is not killed till it enters the ground to pupate. The parasite finally transforms to the adult within the host pupa, without spinning a definite cocoon—merely spinning a little silk on the inside of the empty pupa case of the host. The adult finally emerges by breaking an irregular hole at the anterior end of the pupa case.

Echthromorpha fuscator (Fab.)—This large Ichneumonid has a large number of hosts. I have reared it from the following: *Vanessa tammeamea* Esch., *Lycaena boetica* Linn., *Plusia chalcites* Esp., *Nacoleia accepta* (Butl.), *Nacoleia blackburni* (Butl.), *Archips postvittanus* (Walk.), *Amorbia emigratella* Busck., *Euhyposmocoma trivitella* Sw.; and Dr. Perkins records it from *Vanessa cardui* (L.). *Vanessa tammeamea* is its special favorite. One can hardly collect a chrysalis of this butterfly that has not been parasitized. In my experience I have collected but two which yielded butterflies instead of parasites. Dr. Lyon tells me that Mrs. Lyon once collected a large number of the chrysalids in the forests of windward Maui, and obtained very few butterflies from them, the parasites emerging instead. The female oviposits in the host pupa. The chrysalis of *Vanessa tammeamea* hanging fully exposed is easily found by it. The pupae of *Plusia* are stung thru the thin cocoon. The pupae of leaf-rollers hidden by folded leaves are parasitized by stinging thru the leaf. Pupation takes place within the chrysalis, no regular cocoon being made, only a little silk being spun onto the inner wall of the empty chrysalis. The adult parasite emerges by gnawing a roundish lateral hole near the anterior end of the chrysalis.

Pimpla hawaiiensis Cam.—Altho described from the Hawaiian Islands, Dr. Perkins is of the opinion that this parasite was introduced from Mexico. It parasitizes pupae similarly to *Echthromorpha*. I have reared it from *Cryptoblabes aliena* Sw., *Euhyposmocoma ekaha* Sw., *Nacoleia accepta* (Butl.), *Nacoleia blackburni* (Butl.), *Amorbia emigratella* Busck, *Archips postvittanus* (Walk.), *Cryptophlebia illepida* (Butl.); and Dr. Perkins has reared it from *Ethmia colonella* Walsm. also. Other hosts are *Gelechia gossypiella* reared by Fullaway, and *Hyposmocoma liturata* Walsm.

Eniscospilus dispilus Perk.—I have reared this from *Eriopygodes euclidias* (Meyr.), so also has Mr. Fullaway. It very likely parasitizes the caterpillars of related species as well.

Enicospilus spp.—Rreported by Dr. Perkins to parasitize *Agrotis* sp., *Scotorythra* sp., and Pyralids. The females of this genus oviposit in the caterpillars. The larva lives within, feeding and growing, not killing the caterpillar until it has hidden under moss, bark, or in rotten wood, or in the ground to pupate. The full-grown parasite larva issues from the host caterpillar and spins a dense brown cocoon in which it completes its transformations. There are quite a number of species of this genus here, and when their habits are fully studied they will probably be found to be parasitic on similar caterpillars to the above.

Athyreodon debilis P.—I have reared from *Phlyctaenia iocrossa.*

Athyreodon sp.—Dr. Perkins records it from a species of *Phlyctaenia.*

Atrometus tarsatus Ashm.—I have reared from *Hyposmocoma trimaculata.*

Atrometrus sp.—I have reared from *Aristotelia* n. sp. in galls on *Gouldia.* The parasite transformed to maturity within the pupa of its host similarly to *Echthromorpha.*

Cremastus hymeniae Vier.—This undoubtedly is an introduced species, for it was not known till 1910. It appeared on the lowlands about Honolulu, but has now spread to the mountains as well, and all over the Island of Oahu. Its first noticeable host was *Hymenia recurvalis* Fab., whose life-history was being investigated by Mr. H. O. Marsh in 1910. Other hosts from which I have reared it are: *Genophantis leahi* Sw., *Phlyctania platyleuca* Meyr., *Phlyctaenia calcophanes* Meyr., *Phlyctaenia campylotheca* Sw., *Thyrocopa* sp., *Cryptophlebia illepida* (Butl.), *Capua santalata* Sw., *Batrachedra cuniculator* Busck, *Petrochroa dimorpha* Busck, and *Bactra straminea.*

Limnerium polynesiale Cam.—This must be an introduction, for its only known host here is the diamond-back cabbage moth (*Plutella maculipennis* Curt.), which it parasitizes very extensively.

Limnerium blackburni Cam.—This species has a very large number of hosts. I have reared it from the following: *Nesamiptis obsoleta* (Butl.), *Scotorythra* sp., *Nacoleia accepta* (Butl.), *Nacoleia asaphombra* (Meyr.), *Nacoleia anastrepta* (Meyr.), *Nacoleia blackburni* (Butl.), *Nacoleia localis* (Butl.), *Nacoleia monogona* (Meyr.), *Phlyctaenia endopyra* Meyr., *Phlyctaenia platyleuca* Meyr., *Phlyctaenia campylotheca* Sw., *Pyrausta constricta* (Butl.), *Pyrausta dryadopa* Meyr., *Mecyna aurora* (Butl.), *Scoparia* sp., *Platyptilia rhynchophora* Meyr., *Homoeosoma humeralis* (Butl:), *Genophantis iodora* Meyr., *Phthorimaea operculella* (Zell.), *Mapsidius auspicata* Walsm., *Batrachedra* sp., *Archips capucinus* (Walsm.), *Tortrix metallurgica* Walsm., *Tortrix thoracina* Walsm., and *Epagoge infaustana* Walsm. In addition to these, it was reared from *Phlyctaenia stellata* (Butl.) by Dr. Perkins, from *Phlyctaenia* *despecta* (Butl.) by Perkins and Fullaway, and from *Nacoleia continuatalis* (Wall.) by Fullaway. The larvae live singly in the host larvae. The latter spins up for pupation but fails to pupate, as about that time it has been nearly consumed by the parasite within, which soon breaks out of the remains of the host, finishes eating it except the skin, and makes its cylindric-oval cocoon within the cocoon made by the host. The adult emerges therefrom in about ten days. The habits of the related genera: *Cremastus, Pristomerus,* are similar to this.

Pristomerus hawaiiensis Ashm.—Reared from *Nacoleia accepta* (Butl.), *Phlyctaenia chytropa* Meyr. and *Heterocrossa* sp. in *Olea* seeds. Mr. Fullaway has reared it from *Omphisa anastamosalis* Guen. and *Gelechia gossypiella.* I have seen the males of this species in swarms in the air like one often sees gnats.

Lathrostizus insularis Ashm.—Breeds in the larvae of *Plodia interpunctella* Hub., *Ephestia elutella* Hub., and probably other flour moths. The adult parasite emerges from the pupa of the host.

Family Braconidae.

Chelonus blackburni Cam.—This species has quite a number of hosts: *Hymenia recurvalis* Fab., *Lineodes ochrea* Walsm., *Homoeosoma humeralis* (Butl.), *Phthorimaea operculella* (Zell.), *Batrachedra cuniculator* Busck., *Phlyctaenia despecta* (bred by Perkins), *Gelechia gossypiella* (bred by Perkins and Fullaway), *Petrochroa dimorpha* Busck (Perkins). The larva of this parasite lives singly in the host larva. It emerges from it after the latter has made its cocoon for pupation, and makes its own white oblong cylindrical cocoon within that of its host. I do not know whether oviposition takes place the same with this species as with *Chelonus texanus* as reported by W. D. Pierce and T. E. Holloway in Journal of Economic Entomology, Vol. 5, pp. 426-428, 1912. According to their observations *C. texanus* oviposits in the egg of the host, but does not prevent the hatching of the egg. The host larva grows with the parasite in it, and later is killed, and the parasite larva emerges and makes its cocoon as our species does.

Phanerotoma hawaiiensis Ashm.—Reared from *Stoeberhinus testaceous* Butl. Its white oblong cylindrical cocoon was within the cocoon of the host. It probably parasitizes other related Micros.

Phanerotoma sp.—Two or three specimens were reared from *Myelois ceratoniae* Zell., infesting the pods of *Acacia farnesiana.*

Microdus hawaiicola Ashm.—I have reared it from *Thyrocopa sapindiella* Sw., *Stoeberhinus testaceous* Butl., *Batrachedra rileyi* Walsm., *Ereunetis flavistriata* Walsm., and *Gelechia gossypiella;* and Dr. Perkins reared it from *Ereunetis simulans* (Butl.), and *Hyposmocoma* sp. The larva of this species emerges from its host when the latter has spun its cocoon to pupate, finishes eating the caterpillar, then makes its own white oblong cylindrical cocoon within the cocoon of the host. The adult emerges in about two weeks.

Apanteles sp.—A species that first appeared in Honolulu in 1910, and has now become abundant. I have reared it only from *Opogona aurisquamosa* (Butl.), but it probably attacks other Micros whose larvae feed in decaying vegetation on the ground. Mr. Fullaway has also reared it from the same host as above. I have not ascertained the feeding habits of the larva of this parasite, but probably there is but one per host. Its white oblong cylindrical cocoon is made in the cocoon of the host.

Protapanteles hawaiiensis Ashm.—I have reared this only from cocoons in the larval cases of *Oecia maculata* Walsm., which it often parasitizes quite heavily. Of 33 larval cases collected at one time, 70% contained parasite cocoons. There is one parasite per host.

Bracon omiodivorum (Terry).—This was introduced from Japan by Mr. Koebele probably in 1895, to parasitize the plam leaf-roller and the cane leaf-roller, *Nacoleia blackburni* and *N. accepta.* I have also reared it from *Hymenia recurvalis*, and once from either *Archips postvittanus* or *Amorbia emigratella.* It mostly attacks the cane leaf-roller, however. Often as high as 75% of the caterpillars in a bad outbreak of the cane leaf-roller will be found parasitized by this Braconid. It is the most important parasite on this pest. The parasite stings the caterpillar so that it is paralyzed and remains so. The eggs are laid on the exterior of the caterpillar, from 1 to 3, tho 6-8 are about the usual number. The eggs hatch in a day or two, and the young larvae feed externally on the caterpillar, growing rapidly and becoming full-grown in about 3-4 days. The cocoons are flattish and made on the leaf near the dried remains of the caterpillar, more or less connected or in a mass. The adults emerge in about a week. The life-cycle thus being very short—about 14 days.

Bracon sp.—I reared six of this parasite from cocoons of *Batrachedra cuniculator* Busck, a leaf-miner in sedges in the Kewalo swamps of Honolulu, in May, 1914. It was not previously observed here. Its larva feeds externally, one per host, and makes its cocoon in the mine of the latter.

Habrobracon hebetor (Say).—This is the abundant parasite on the meal and flour moths, *Plodia interpunctella* and *Ephestia elutella*. It is often to be found in large numbers in the feed warehouses in Honolulu. From 1 to 8 eggs are laid externally on the host caterpillar; they hatch in about a day, and the larvae get their growth in three days, spin cocoons and the adults emerge in about a week, so that the whole life-cycle occupies but two weeks. The shortness of the life-cycle allows for such frequent generations it is often very effective in controlling the flour moths.

Bracon sp. ?—I have reared an undetermined Braconid from the sedge stem-borer *Bactra straminea* (Butl.).

Bracon sp.—Reared from *Gelechia gossypiella* by Mr. Fullaway.

JANUARY 7TH, 1915.

The one hundred-thirteenth regular meeting of the Society was held in the usual place, President Ehrhorn in the chair. Other members present: Messrs. Fullaway, Illingworth, Kuhns, Mant, Muir, Osborn, and Swezey.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Mr. Swezey reported having found a wasp, *Polistes aurifer*, with a nest but recently started, on the under side of a stone lying on top of the ground at Diamond Head, January 1st. It being the earliest date at which he had observed these wasps beginning their nests. Mr. Ehrhorn stated that he had noticed a nest at the Outrigger Club about three weeks previously.

Mr. Osborn exhibited 28 specimens of *Halobates* sp. which were collected on the beach at Waikiki, Dec. 19, 1914. Large numbers of these bugs, mostly adults, were blown ashore during a three days' "Kona" storm. The species was apparently the same as collected by Mr. G. P. Wilder from the surface of the sea between Maui and Kahoolawe, October, 1913, and by Mr. C. M. Cooke from the surface of the sea near Palmyra, July, 1913. There is no previous record of its capture on the shores of Oahu.

Mr. Swezey exhibited an insect box made from a cigar box lined with parafin instead of cork, and certain advantages of this method of lining insect boxes were pointed out and discussed by himself and Mr. Muir. Cheapness of material and ease of preparation were factors in its favor. Mr. Muir stated that he had learned that this method was being used at the British Museum.

Hawaiian Species of Laboulbenia and Their Hosts.

BY OTTO H. SWEZEY.

The few species of *Laboulbenia* here listed with their hosts are taken from Prof. Roland Thaxter's "Contribution Toward a Monograph of the Laboulbeniaceae, Part II", Memoirs of the American Academy of Arts and Sciences, Vol. XIII, No. VI, 1908.

The hosts are all species of Hawaiian Carabidae. Of the 34 species listed, 5 occur on Kauai, 7 on Oahu, 11 on Maui, 6 on Molokai, 2 on Lanai, and 3 on Hawaii.

Laboulbenia hawaiiensis Thaxter:

Atelothrus erro (Blkb.) Maui.
Atelothrus gracilis Shp. Maui.
Mauna frigida (Blkb.) Maui.
Colpodiscus lucipetens (Blkb.) Maui, Hawaii.
Colpocaccus tantalus (Blkb.) Oahu.
" *hawaiiensis* Shp. Hawaii.
" *lanaiensis* Shp. Lanai, Molokai, Maui.
" *posticatus* Shp. Kauai.
Mesothriscus musical (Blkb.) Oahu.
" *tricolor* Shp. Maui, Molokai.
" *alternans* Shp. Kauai.

Mecyclothorax pusillus Shp. Maui.
" *ovipennis* Shp. Maui.
" *montivagus* (Blkb.) Maui.
Bembidium. Numerous undetermined specimens.

Laboulbenia disenochi Thaxter:
Disenochus fractus Shp. Maui.
" *aterrimus* Shp. Kauai.
" *sulcipennis* Shp. Kauai.
Anchonymus agonoides Shp. Maui.
Brosconymus optatus Shp. Oahu.

Laboulbenia sphyri Thaxter:
Metromenus caliginosus (Blkb.) Oahu.
" *epicurus* (Blkb.) Oahu.
" *latifrons* Shp. Molokai.

Laboulbenia cauliculata Thaxter:
Colpocaccus lanaiensis Shp. Lanai, Maui, Molokai.
" *marginatus* Shp. Kauai.
Atelothrus depressus Shp. Lanai.
" *constrictus* Shp. Molokai.
Mesothriscus hawaiiensis Shp. Hawaii.
" *alternans* Shp. Kauai.
" *musicola* (Blkb.) Oahu.
Metromenus fraudator Shp. Molokai.
and other undetermined specimens.

Laboulbenia cauliculata var. *prolixa* Th.:
Mesothriscus tricolor Shp. Maui, Molokai.
" *collaris* Shp. Molokai.
Metromenus aequalis Shp. Oahu.

Laboulbenia cauliculata var. *spectabili* Th.:
Metromenus caliginosus (Blkb.) Oahu.
" *mutabilis* (Blkb.) Oahu.
" *latifrons* Shp. Molokai.

FEBRUARY 4th, 1915.

The one hundred-fourteenth regular meeting of the Society was held in the usual place, President Ehrhorn in the chair. Other members present: Messrs. Giffard, Fullaway, Illingworth, Osborn and Swezey.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Mr. Osborn exhibited a series of 2 females and 3 males of *Nesophrosyne nimbicola* Kirk. These were collected by Prof. W. A. Bryan on the Island of Lanai at an elevation of 3400 feet. The male of the species appears not to have been described or collected before.

Mr. Osborn also exhibited specimens of the fly *Scatella hawaiiensis* Grim., collected at Waiamao, Oahu, about 1200 feet, on the wet stones about a waterfull, January 17, 1915. Mr. Swezey called attention to the fact that the common form of this species, named var. *sexnotata* by Terry, had apparently not been published.

Mr. Swezey exhibited a specimen of *Tenebroides nana* Melsh., collected by him in his house at Kaimuki. It has not been previously recorded here.

Mr. Swezey also exhibited a moth reared from a caterpillar on *Boerhaavia,* collected by Dr. Wm. Kerr of the U.S.S. Rainbow at French Frigate Shoals in October, 1914. The moth had but recently emerged and appears to be a new species of the *Agrotis* group.

Dr. Illingworth exhibited specimens of insects mounted on celluloid points and cards. A general discussion on insect pins and methods of mounting followed.

Use of Cockroaches in Medicine.

BY J. F. ILLINGWORTH.

In reviewing the literature on the uses of insects in the manufacture of various substances, I came across the following interesting note in Merck's 1907 Index, of the use of cockroaches in medicine:

"Blatta.

(Cockroach) *Periplaneta orientalis.*

Constituents: Blattaric acid; antihydropin; fetid, fatty oil; *uses*: *Internal,* in dropsy, Bright's disease, whooping-cough, etc.—*External,* as oily decoction for warts, ulcers, boils, etc. Doses: 10-15 grains in dropsy, as powder, or pills; or 4 fluid drams decoction."

I have noticed that our wingless, shiny species (*Polyzosteria soror* Brunn.) emits a distinct pungent odor when disturbed, which closely resembles that of the common Pentatomid bugs—the odor that we have often noticed on berries in the States when these bugs have sucked them. Very likely these roaches, also, have medicinal properties which may be of value when they are properly investigated.

MARCH 4TH, 1915.

The one hundred-fifteenth regular meeting of the Society was held in the usual place, President Ehrhorn in the chair. Other members present: Messrs. Fullaway, Illingworth, Kuhns, Osborn and Swezey.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Dr. Illingworth reported on some observations made in a poultry yard on the ant *Pheidole megacephala,* which in great numbers were destroying the eggs of the hen flea, *Xestopsylla gallinacea.* They were also getting the flea larvae and an occasional adult; in several instances they were observed picking fleas which had been killed by creosote from the combs of the hens. He also mentioned the destruction by ants of the larvae of the monkeypod borer, *Xystrocera globosa,* which he was attempting to rear.

Mr. Ehrhorn related some observations he made several years ago on Molokai which indicated that ants were a large factor in controlling "ox warble", *Hypoderma lineata* Villers. The work of this fly is only occasionally observed on Molokai and the large numbers of ants on the cattle ranges destroy the larvae as they emerge and fall to the ground to pupate.

Mr. Muir exhibited a large series of the Delphacid *Aloha lehuae*, from various localities in the Hawaiian Islands, showing color variations from light to dark. The color varies according to locality. The species occurs on "Ohia" trees and there is another species known as *A. ohiae* which appears to grade into *lehuae*, but so far only females have been collected and it is still uncertain whether it should be considered a distinct species or not. Mr. Muir expressed his opinion that *A. lehuae* was close to the original type of Delphacid which first became established on these Islands.

Mr. Fullaway exhibited a parasite reared from spider eggs collected by Messrs. Muir and Giffard at Kilauea, Hawaii. It is a species of *Baeus*, probably new. Dr. Perkins described a species of *Baeus* but its habits were not known.

Mr. Fullaway also exhibited a male Diapriid of the genus *Platymischoides*, collected by Mr. Swezey.

Mr. Swezey exhibited a collection of insects made February 14, at Puu Kapele, at an elevation of 3500 feet on the west side of the Waimea Canyon, Kauai. Some of them of special interest, and some of them were new species. He also exhibited four larvae of the Lucanid *Apterocyclus*, the only genus of native Lamellicorns. These grubs were found by Mr. Meinecke under rotten logs a little higher up than Puu Kapele, on the same day. They were said to be very numerous there. It is probably near the region where the few specimens of these beetles were previously collected.

APRIL 1st, 1915.

The one hundred-sixteenth regular meeting of the Society was held in the usual place, President Ehrhorn in the chair. Other members present: Messrs. Fullaway, Illingworth, Muir, Osborn, Pemberton and Swezey.

Minutes of previous meeting read and approved.

Mr. Muir, chairman of the Finance Committee, reported that the Trustees of the Hawaiian Sugar Planters' Association had appropriated the sum of $100.00 per year to aid the Society in the publication of the "Proceedings".

ENTOMOLOGICAL PROGRAM.

Description of an Interesting New Crabro from Kauai.

BY WALTER M. GIFFARD.
(Presented by F. Muir.)

Melanocrabero discrepans sp. n.

MALE. Black; second segment of abdomen with a yellowish white dorsal fascia near its base, widest towards the sides; fourth segment with a yellowish white spot on the side, sometimes very small or entirely wanting; fifth segment with entire fascia at base; sixth with lateral spot. Front legs pale, especially on the anterior surface, tibia not flattened. Clypeus slightly produced in front, subangular in middle and covered with silvery pubescence. Mandibles black, the underside regularly fringed with yellowish hairs. Antennae with apex of sixth joint prominently and strongly produced ventrally. Head and thorax dull, rugosely sculptured and covered with long white hair. First joint front tarsus subterete, slightly flattened beneath; about as long as the four distal joints together. Abdomen with basal segment extremely finely punctured, sparsely clothed with short, inconspicuous hairs; second to fifth closely and finely punctured, the short hairs becoming more numerous posteriorly; sixth and seventh more coarsely punctured, the latter emarginate at apex, hairs much longer, projecting beyond hind margin, those on the underside also long and projecting beyond the hind margin like a fringe. Beneath, the second segment is somewhat shiny, finely punctate, slightly convex and sparsely clothed with fine hairs, the following segments dull and strongly depressed.

HAB. Forests and mountain slopes of Kauai, 4,000 feet elevation.

Described from 2 taken at Kaholuamano, September, 1909 (Giffard), and 1 at Waialeale, June, 1913 (Hardy). Types in author's collection.

OBS. This comes near to *curtipes* but is easily distinguished from it by the first front tarsus not being flattened, and the hind tibiae flattened anteriorly, causing the posterior half to be somewhat carinate dorsally; the second abdominal sternite slightly but distinctly convex; more prominent antennal tooth; the mesonotal sculpture less dense.

The interest attached to this species lies in its *Hylocrabro* affinities. Dr. R. C. L. Perkins, in a letter to me about this insect, remarks that it "connects *Hylocrabro* still more closely with *Melanocrabro* and I should not wonder if its female is not what I call *Hylocrabro.*"

New and Little-Known Derbidae.

BY F. MUIR.

The species described in this paper were collected by the writer during 1913-14, or were presented to him by entomologists in Formosa during his visit there. The addition of 17 species to the Java list indicates the richness of that island, especially when we consider that the writer only had three days collecting in suitable localities, and that nearly all his specimens were taken at Bendoredjo during one morning's collecting. Formosa and Philippines will also prove to be very rich. The family already has some eighty genera and nearly four hundred species, and when the South and Central American, as well as the Indo-Malayan areas, are more closely worked this number will be easily doubled. They are forest insects, all the nymphs as far as is at present known, living in rotten trees.

The measurements are from the apex of head to anus, and from base to apex of one tegmen.

Vekunta Dist.

(1) *pseudobadia* sp. n.

♂ This differs from the Bornean species *badia* in the spot on costa being smaller and having no darker spot in center of it, also in the genitalia as follows: Apex of anal segment truncate or slightly emarginate instead of pointed; styles narrower, ventral edge entire, dorsal edge produced into wide angular process in middle, apex blunt, turned inward; whereas in *badia* they are broader, the dorsal edge straight and the apex with small, sharp, inwardly turned apex.

Length 2.5mm.; tegmen 4mm.

Hab. Bendoredjo, Java; on palms (Muir, March).

Proc. Haw. Ent. Soc. III, No. 2, July, 1915.

(2) *lineata* Melichar.

♂ Ventral and lateral edges of pygophor straight; anal segment long, anus in basal third where segment slightly widens, then gradually narrows to point, the apical third turned ventrally and cleft from apex to angle of head; styles long, narrow, apical third turned upward, apex pointed, basal two-thirds subparallel sided, dorsal margin slightly incrassate, a small quadrate process on inner surface near base.

Hab. Mount Maquiling, Luzon (Muir, February).

(3) *malloti* Mats.

V. malloti Matsumura 1914, Ann. Mus. Nat. Hung. XIII, 288.

V. okadae Muir 1914, Pro. Haw. Ent. Soc. III, 1, p. 45.

LAMENIA Stal.

Thyrocephalus Kirkaldy 1906. H. S. P. A. Bull. I, p. 429.

Dr. Melichar in describing *L. flavescens* (Philip. Jour. Sci. 1914, IX, D. 2, p. 179) has placed this genus in the *Achilinae*. To this I cannot agree, as this genus has the characteristics of the family (or subfamily); should it be upheld then some fifteen or sixteen genera of the *Cenchrea* group will also have to be moved to *Achilinae*. The two following species have the characteristic subantennal plate as long as, or a little longer than, the antenna.

(1) *javanica* sp. n.

♂ Stramineous, fuscous over keels of face, clypeus, labium, tibiae, margin of tegulae, tergites of abdomen and genitalia, a dark round spot on propleura; tegmina stramineous, opaque with waxy secretion, fuscous over clavus, along hind and costal margins and an acutely angular mark on margin between subcosta and media; wings opaquely white with waxy secretion, veins brown.

Ventral edge of pygophor straight, lateral edges rotundate; anal segment large, much longer than broad, basal portion subparallel sided, then gradually narrowed to pointed apex which is turned ventrally, anus about a third from base; styles reaching to end of anal segment, narrow, semispatulate, the dorsal edge nearly entire, curving slightly upward and broadly dilatate, the ventral edge roundly produced beyond the middle and narrowly dilatate, apex pointed and turned inward, a small round knob on niner side near base from which rises a small sharp spine.

♀ Last abdominal sternite longer than broad, posterior edge steeply curved from sides near base to middle; anal segment ovate, anus near base.

Length 2.5mm.; tegmen 3.5mm.
Hab. Buitenzorg, Java (Muir, May).

(2) *albipennis* sp. n.

♂ Stramineous, fuscous on keels of face, tibiae, especially apices of hind pair, and dorsum of abdomen; tegmina white, opaque with waxy secretion, slightly infuscate along hind margin, especially from end of clavus to cubitus, three fuscous marks on border, one at apex of first median sector, one at apex of radia and the third at apex of subcosta; wings opaquely white with waxy secretion, veins white.

Ventral edge of pygophor straight, lateral edges slightly sinuous; anal segment large, sides subparallel, slightly narrowed before apex, apex truncate, anus one-third from base; styles reaching to end of anal segment, dorsal edge nearly straight, subparallel to ventral edge for basal two-thirds, then ventral edge narrowing to sharp apex which is turned inward, a rounded keel runs from base to apex on outer surface, a small round process on inner side on basal half.

Length 3.3mm.; tegmen 5mm.
Hab. Bendoredjo, Java, on palms (Muir, March).

Pyrrhoneura Kirk.

(1) *javana* sp. n.

♂ Vertex and face in profile slightly more rounded than in type species. Vertex, base of face, dorsum of thorax and all abdomen and genitalia dark reddish brown, apex of face, antennae, clypeus, ventral surface of thorax and legs yellow; tegmina reddish fuscous, veins darker except costa and apical veins which are lighter red, a dark spot on cross-vein at base of fourth median sector; wings fuscous, veins dark.

Ventral edge of pygophor straight, lateral edges subangularly produced in middle; anal segment much longer than broad, broadest at base, gradually narrowing to apex which is rounded, anus at apex; styles reaching to end of anal segment, narrow, dorsal edge almost entire, ventral edge gradually produced to about a third from apex, then narrowing to the rounded apex which is turned upward and inward, on inner surface a small plate runs from base to about middle where it is rounded off.

♀ Hind border of tegmina bearing light mark along clavus and between cubital veins. Last abdominal sternite broader than long, hind margin subangularly produced from sides near base to middle, the sides of production being very shallowly excavate, the disk of angularly produced portion slightly depressed.

Length 2mm.; tegmen 4.5mm.
Hab. Bendoredjo, Java (Muir, March).

TEMPORA Mats.

Tempora Matsumura 1914, Ann. Mus. Hung. XII, p. 290.

This genus is placed by its author next to *Vekunta*, but the neuration of tegmina show that it belongs to the *Otiocerus* group; it comes next to *Pyrrhoneura* Kirk., from which it differs only in having the lateral keels of face approximate or touching near their bases, a character found in *P. rubida*. It will be difficult to keep these two genera apart.

SWEZEYIA Kirk.

(1) *vandergootii* sp. n.

♂ Antennae slightly smaller than in *lyricen* Kirk., otherwise typical.

Stramineous, a dark mark over sides of face in front of eyes, and from behind eyes over sides of thorax down middle to tip of tegmina; tips of labium and tarsi slightly infuscate. Tegmina hyaline slightly opaque with waxy secretion, veins yellowish except where fuscous mark passes down tegmina through clavus, over base of cubitus and along median, mark darkest at base of third median sector; wings hyaline, slightly opaque with secretion, veins reddish.

Ventral edge of pygophor straight, lateral edges slightly curved, anal segment about twice as long as broad, subparallel sided, apex slightly rounded, tip turned down, dorsal surface sloping from middle to sides, anus at apex; styles reaching beyond anal segment, slender, slightly broadened and curved upward at apical half, apex bluntly pointed and curved inward.

Length 2.3mm.; tegmen 3.2mm.
Hab. Bendoredjo, Java, on palm trees (Muir, March).

I name this little insect after Mr. P. van der Goot, to whose help in entomological matters while in Java I am greatly indebted.

NESOKAHA Muir.

(1) *philippina* sp. n.

♂ In profile vertex and face rounded, no angle where they meet;

antennae slightly more ovate than in *N. piroensis*. Light yellow, eyes brown, light brown over keels of face; tegmina light yellow, slightly opaque with waxy secretion, veins yellow, a black spot at apex between third and fourth median sectors, a small dark mark at end of subcosta; wings very light yellow, opaque with waxy secretion, veins yellow.

Ventral edge of pygophor straight, lateral edges angularly produced in middle; anal segment longer than broad, slightly narrower at apex than base, apex slightly emarginate (a little spine at each corner), anus at apex; styles narrow, reaching to end of anal segment, curved slightly upward on apical portion, apex pointed, ventral edge entire, dorsal edge having a small angular projection near base and a minute spine in middle.

♀ Last abdominal sternite wider than long, hind margin angularly produced from sides to middle, the apical portion turned upward; in lateral view sternite concave at base and convex in middle.

Length 2mm.; tegmen 4mm.
Hab. Mount Maquiling, Luzon. (Muir, February.)

(2) *lineata* sp. n.

♀ Light yellow, eyes brown, keels of face brownish. Tegmina hyaline slightly opaque with waxy secretion, veins white except costa, subcosta and apical veins which are yellowish, a black line on basal portion of costa through subcostal cell to radial cross vein, continued very faintly to basal portion of fourth median sector, another black line from base of claval margin to apex of first median sector, a round black spot in middle of fourth median sector,; wings opaquely white with waxy secretion, veins white.

Last abdominal sternite broader than long, hind margin angularly produced from sides to middle, apex turned dorsad.

Length 2.4mm.; tegmen 4.2mm.
Hab. Los Banos, Luzon. (Muir, February.)

Devadanda Distant.

(1) *leefmanii* sp. n.

♂ Face produced in front as in *pectinata*; first joint of antennae small, second joint bilobed, a smaller, rounded, basal part which bears the arista and scattered small "scales" and a long cylindrical portion bearing long "scales". Dirty yellow, face, hyaline above eyes, brownish below, darker around eyes and along edge of hyaline area, two dark marks on apex of face, dark across base and aper of clypeus, along medio-lateral portion of thorax, over ventral surface of thorax, coxae, base of femora, abdomen and genitalia. Tegmina hyaline, slightly opaque with waxy secretion, veins yellow on basal half, reddish brown on apical half, apical veins and transcostal veins red, fuscous along costal, apical and hind margins, subcostal and radial veins darker, a dark mark at base of fourth median sector, two small marks in clavus and one in median cell; wings hyaline, opaque with waxy secretion, veins basally yellow apically fuscous.

Ventral edge of pygophor straight, lateral edge slightly curved; anal segment long, dorsal surface angular, sloping from middle to sides, apex rotundate, anus at apex; styles long and narrow, apices rounded and turned inward, ventral edge gradually produced into a short wide angle about middle, dorsal edge produced into a small rounded process near base and a small spine about middle.

♀ Second joint of antennae globose, covered with short sense organs as in *Kaha*; posterior margin of last sternite angular, apex turned upward into base of styles. Body lighter colored than male.

Length 2.5mm.; tegmen 4mm.

Hab. Buitenzorg, on palms. (Muir, May.)

I name this species after Mr. F. Leefman, to whose guidance I owe some very pleasant collecting trips.

(2) *perplexa* Muir.

From Buitzenzorg, Java, on palm trees, both sexes in numbers. (Muir, May.)

♀ Antennae small, globous, with elevated sense organs and small "scales", last abdominal sternite as in *leefmanii.*

(3) *extrema* (Muir).

Kaha extrema Muir, 1913 H. S. P. A. Ent. Bull. XII, 52.

This species was described from a single specimen with damaged antennae. I can now recognize that it should be placed with the above species. All three differ from the description of the generic type in the form of antennae, but I think there is some mistake, as *pectinata* is described as having antennae different from any Derbid yet known. I submitted specimens of one of the above species to Mr. Distant, who considers it distinct from *Devadanda*, but I shall await the opportunity to examine the type before I erect a new genus.

Eosaccharissa Kirk.

(1) *ouwensii* sp. n.

♂ Yellow; eyes brown, vertex and basal portion of face whitish, fuscous mark across apical portion of face. Tegmina white, opaque with waxy secretion, veins yellow spreading into cells, five black hair-lines across costal and apical radial cell more or less bordered with yellow, a small black dot in first medio-apical cell, another in fifth, a light yellow mark across clavus and over cubitus, the upper portion of cubitus and the median cross-vein bordered with fuscous.

Ventral edge of pygophor produced in middle into acutely angular process, lateral edges into sharply pointed angle in middle; anal segment much longer than broad, slightly broader at base than apex, apex truncate, anus at apex, from the ventral surface near apex arises a minute pointed process curved backward; styles reaching to end of anal segment, narrow, curved upward, apex rounded and turned inward, ventral edge produced into small angular process near base, dorsal edge near base produced into rotundate process with a fine spine on top.

♀ Last abdominal sternite longer than broad, hind edge produced acutely angularly in middle.

Length 2.5mm.; tegmen 3.8mm.

Hab. Buitenzorg, Java, on palm trees. (Muir, May.)

I have named this little insect after Major Ouwens of the Zoological Museum, Buitenzorg.

Leptaleocera Muir.

The following species differs from the type in having the head in profile ovally produced, the junction of vertex and face being at the apex of the extension; the lateral edges of the pronotum are curved forward; the antennae flat but not quite so large proportionally. Until I have examined the type of *Nicerta* and *Interamma* I am dubious as to the validity of this and certain allied genera.

(1) *coccinella* sp. n.

♂ Bright scarlet, antennae fuscous along edges, clypeus and coxae yellowish.

Ventral edge of pygophor produced in middle into small plate longer than broad, slightly narrowing to apex which is formed by two arcs touching in middle, lateral edge of pygophor rounded; anal segment boat-like, longer than broad, narrowing to apex which is subtruncate, sides turned upward, anus situate in concavity of dorsal surface near base; styles long, narrow, curved slightly upward, apex round, ventral edge slightly sinuous, dorsal edge complex, a small process with rounded apex arising from middle.

♀ Yellow, inclining to scarlet, a dark scarlet mark through middle of face to eyes, antennae brown; tegmina white, opaque with waxy secretion, veins yellow, reddish along costa, yellowish over clavus, along hind margin, apical portion of cubital cell and more or less over apical cells, scarlet mark near base of media, on cubitus and over median cells to apex; wings hyaline opaque with waxy secretion, reddish yellow veins.

Last abdominal sternite a little wider than long, rotundately produced from sides to middle; anal segment large, boatshape, bluntly rounded at apex, anus in middle.

Length 2.5mm.; tegmen 4.5mm.

Hab. Bendoredjo, Java, on palm tree. (Muir, March.) In spite of the difference in color I feel sure that these are the sexes of the same species; more mature females may be scarlet like the male.

Epotiocerus Mats.

(1) *flexuosus* (Uhler).

Otiocerus flexuosus Uhler, 1896, Pro. Nat. Mus. U. S. A., p 283; Matsumura, 1904, 1000 Ins. Japan, II, p. 61., Pl. XXI, fig. 13.

Nicerta flexuosa Muir 1914, Pro. Haw. Ent. Soc., VIII, 1, p. 48.

Epotiocerus flexuosus Matsumura 1914, Ann. Mus. Nat. Hung., p. 300.

The validity of this genus cannot be judged without comparison with the type of *Nicerta*.

♂ Ventral edge of pygophor produced into a small trapezoidal plate, longer than broad, base slightly broader than apex, each corner of apex produced into a small spine; lateral edges entire, slightly curved; anal segment slightly longer than broad, sides turned upward boatshape, apex slightly emarginate, anus in middle; styles longer than anal segment, ventral edge slightly sinuate, curved upward towards apex, dorsal edge deeply sinuate, pointed apex turned inward, a keel runs from apex to base on outer surface.

♀ Posterior edge of last abdominal sternite steeply and rotundately produced to middle, the produced portion longer than the basal portion, middle slightly "lipped".

Specimens from Formosa differ slightly in genitalia from

Japanese specimens, but without fresh material for comparison they cannot be separated.

Megatropis Muir.

Mesotiocerus Matsumura 1914, Ann. Mus. Nat. Hung. p. 301.

(1) *formosana* (Mats.)

♂ Ventral edge of pygophor straight, lateral edges slightly curved; anal segment medium size, basal half tubular, distal half semi-tubular, apex forming small downward turned lobe, anus in middle within the tubular portion; styles projecting slightly beyond anal segment, edges subparallel, curved slightly upward towards apex where slightly sinuate, apex rounded.

♀ Last abdominal sternite as broad as long, hind margin angularly produced from sides to middle.

(2) *interruptolineata* Melichar.

Three specimens from Los Banos, Luzon, 1 ♂ and 2 ♀. In the male the antenna has a projection from base of second joint somewhat similar to *obliquefasciata* Mel. which the female does not possess.

♂ Ventral and lateral edges of pygophor straight; anal segment fairly large, basal half tubular, distal half subtubular, apex rounded, anus in middle within tubular portion; styles projecting slightly beyond anal segment, edges very slightly sinuate, slightly increasing in width from base to middle then gradually narrowing to blunt inward-turned point.

♀ Last abdominal sternite broader than long, steeply and rotundately produced from sides to middle; anal segment as in ♂ but basal tubular portion shorter.

Mysidioides Mats.

Mysidioides Matsumura 1904, 1000 Ins. Japan, II, p. 60.

Neocyclometopum Muir 1913. H. S. P. A. Ent. Bull. XII, p. 61.

(1) *jacobsoni* (Mel.)

Neocyclometopum jacobsoni Melichar Notes Leyden Mus. XXXVI, p. 102.

Two male specimens from Bendoredjo, Java, on palms, (Muir, March), which appear to be this species, the tegmina very slightly infuscate along margins.

Ventral edge of pygophor straight, two small, pointed processes arising from middle, their apices diverging, lateral edges of pygophor drawn out into sharp point in middle; anal segment large, subparallel sided, apex emarginate (each corner drawn out to a point); styles reaching beyond anal segment, dorsal edge curved slightly upward, ventral edge deeply emarginate on basal half, apical half gradually narrowing to apex which forms a small, inwardly turned point.

(2) *sapporensis* (Mats.)

Two ♀ specimens from Arisan, Formosa (Maki, July), and one ♂ from Japan (Okada, on bamboo); until a male from Formosa has been examined there will be some uncertainty as to the right identification.

♂ Ventral edge of pygophor straight, from between styles arises a small triangular plate, the apex produced into two divergingly curved sharp spines; lateral edges straight with a small sharp spine about middle; anal segment broad at base gradually narrowing to downward turned apex, which is deeply emarginate (apex forming two spines); styles reaching beyond anal segment, subparallel sided to beyond middle, where it widens out on ventral edge then narrows to the inwardly turned blunt apex, a small rounded process arises about middle on inner side of ventral edge.

♀ Last abdominal sternite broader than long, posterior edge very slightly and angularly produced from sides to middle.

(3) *infuscata* sp. n.

♀ Stramineous with castaneous markings on sides of clypeus, inner sides of antennae, between keels of pronotum and scutellum; dark brown at posterior portion of scutellum and over abdomen, legs with faint bands. Tegmina yellowish with yellow veins and irregular dark brown markings as follows: spot at base, two small bands across middle and small spot near apex of costal cell, at base of radial through median and over second cubital cells, spots at bases of sectors, over most of apical cells, especially along apical veins, spots at base and through middle of cubital cell and in clavus.

Last abdominal sternite large, shield-shape, posterior margin steeply and rotundately produced from near the sides; anal segment small, rotundate, anus in middle.

Length 4.2mm.; tegmen 8.4mm.

Hab. Arisan, Formosa. (M. Maki, July.)

No angle at junction of vertex and face, keels of face contiguous at base.

(4) *maculata* sp. n.

♂ Fuscous yellow, dark on face, antennae, ventral surface of thorax and over abdomen. Tegmina dirty white, opaque with waxy secretion, veins light yellow, black mark on hind margin at end of clavus, in some specimens forming small V, and infuscate spot in clavus, over radial cross-vein, end of subcosta and more or less over all apical cells; wings dirty white with yellowish veins.

Ventral edge of pygophor straight with a small rotundate projection in middle, from the middle inner surface arises a pair of flattened divergingly curved spines bluntly pointed at apex, lateral edges slightly curved; anal segment large, sides subparallel, anus in middle, beyond anus segment curved ventrally, apex broad, roundly excavate, (each corner produced into a point); styles large, reaching beyond anal segment, dorsal edge straight, ventral edge sinuous, produced in middle half, apex pointed and turned inward, from inner surface near base arises a small round-pointed process.

♀ Markings on tegmina much smaller and fainter. Last abdominal sternite wider than long, median three-fifths roundly produced.

Length 3.5mm.; tegmen 7mm.

Hab. Arisan, Formosa. (M. Maki, July.)

The male has no angle at junction of vertex and face and the keels of face are contiguous at base; the female has the vertex slightly flattened, slightly angular at junction with face and the keels of face not contiguous till a little beyond base.

Platocera Muir.

(1) *albipennis* sp. n.

♂ Antennae as in *nigrifrons* but not quite so flattened, sense organs equally distributed over its surface.

Head and body stramineous to light castaneous, darker over face, edges of antennae, lateral portions of pro and mesonotum and sides of abdomen. Tegmina and wings white, opaque with waxy secretion, veins light yellow.

Ventral edge of pygophor slightly and evenly convex, between the styles a bifurcate process, the apices pointed and divergingly curved with a small projection below apices on outer sides, lateral edges straight, a small angular projection from inner surface near middle; anal segment large, base broad tapering to pointed apex, anus about middle; styles large, broadest on distal half, curved slightly upward, apices rounded, ventral edge produced into a small angular point about third from apex, a little below this a small process with round apex arises from inner surface.

♀ Posterior edge of last abdominal sternite slightly rounded.

Length 4.8mm.; tegmen 9mm.

Hab. Arisan, Formosa. (M. Maki, July.)

Sikaiana Dist.

(1) *makii* sp. n.

Wings half as long as tegmina, anal area forming stridulating organ.

♂ Stramineous, eyes brown, fuscous on antennae, apices of tibiae and sides of abdomen; tegmina white, opaque with waxy secretion, veins yellowish, a black mark across tegmina, widest over base of second and middle of first median sectors, eight small red dots on costa, at second and third red dot a black mark through costal cell, two small black spots near base, another in clavus, another at end of clavus, from apex of costa to base of third median sectors a larger black mark, black marks on hind margin near apex of median sectors; wings white, opaque with waxy secretions, a black mark in middle of hind margin.

No medio-ventral process on pygophor, lateral edges roundly produced on sides of anal segment; anal segment longer than broad, apex round, dorsal surface convex, ventral concave, anus near apex on ventral side, anal style large, subcordate, concavo-convex, looking as if apical portion of segment; styles shorter than anal segment, broad at base narrowing to apex which is turned in and ends in a minute fine spine with another slightly before apex, dorsal edge nearly entire, ventral edge roundly produced on basal half.

♀ Anal segment very short, anal style large, subcordate.

Length 2mm.; tegmen 5.5mm.

Hab. Arisan, Formosa. (M. Maki, June.)

Zeugma West.

(1) *monticola* Kirk.

Several specimens from Bendoredjo, Java, on palm trees. (Muir, March.)

In the description of the genitalia of this species the apex of anal segment is described as "angularly emarginate". This would be more correctly described as being cleft nearly down to anus, so that the apex is formed of two long ensate processes. The lateral angular projection of the pygophor has a suture across the lower portion, cutting off a small triangular portion. It is very probable that this is the same as *vittata* Westwood.

(2) *javana* sp. n.

♂ Vertex and face narrower than in *vittata*, but not so narrow as in *makii*; a faint keel dividing vertex from face. Tegmina broader than in *vittata*, being produced on hind margin beyond clavus, a character shared by *makii*.

Stramineous or light brown, dark brown or black between keels of vertex, face and clypeus, and along outer sides of keels, dark mark down first and second coxae, two longitudinal marks on femora, the tarsi and tips of tibiae fuscous, six dark marks down scutellum, abdominal segments lightest on posterior edges; tegmina light stramineous, veins yellow bordered with fuscous, fuscous over radial cell and gradate cross-veins, a round black spot at base of cubitus.

Ventral edge of pygophor slightly angularly produced in middle, lateral edges forming a broad angular plate, the ventral edge of which is toothed near apex; anal segment quadrate, longer than broad, anus about middle, a small ridge across base, apex forming a flattened surface; styles longer than anal segment, lanceolate, the apices turned upward.

♀ Last abdominal sternite broader than long, posterior edge produced angularly towards middle, the apex turned upward, a slight longitudinal depression near lateral edges.

Length 4mm.; tegmen 9mm.

Hab. Bendoredjo, Java, on palm trees. (Muir, March.)

PROUTISTA Kirk.

It is to be regretted that several Homopterists actively engaged in describing Derbidae refuse to recognize this genus. Bierman* showed the validity of Buckton's genus *Assamia* and Kirkaldy recognized it also, *Proutista* being the new name he proposed, as Buckton's was preoccupied.

(1) *pseudomoesta* sp. n.

This species differs from *moesta* in having the face, antennae, middle of thorax, lateral keels and apex of scutellum and pleura of thorax yellowish; the dark markings on tegmina slightly reduced.

♂ Ventral edge of pygophor produced into small point in middle, anal segment shorter, straight, apex rounded and not turned ventrad, styles long, narrow, edges subparallel except at base where inner edge

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* Notes from Lyden Mus. XXXIII (1910), p. 35.

broadens out, apex sharply pointed turned inward and upward, from inner surface near base arises a quadrate process about twice as long as broad.

♀ Anal segment cylindrical, as long as broad, apex of abdomen (genital area) cylindrically produced.

Length 2.5mm.; tegmen 6mm.

Hab. Bendoredjo, Java, on palms; Pasoeroean, Java, on sugar-cane (Muir); Buitenzorg, Java, on palm (Leefmans).

In collecting I passed over this species for *moesta* and it was only by chance that I secured a series.

(2) *dolosa* sp. n.

♂ This species differs from *pseudomoesta* by its darker thorax and by the markings on tegmina and wings being still more reduced, in radial cell it only forms three bands, one near base, one over cross-vein and one at apex; on hind margin the markings form a series of fine dot at apices of veins; wings hyaline, veins dark, fuscous mark on apex.

♀ Anal segment cylindrical, much shorter than broad, apex of abdomen (genital area) flattened, sunk between two small lateral plates. In the shape of genital area this is nearer to *moesta* than to *pseudomoesta*.

Length 2.5mm.; tegmen 6mm.

Hab. Bendoredjo, Java, on palms; Pasoeroean, Java, on sugar-cane (Muir, March).

P. fenestrata (Bier.) is intermediate between these two species.

Paraproutista Muir.

At the time of erecting this genus I had doubts as to the value of its chief characteristic, the furcation of the third median sector. Experience has shown its constancy; of its utility there can be no doubt for the facies of the species of this and some allied genera are so similar that any good distinction is an advantage. Whether it should be considered as generic or subgeneric is a matter of personal opinion. In *albicosta, pseudoalbicosta* and *brunnia* the keels of face do not meet till below eyes or thereabout and are not so closely contiguous.

(1) *albicosta* sp. n.

♂ Dark stramineous or light brown, clypeus and abdomen red slightly fuscous, veins red, some eight or nine small white spots in costal cell connected together by the white or yellowish white costa, small white spot on apical border with fuscous spot in middle.

Pygophor very short, ventral edge straight, lateral edges angularly produced, the lower edge of angle slightly sinuous and longer than upper edge; anal segment about twice as long as wide, sides subparallel, apex rounded, lateral edges about middle produced into a small downward-turned angular process, anus about middle; styles in ventral view sublanceolate, apex forming blunt, hollow cone, the apical edge being rounder, below and inside of this apical cone dorsal edge complex forming a long inwardly pointed process and a smaller outwardly turned curved spine.

♀ Anal segment exceedingly short, forming ring in apical portion of the ovate genital area.

Length 2.7mm.; tegmen 7mm.

Hab. Bendoredjo, Java, on palms. (Muir, March.)

This species is very like *coccineo-venosa*, but the genitalia is quite distinct.

(2) *brunnia* sp. n.

♂ Light brown, darker over apex of clypeus, labium and apical edge of genital styles, yellowish over keels and apex of scutellum; tegmina fuscous brown with lighter mottlings over posterior half, veins dark brown with lighter marks, lighter markings through costal and apical portion of subcostal cells and at apices of radia and media; wings light brown, veins dark.

Pygophor very short, ventral edge subangularly produced in middle, lateral edges slightly and roundly produced; anal segment little longer than broad, apex broadly rounded, anus in apical half; in ventro-lateral view styles ovate, dorsal edge produced into a subquadrate process, depressed in middle and bent inward, a little distad of this a small blunt angular process turned inward.

Length 4mm.; tegmen 9.5mm.

Hab. Macassar, Celebes, on palms. (Muir, May.)

This has the tegmina more uniformly colored than *ceramensis* and the genitalia is distinct.

(3) *pseudoalbicosta* sp. n.

♂ Light brown, apex of clypeus and abdomen darker, antennae, legs and keels of thorax lighter, tegmina very like *albicosta*, veins not such a bright red, whitish spots along costa not so pronounced and confined more to distal half.

Pygophor very short, ventral edge slightly curved in middle, lateral edges angularly produced, anal segment little longer than broad, anus before middle, beyond anus segment curved downward, slightly narrowed to truncate apex; styles broader than long, in latero-ventral view sublanceolate, apex turned inward, dorsal edge incrassate, the margin turned inward and produced into a complex process, differing considerably from that of *albicosta*.

♀ Anal segment exceedingly short set between two angular plates, ventral border of genital area sinuate and elevated.

Length 3mm.; tegmen 8mm.

Hab. Urai, Formosa. (Muir, August.)

Besides the slight difference in color this species is differentiated from *albicosta* by genital structures.

(4) *sauterii* sp. n.

♂ Stramineous tinged with green, a small black dot on each side of the third abdominal tergite another at each corner of last sternite and on anal segment above anus; tegmina hyaline, opaque with waxy secretion, veins yellow tinged with red along costa and subcosta, slightly fuscous over radial and median basal cells and on veins, especially cross veins and in apical radial cells, faint spot at end of veins on hind margin.

Pygophor very short, anal segment longer than broad, sides subparallel to anus where there is a slight constriction, rounded beyond anus with a small median lip-like process in middle; styles subquadrate, base much narrower than apex, apical margin as long as dorsal margin, both entire and slightly rounded, a deep depression near base of ventral edge, a small, broad outwardly turned spine about middle.

♀ Apex of abdomen (genital area) flattened, triangular; anal segment very short, below anus two downward and inward curved pointed processes, near basal line of genital area two rounded knobs.

Length 4mm.; tegmen 9mm.

Hab. Arisan, Formosa. (M. Maki, June; Muir, August.)

This species is near *variegata,* especially in shape of *genitalia.* I have named it after Mr. H. Sauter, whose work in Formosa has added so much to our knowledge of the zoology of that interesting island.

ZORAIDA Kirk.

One of the chief characters of this genus is the narrow face formed by the contiguous lateral keels, which are continuations of the lateral keels of the vertex. Several allied genera have been erected having wider faces, with a carina or a fine groove down the middle. The nymphs of all the narrow-faced Derbidae, including Zoraida, have broad faces. In the nymph of Z.

insolicola the face is as broad as long, the lateral edges arcuate, two pair of carinae, one lateral and one medio-lateral. At the last ecdysis the face is invaginated down the median line, the lateral keels coming together and more or less coalescing. If the head of an adult *Zoraida* be boiled in caustic potash the face will open out, showing, during the process, characters attributed to certain genera. From observations made on several species it appears probable that some of these genera are only imperfectly developed specimens of *Zoraida*.

(1) *cydista* Dist.

One ♀ specimen from Bendoredjo, Java, which agrees with specimens from Papua and Amboina. (Muir, March, on palm tree.)

Peggiopsis Muir.

The two following species have the bulging eyes very slightly emarginate on lower margin, and the long, flat antennae of the type; the clypeus not so large proportionately as is general in *Zoraida*.

(1) *nigrovenosa* sp. n.

♂ Stramineous, white with waxy secretion over pronotum, eyes brown, fuscous on antennae, tarsi and abdomen; tegmina and wings hyaline, veins dark brown or black, ends of four in apex of tegmina colorless with a small black dot where color ends.

Ventral edge of pygophor produced into small lanceolate process in middle, lateral edges angular beside anal segment; anal segment spatulate with wide and short base, anus about middle; styles longer than anal segment, narrow, tip narrowed to a rounded apex and turned upward, ventral edge produced into small blunt angle before middle, dorsal edge with small round process near apex.

Length 2.5mm.; tegmen 8mm.
Hab. Bendoredjo, Java, on palms. (Muir, March.)

(2) *javana* Mel.

♂ Ventral edge of pygophor produced into small spatulate process, lateral edges subangularly produced; anal segment much longer than broad, slightly widened beyond middle then gradually narrowed to rounded apex which is turned down slightly and "lipped", anus in middle, dorsal surface of basal half sloping to sides, a small projection in middle half way to anus; styles not reaching to end of anal segment, very similar to *nigrovenosa* but more curved, the apices blunter and turned inward nearly at right angles.

Bendaredjo, Java, on palms. (Muir, March.)

These two species are very close, but the color of the neuration and the shape of genitalia, especially the anal segment, distinctly separates them. My five specimens of *javana* are males, the species was described from a single female.

Decora Dammerman.

Dichotropis Muir 1913, H. S. P. A. Ent. Bull. XII, p. 83.

(1) *pavo* Bireman.

♂ Edges of pygophor entire; anal segment as long as width of base, narrowing to truncate apex, anal style projecting beyond apex of segment; styles subovate, apex somewhat truncate, on dorsal edge from near base arises a small spine with apex bent outward.

Decora Dammerman.

(1) *pavo* Bierman.

♂ Edges of pygophor entire; anal segment as long as width of base, narrowing to truncate apex, anal style projecting beyond apex of segment; styles subovate, apex somewhat truncate, on dorsal edge from near base arises a small spine with apex bent outward.

One ♂ specimen from Bendoredjo on palm tree, which conforms very closely to Bierman's description. *Dichotropis* only differs from this in the degree of development of keels of face and slight difference in width of vertex, character not sufficient to justify its retention.

Mecynorhynchus Muir.

(1) *kershawi* Muir.

Four specimens from Mount Maquiling. (Muir, February.)

The single ♂ specimen of *kershawi* on which the genus was founded was taken in Borneo.

♂ Pygophor very short, ventral edge straight, lateral edges slightly arcuate; anal segment very short; styles longer than broad, gradually widened to apex which is broad and rounded, ventral edge entire dorsal edge in middle produced into a long curved spine.

♀ Last abdominal sternite very short and broad, posterior edge straight except in middle where it is produced into a minute angle.

(2) *hyalinus* sp. n.

♂ Light yellow, darker on keels of face and vertex and over mesonotum and dorsum of abdomen. Tegmina hyaline, slightly opaque with waxy secretion, veins yellow, a black mark in middle of costal cell and one on hind margin at apex of cubitus, slightly fuscous over radial cross-vein.

Pygophor exceedingly short, ventral and lateral edges straight; anal segment very short, anal style projecting beyond apex; styles acinacicate, apex truncate, reaching to anal segment, from dorsal edge near apex a small spine with small knob on apex.

Length 1.6mm.; tegmen 3.5mm.
Hab. Bendoredjo, Java, on palm tree. (Muir, March.)

(3) *stramineus* Muir.

One ♂ specimen from Buitenzorg, Java, off palm tree, which I cannot separate from the Formosan species.

(4) *obscurus* sp. n.

♂ Yellow, fuscous over face and vertex, apex of clypeus, apex of labium, femora and apices of tibiae, blood red mark on middle of first and second tibiae, dorsum of abdomen and genitalia brown, anal style brown. Tegmina hyaline, slightly fuscous and opaque with waxy secretion, veins very light yellow or white, costa darker yellow, slightly infuscate over basal half of subcosta, and bases of median sectors, wings hyaline, veins white. The basal portion of subcosta raised considerably.

Pygophor very short, anal segment longer than wide, anal style projecting beyond apex from under side; styles longer than wide, widest near apex, apex rotundate, dorsal edge roundly produced near base and drawn out into a sharp spine about middle, the spine curved at apex.

Length 1.4mm.; tegmen 3.5mm.
Hab. Buitenzorg, Java, on palm tree. (Muir, May.)

(5) *fuscus* sp. n.

♂ Yellow, fuscous over dorsal surface of head and thorax, abdomen and genitalia fuscous, pleura tinged with red. Tegmina fuscous, veins dark except in costal cell and apical margin where they are yellow, basal portion of costal cell nearly hyaline; wings fuscous with dark veins; both tegmina and wings with slight waxy secretion.

Pygophor very short, edges straight; anal segment short, anal style projecting beyond apex; styles subquadrate, base narrower than apex, apex slightly rounded, spine on dorsal edge curved, with small knob at apex. This genitalia comes near to *hyalinus*.

Length 1.5mm.; tegmen 3.5mm.
Hab. Buitenzorg, Java, on palm tree. (Muir.)

Levu Kirkaldy.

The presence of a well-developed shoulder keel on the pronotum distinguishes this genus from *Rhotana*; there is a slight difference in neuration of tegmina and in general shape. The genus is not recognized by some Homopterists, but the distinction is useful even if only considered as of subgeneric value.

(1) *toroensis* (Mats.).

Rhotana toroensis Matsumura.

(2) *hopponis* (Mats.).

Rhotana hopponis Matsumura.

(3) *matsumurae* sp. n.

♂ Yellowish red, apical portion of abdomen darker red, legs light yellow. Tegmina, vitreous, veins yellowish, at apex of clavus a brown or fuscous mark from hind margin to first median sector, brownish at base of second median sector and over apical cross-veins, four small black dots on basal half of subcosta; wings hyaline, veins white.

Pygophor laterally compressed, ventral edge not produced, lateral edges broadly anugularly produced in middle; anal segment small, little longer than broad, anus at apex, anal style spatulate, longer than broad, projecting beyond end of segment; styles longer than broad, slightly narrowed at base, apex rounded, a small curved blunt pointed spine on inner surface near base.

♀ Last sternite of abdomen broader than long, hind margin in middle produced into angular process which turns up between base of styles; anal segment exceedingly short, anal styles small, narrowly spatulate.

Length 2.5mm.; tegmen 4mm.
Hab. Arisan, Formosa. (Maki, July; Muir, August.)

(4) *quadramaculata* sp. n.

♂ Light yellow, slightly tinged with red on face, tegmina hyaline slightly opaque with waxy secretion, veins yellow, a yellowish band bordered with fuscous from the hind margin apical of clavus to costa, broadest over media then narrowing to costa, fuscous yellow over apical portion of subcosta and radia and over apical cross-veins, a row of four black spots on cross-veins between median sectors; wings hyaline, opaque with waxy secretion, veins white or light yellow.

Pygophor laterally compressed, ventral edge not produced, lateral edges slightly and very broadly angularly produced in middle; styles considerably longer than broad, narrowest at base, apex narrowly rounded, from middle of inner surface arises a small, outwardly curved, blunt pointed spine, a small rounded process arises near base.

♀ Last abdominal sternite broader than long, hind margin angularly produced from sides to middle.

Length 2.5mm.; tegmen 4.5mm.

Hab. Arisan, Formosa. (M. Maki, July.)

(5) *lucida* sp. n.

♀ This species differs from the type of the genus in having the basal half of the costa arcuate and the costal cell very broad, especially the basal half.

Light yellow, front and middle femora streaked with red. Tegmina yellowish and dull in middle, brown and glittering around borders, three glittering spots at apex, one hyaline and two black; veins in median portion white with fuscous marks, in other parts of tegmina yellowish, wings white with white veins.

Length 2.5mm.; tegmen 4mm.

Hab. Poespoe, East Java. (Muir, April.)

Notes on Hawaiian Roaches.

BY J. F. ILLINGWORTH.

Leucophaea surinamensis Fab.

On May 21st, 1914, I collected 10 pairs of this burrowing roach from the loose soil, under stones, on the College Farm. I placed these in a large jar with a quantity of the soil in which I had found them. They were fed on various substances, but I found that they took kindly to bread and the inner part of banana skins; refusing meat, butter, insect remains, etc.

June 1st, I found many young had been born—it has been noted that this is one of our four viviparous species. During that summer the birth-rate was enormous, so that the soil was literally swarming with young of various stages. Early in September, I found most of the adults were dead, and all of them covered with mites. Since these mites did not appear to attack the nymphs, I removed all of the old roaches from the jar, at once, and wet down the soil. The activity of the young roaches in scrambling thru the soil may account for their freedom from attack.

March 15, 1915, the first adult emerged; a second one appeared on March 28th, and another today—April 1st, being 10 months a nymph. Since these roaches lived in their native soil and were continually supplied with food and drink, we get some notion of the length of their period of development under rather favorable conditions.

Rhyparobia maderae (Fab.).

Nine adult specimens, received from Hilo, Hawaii, on Nov. 14, 1914, thru the kindness of Bro. Matthias Newell and Mr. Ehrhorn, have given me the opportunity to make observations on this, our largest roach.

These insects came over in a box, packed in moss; and I have kept them in this same material, transferring them to a glass jar with a cover of wire screen. A small quantity of water was sprinkled on the moss and they were supplied with bits of bread. They were evidently very hungry, for they began eating at once and sipping up the water.

A Viviparous Species.

The day following their arrival I discovered young in the moss. These were separated out into another jar with some of the moss; and found to be 32 in number. They have much the appearance of the ordinary sowbug, in form and color.

This makes the fourth viviparous species for our Hawaiian fauna. This habit of bearing living young appears to be rather uncommon among roaches in general, being confined to tropical species. The first case mentioned in the literature* was a South American form (*Panchlora viridis*).

* Insect Life, Vol. III, p. 443, 1891.

Stridulation.

This species produces a very noticeable stridulation, whenever disturbed. By holding the insect between the fingers, we are able to observe that the sound is produced by rubbing the caudal border of the pronotum over the mesonotum. The stridulation can be made by working these parts together with the fingers.

Disagreeable Odor.

None of our roaches are more disagreeable to handle. While most roaches emit a liquid fecal matter, when disturbed, I have never found a species before that compares with this for the unpleasant odor.

Rhyparobia maderae feeds extensively upon insect remains. This is especially true with the nymphs, which eat up their own cast skins as fast as they shed them. I have not found them eating each other, but they soon clean up the remains of any soft-bodied insects that I place in the jars; a large dragon-fly will be eaten over-night.

The period of development of this species is evidently somewhat longer than that of *L. surinamensis;* nymphs at 4 months are less than one-fourth the size of the adults.

Phyllodromia hospes Perk.

HAB. Under stones, rubbish, etc.; out of doors, also in houses.

The females of this species are wingless. I found them in great numbers on the Waialae beach, beyond Diamond Head, among camp refuse. They were associated with *Nauphoeta bivitata, Phyllodromia hieroglyphica* and *Eleutheroda dytiscoides.* One specimen of *Rhyparobia maderae* nymph, was also found in this place. Several of the females were found with the oothecae still attached to them. On May 4th, 1914, one of these reproducing females and a male were placed in a jar in the laboratory where observations were made on the reproductive habits as indicated below:

1914.			
May 14th	1st ootheca		Hatched Aug. 30th. 108 days. Ootheca very dry.
" 20th	2nd	"	
" 23rd	3rd	"	
" 28th	4th	"	
June 1st	5th	"	
" 8th	6th	"	
" 16th	7th	"	
" 24th	8th	"	
" 30th	9th	"	
July 3rd	10th	"	
" 6th	11th	"	
" 10th	12th	"	
" 12th	13th	"	
" 15th	14th	"	Male died.
" 17th	15th	"	
" 19th	16th	"	
" 22nd	17th	"	
" 25th	18th	"	
Aug. 1st	19th	"	
" 6th	20th	"	
" 13th	21st	"	
" 17th	22nd	"	
" 23rd	23rd	"	
" 28th	24th	"	
Sept. 2nd	25th	"	
" 7th	26th	"	
" 15th	27th	"	Hatched Oct. 20th, time 35 days. 20 young.
' 20th	28th	"	Hatched Oct. 26th, time 36 days. 20 young.
" 25th	29th	"	Dried up. Open vials.
" 30th	30th	"	" " " "
Oct. 8th	31st	"	" " " "
" 14th	32nd	"	" " " "
" 20th	33rd	"	Hatched Dec. 4th, time 45 days. 18 young.
" 28th	34th	"	Hatched Dec. 10th, time 43 days. 20 young.
Nov. 14th	35th	"	Dried up—cotton plugs in vials.
" 21st	36th	"	Dried up—cotton plugs in vials.
Dec. 1st	37th	"	½ size. Dried up—cotton plugs in vials.
" 10th	38th	"	½ size. Dried up—cotton plugs in vials.
1915			
Apr. 12th			No more oothecas produced.

The egg cases were at first kept in open vials, after removing them from the jar, but the eggs dried out too much, so that many of them did not emerge at all. Later, in order to determine how long she could produce fertile eggs, after the death of the male, I placed each ootheca in a corked vial on the day that it was laid, and left these in the table drawer. Those that I treated in this way—the 27th, 28th, 33rd, and 34th cases—

hatched without undue drying, in an average of about six weeks. Evidently she is able to produce fertile eggs several months after mating and, quite possibly, as long as her egg-laying period lasts.

At the present writing (April 1) this female appears to be well-fed and contented tho she has produced no more egg-cases.

Bees Destructive to Hardwood.

BY J. F. ILLINGWORTH.

Xylocopa aeneipennis de Geer, *Lithurgus albofimbriatus* Sich.

These two species were found recently, working in a large block of Koa (*Acacia koa* Gray), which had been stored for some time, with other lumber under a building. The principal damage was to the sap-wood, but in several places the burrows extended into the hardest portions of the seasoned heart-wood.

The first species made its entrance thru the ends of the block, following pretty much the grain. Opening up the inside, the nest was found to be a series of longitudinal, tubular burrows, placed side by side; each individual burrow being about 3 to 6 inches in length, and the several chambers were connected by side openings. Young in all stages were found, but only one specimen in each tube. The lower end of the chambers containing the larvae was stored with a pollen-mass, similar to ordinary bee-bread; and each slender white larva rested with its head in this. In several of the tubes partial wooden partitions had been formed across, near the end, from chewed wood-pulp. The small chambers thus set off were about three-fourths of an inch in length, and in one case several of these had been formed one above another; their use is not evident, since the pupae usually lie exposed in the cavities in which they have developed.

Another block of wood was found later that showed perfectly the partitions, in which case they were entire, enclosing full-grown larvae, one above another, in series of threes.

The burrows of the small species were much more irregular, cutting in every direction. In many places they opened into the chambers of the large species; and they probably lived harmoniously together, for apparently they used the same exit.

No specimens of *Lithurgus* were found in the nest, but the appearance would indicate that it had been recently abandoned. In the ends of many of the burrows were the fresh cocoons of the emerged bees, and in some places the dry bee-bread still remained.

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Paradise-Pac

Vol. III., No. 3. September, 1916

PROCEEDINGS

OF THE

HAWAIIAN ENTOMOLOGICAL SOCIETY

MAY-DECEMBER, 1915

HONOLULU, HAWAII
PRICE 50 CENTS

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All correspondence should be addressed to the Secretary, Hawaiian Entomological Society, Experiment Station, H. S. P. A., Honolulu, Hawaii, from whom copies of the Proceedings may be purchased.

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PROCEEDINGS

OF THE

Hawaiian Entomological Society

Vol. III, No. 3. May to December 1915. September 1916.

MAY 6TH, 1915.

The one hundred-seventeenth meeting of the Society was held in the usual place, President Ehrhorn in the chair. Other members present: Messrs. Back, Bryan, Fullaway, Illingworth, Mant, Muir, Osborn, Pemberton, and Swezey. Three students of Professor Illingworth's from the College of Hawaii were present as visitors: A. H. Case, Y. Kutsunai, and H. E. Starratt.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM

Mr. Muir gave a short summary of a paper he was preparing for publication on "A Review of the Native Genera of Hawaiian Delphacidae," which contained quite a number of new species.

Mr. Swezey stated that this was one of the groups in which he had collected for several years, and that he considered that other groups would yield new species similarly if more thoroly collected.

Mr. Fullaway remarked on the very large number of undescribed species which he had found in looking over material of the genus *Sierola,* collected by Mr. Swezey, Mr. Giffard, and himself.

In consideration of some of the subjects touched on by Mr. Muir above, Mr. Bryan mentioned some evidences of depression and elevation which he had recently been making observations on in the Waianae region. Well drillings in one of the valleys show silt to 1500 feet below sea level, from which it is estimated that there has been a subsidence of at least 3000 feet since the valley was eroded. Some elevated coral reefs of the Eocene age show an elevation of 60 to 80 feet since that time.

Bruchid in palm seeds.—Mr. Ehrhorn exhibited a Bruchid found in a shipment of palm seeds from Cuba. A Chalcid had emerged in numbers from the shipment and observations by Mr. Fullaway indicated it to be a parasite attacking the Bruchid eggs but emerging from the pupae. If satisfied of its parasitic habit on Bruchids, the parasite will be released here.

Chrysidid.—Mr. Mant exhibited several specimens of a Chrysidid captured at his residence in Manoa. It was an undetermined species which has only lately made its appearance here, the first specimen having been collected in June, 1914, by Mr. Potter.

Chrysomyza aenea.—Mr. Fullaway reported finding a mass or the larvae of this Ortalid breeding in horse and cow manure at Waialae, about 50% of which proved to be parasitized by *Spalangia.*

Telespiza ultima.—Professor Bryan reported this as a new species of bird from Nihoe or Bird Island, taken by Captain Brown of the "Thetis." The description will be in a forthcoming number of the "Auk."

Chinese thrush.—Professor Bryan reported that he was trying some feeding experiments on the Chinese thrush. A nest had been upturned, the three nestlings found were placed in a rat trap in which the mother bird was captured later. In this connection, Mr. Ehrhorn mentioned that dried water boatmen was the favorite bird-food used by the Chinese bird men on vessels.

Coconut leaf-roller [Omoides blackburni (Butl.)] destroyed by ants.—Professor Illingworth reported that these moths began depositing eggs on his coconut trees in Palolo Valley, March 16, 1915, and continued to the present (May 6, 1915), but none of the caterpillars had been able to resist the attacks of the ants *(Pheidole megacephala)* long enough to pupate. A few of the larvae reached almost full size, but they had to finally succumb. The ants were first observed, actually at work, destroying a young colony, on April 14th last. They first cut away the under-part of the web, that protects the caterpillars, and then pulled them out. In a number of cases they were seen eating the egg-masses, and several times they were found attacking the almost full-grown larvae.

Sitodrepa panicea in curry.—Professor Illingworth exhibited a bottle of curry very much infested by the common drug store or bread beetle.

JUNE 3RD, 1915.

The one hundred-eighteenth meeting of the Society was held in the usual place, President Ehrhorn in the chair. Other members present: Messrs. Back, Kuhns, Pemberton, Swezey, and Wilder; and Mr. August Busck of the U. S. National Museum, visitor.

In the absence of the Secretary, Mr. Swezey was appointed Secretary pro tem.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Mango weevil.—Mr. Ehrhorn mentioned that Captain Kidwell had sent mangoes from his place in Manoa Valley, having specks on them which had turned out to be where the mango weevil had laid eggs. Mr. Wilder stated that on account of infestation by the mango weevil the past year, only about 18% of the mango seeds germinated in his propagation work. He further stated that he had never found the Chinese chutney and the No. 9 mango to be attackd by the Mediterranean fruitfly.

Pseudococcus nipae.—Dr. Back exhibited some samples of a kind of sugary honey-dew produced abundantly on guava leaves by this mealybug. The speimens were collected in Kona, Hawaii. He also exhibited excellent photographs of some of the leaves.

Hypocala andremona.—Mr. Wilder reported that his *Dirospyros* (or *Ebenaster)* tree had never again been infested with caterpillars since the time in 1908 when it was so badly eaten by the numerous caterpillars of this moth.

Cremastus hymeniae.—Mr. Swezey exhibited a specimen of this Ophionid and called attention to the fact that it has a large number of hosts, being parasitic on the caterpillars of a good many species of Pyralids and Tortricids. It first began to be noticed about Honolulu in 1910, and has now spread all over the Island, even into the mountains, where it attacks many native species of moths. It is not yet known where this parasite came from. It was described from specimens collected here—bred from *Hymenia recurvalis.*

Mr. Busck made some remarks on first impressions in Hawaii, and commented on the scarcity of the native insect fauna here as compared with other places he had visited in the Tropics.

JULY 1st, 1915.

The one hundred-nineteenth meeting was held in the usual place. No quorum being present, only informal entomological discussions took place. Those present were Messrs. Ehrhorn, Fullaway, Illingworth, Osborn, and Mr. Busck, visitor.

SEPTEMBER 2nd, 1915.

The one hundred-twentieth meeting of the Society was held in the usual place, President Ehrhorn in the chair. Other members present: Messrs. Kuhns, Illingworth, Mant, Osborn, Potter, and Swezey; and Mr. August Busck, visitor.

NOTES AND EXHIBITIONS.

Nyctalemon patroclus.—Mr. Mant exhibited a fine male specimen of this large moth, which was captured by one of the officers of the British steamer "City of Bristol," about 300 miles from the Nicobar Islands.

Azya luticepes.—Mr. Ehrhorn reported finding this Coccinellid abundant at Moanalua. It was introduced from Mexico by Mr. Koebele in 1908, and first recovered in 1910, but was rarely seen till a few years later.

Paralaptomastix abnormis.—Mr. Ehrhorn reported having brought a colony of this mealybug parasite from the California State Insectary, where it is being reared in large numbers on *Pseudococcus citri* and distributed in the State. It had been introduced from Sicily the previous year. Mr. Ehrhorn tried it on five of the local mealybugs and found it to attack three of them: *Pseudococcus citri, P. virgatus,* and *P. bromeliae.*

Rhyparobia maderae.—Professor Illingworth stated that young of this roach which he had under observation had completed their life cycle in 9 months and 15 days.

Eleutheroda dytiscoides.—The habits of this roach were discussed. Mr. Osborn reported having been shown a grove of algaroba trees at Makaweli, Kauai, in which a large number of the trees within an area of about 25 acres had had the bark scraped off from the upper limbs and portions of the larger branches so that there was considerable dead timber. The appearance of the scraped limbs was very similar to the cypress twigs that have been killed by this roach having eaten off the bark, and it may be that it has also been injuring the algaroba in the same way. Mr. Kuhns reported having observed similar injury to algaroba trees at Waianae. Mr. Illingworth statetd that he had often seen this roach very abundant about the base of algaroba trees.

Mr. Swezey and Mr. Ehrhorn reported briefly on the meetings of the Entomological Society of America and American Association of Economic Entomologists, which they had attended at Berkeley, Cal., early in August.

OCTOBER 7TH, 1915.

The one hundred-twenty-first meeting was held in the usual place, Vice-President Illingworth in the chair. Other members present: Messrs. Giffard, Osborn, Pemberton, Swezey; and Mr. August Busck, visitor.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Agrotis ypsilon.—Mr. Giffard exhibited a specimen of this cosmopolitan moth which he had captured flying about in his cabin on board the steamer "Sonoma," when three days out of San Francisco. The incident illustrates how readily such insects may effect their introduction to Hawaii.

Catorama mexicana.—Professor Illingworth called attention to the ease with which this beetle is distributed thru commerce. He had recently found specimens in a tightly sealed tin of chocolate from New York.

Crater Lake insects.—Mr. Swezey exhibited a collection of about 160 species of insects which he had taken during a two days' stay at Crater Lake, Oregon, in July.

"Gonatocerus mexicanus," a Mymarid parasitic in the eggs of "Draeculacephala mollipes" in Hawaii.

BY OTTO H. SWEZEY.

Two specimens of this Mymarid were caught on sedges at Kapiolani Park, Honolulu, August 26, 1915. In examining the eggs of *D. mollipes* in sedges, some were found containing different parasites than had been previously reared from these eggs here. Rearing some of these parasites they proved to be a Mymarid species, which, on comparison with Dr. Perkins' type of *Gonatocerus mexicanus,* apparently agrees with it. This species was described from specimens bred by Mr. Koebele from Jassid eggs in grass, Chapultepec, Mexico, in 1907. (Ent. Bul., Exp. Station, H. S. P. A., 10, p. 21, 1912.)

At that time Koebele was studying egg-parasites of leafhoppers, and attempted the introduction of several species from America. This one must have been amongst them, tho there was no record of it. My finding it at this time is the first record of its having become established here.

Ootetrastichus beatus was also bred from eggs of *D. mollipes* collected the same day at Kapiolani Park as the above. This now makes four different species of parasites breeding in the eggs of this Jassid in Honolulu. Two Trichogrammids: *Jassidophthora lutea* and *Westwoodella caerulocephala,* described by Fullaway on pages 22 and 23 of Proc. Haw. Ent. Soc. III, 1914. A Eulopid: *Ootetrastichus beatus,* which parasitizes the sugar cane leaf-hopper and was purposely introduced from Fiji in 1905. A Mymarid: *Gonatocerus mexicanus.*

The *Anagrus* sp. reported on page 9, Proc. Haw. Ent. Soc., III, 1914, as having been bred from eggs of *D. mollipes,* proved later to be from the eggs of *Kelisia paludum,* whose eggs were in the same sedges as those of *D. mollipes* and were overlooked at the time.

A Note on "Tineola uterella" in Hawaii.

BY OTTO H. SWEZEY.

Mr. August Busck has called my attention to this species of moth among the specimens labelled *Oecia maculata* in the cabinet of the Experiment Station, H. S. P. A. In fact, nearly all so-labelled proved to be *Tineola uterella*. This species has not been previously recorded in the Hawaiian Islands. Walsingham, in the Fauna Hawaiiensis, records a single specimen of *O. maculata*, without locality, collected by Blackburn in the Hawaiian Islands. This no doubt was collected in Honolulu. Walsingham remarks that *O. maculata* is "extremely similar in appearance to *Tineola uterella*." This and the fact that only the former had been recorded here, led to my confusion of the two species, which I am now able to separate readily, since having their distinctions pointed out by Mr. Busck. They both occur in the West Indies and Brazil, from where they were described. Their larvae are said to have similar habits, in that they live in flattened cases and are found about the walls of houses.

In Honolulu, *T. uterella* is much more common than *O. maculata*, for I have collected but one specimen of the latter in 11 years of collecting; whereas, the former I have collected frequently from many localities in the Islands, and also reared it from the larval cases so commonly seen about buildings.

A Braconid, *Protapanteles hawaiiensis*, is often bred from these cases. It will be necessary to make a correction in a statement about this parasite on page 108 of Proceedings of the Hawaiian Entomological Society, Vol. III, 1915. *Tineola uterella* should be substituted for *Oecia maculata* as the host of this Braconid.

Proc. Haw. Ent. Soc. III, No. 3, September, 1916.

Notes on the Orthopteroid Insects of the Fiji Islands.

BY LAWRENCE BRUNER.

(Presented by O. H. Swezey.)

INTRODUCTION.

During the latter part of 1913 the compiler of these notes had the pleasure of visiting the entomologists of Hawaii in Honolulu. While there the subject of orthopteroid insects naturally came up for discussion along with other matters entomological. Among the specimens examined were a number of Orthoptera from the Fiji Islands. Most of these were brought along to the University of Nebraska to be studied. Later a second collection of these insects taken in the same islands was receivd from Professor J. F. Illingworth of the College of Hawaii.

In studying this material a list of these insects for the group of islands was prepared as a basis for the determinations of the forms in hand. Several new forms were found among the collections studied and their descriptions are given herewith. In this paper the Isoptera or termites are not included.

BLATTOIDEA.

Allacta spuria (Brunner).

Phyllodromia spuria Brunn., Nouv. Syst. Blatt. p. 96 (1865); Kirby Syn. Cat. Orth., I, p. 93 (1904).

Allacta spuria Shelford, Genera Ins. Fasc. 73, p. 18, pl. 2, fig. 7 (1908). For additional synonomy see Shelford, l. c.

Not found in the collections seen, but originally described from the Fiji Islands.

Phyllodromia vitrea Brunner.

Phyllodromia vitrea Brunn., Nouv. Syst. Blatt. p. 109, No. 28 (1865); Kirby, Syn. Cat. Orth. I, p. 95 (1904); Shelford, Genera Ins. Fasc. 73, p. 15 (1908).

Blatta vitrea Sauss., Miss. Mex., Orth. p. 30, pl. I, fig. 18 (1870).

Blatta dilatata ♂, Sauss., Rev. Zool. (2) XX, p. 98 (1868).

A specimen in the collection of the College of Hawaii comes from Nadi, where it was taken in August, 1913.

Phyllodromia germanica (Linnaeus).

Blatta germanica Linn., Syst. Nat. (ed. XII) I, (2) p. 668, No. 7 (1767).

Blatta obliquata Daldorf, Skriv. Nat. Selsk. Vol. 2 (2), p. 164 (1793).

Ectobius germanica Steph., Ill. Brit. Ent., Mand. VI, p. 46 (1835).

For additional synonomy see Shelford, Genera Ins. Fasc. 73, p. 11, and Kirby, Syn. Cat. Orth. I, p. 87.

This insect is cosmopolitan and occurs in all temperate and tropical seaports, as well as in most inland cities and towns, where it has been carried by commerce. Possibly too common to have been taken.

Phyllodromia bivittata (Serville).

Blatta bivittata Serv., Hist. Ins. Orth. p. 108 (1839).

Phyllodromia bivittata Sauss., Miss. Mex. Orth. p. 28 (1870); Kirby, Syn. Cat. Orth. I, p. 87 (1904); Shelford, Genera Ins. Fasc. 73, p. 11 (1908).

The two-lined cockroach, like the preceding, is very widely distributed over the warmer portions of the earth, where it has been carried by commerce. The same remarks might be made of this as of the preceding species.

Phyllodromia suppellectilum (Serville).

Blatta suppellectilum Serv., Hist. Ins. Orth. p. 108 (1839).

For a rather full synonomy of this species see Shelford, Genera Ins. Fasc. 73, p. 11 (1908).

This is still another of the cosmopolitan species that occurs in all seaports of tropical and subtropical countries. See remarks regarding *germanica* and *bivittata*.

Phyllodromia rufescens (Beauvois).

Blatta rufescens Beauv., Ins. Afr. Amer. p. 183, Orth. pl. 1b, f. 7 (1805).

For synonomy see Kirby, Syn. Cat. Orth. I, p. 82, and Shelford, Genera Ins. Fasc. 73, p. 11.

Still a fourth cosmopolitan species of the genus *Phyllodromia* is to be met with in these islands. While not represented in the collection studied, it certainly occurs in the Fijis.

Phyllodromia notulata (Stål).

Blatta notulata Stål, Freg. Eugen. Resa, Ent. p. 308 (1858).

Allacta notulata Kirby, Syn. Cat. Orth. I, p. 100 (1904).

Phyllodromia notulata Shelford, Genera Ins. Fasc. 73, p. 13 (1908).

Phyllodromia hieroglyphica Brunn., Nouv. Syst. Blatt. p. 105 (1865).

There are specimens in the collection of the College of Hawaii taken at Nadi during the month of June, 1913.

Temnopteryx ferruginea sp. nov.

Rather small, ferrugineo-piceous with a testaceous border on the sides of the pronotum and abdomen, legs also testaceous with prominent piceous maculae on coxae, femora and tibiae. Tegmina and wings abbreviated, the former obliquely truncated internally at apex, their inner margins touching; wings narrow, sublinear, as long as the tegmina. Dorsum and venter becoming piceous at outer margins and adjoining the narrow testaceous border. Spines of legs piceous at their base. Head ferruginous, paler on the vertex, the clypeus testaceous; maxillae testaceous, the apical joint infuscated; antennae also somewhat infuscated.

Length of body, ♀, 10 mm.; of pronotum, 2.85 mm.; width of pronotum, 4 mm.; length of tegmina, 3 mm.

Habitat.—A single female, the type, comes from Rewa, Fiji (Muir, 1906).

Cutilia nitida (Brunner).

Platyzosteria nitida Brunner, Nouv. Syst. Blatt. p. 214 (1865).

Cutilia nitida Shelford, Genera Ins. Fasc. 109, p. 8 (1910). For synonomy see Shelford, l. c.

Habitat.—Malay Archipel. etc.; Suva, Fiji, Aug. 25, 1913 (College of Hawaii). These specimens were collected from cocoanut leaf sheaths.

Cutilia feejeeana sp. nov.

A single ♀ specimen of a second and rather closely related species of "Cutilia" is at hand. The color of this insect is a deep piceo-ferruginous and in form it is somewhat broader than the preceding. Its length is 23 mm., its greatest width 16 mm., length of pronotum 7.5 mm., width of hind margin of pronotum 15 mm., length of hind tibiae 10.75 mm.

Habitat.—Rewa, Fiji (Muir, 1906). Type in the collection of L. Bruner.

Stylopyga rhombifolia (Stoll).

Blatta rhombifolia Stoll, Spectres, Blatt. p. 5, pl. 3d, fig. 13 (1813).

For synonomy see Shelford, Genera Ins. Fasc. 109, p. 14, and Kirby, Syn. Cat. Orth. I, p. 135 (1904).

This is a cosmopolitan insect that is very widely disseminated thruout the Oriental region. It is especially common in the islands of the Pacific. It should be found in the principal seaports of the Fijis.

Blatta orientalis Linnaeus.

Blatta orientalis Linn., Syst. Nat. (ed. X) I, p. 424, No. 7 (1758).

For synonomy see Kirby, Syn. Cat. Orth. I, p. 137 (1904).

Found about the wharves, in dwelling houses, hotels, business blocks, etc., thruout the civilized world; also to some extent out-of-doors in the tropical forests. No specimens are at hand, possibly because of its being too common and well known.

Blatta rotundata (Brunner).

Periplaneta rotundata Brunn., Nouv. Syst. Blatt. p. 230 (1865).

This moderately large insect appears to be confined entirely to the Fiji Islands. No specimens are at hand. Hence it would seem either to be rare or else confined to the jungles or some special haunts away from human habitations.

Periplaneta americana (Linnaeus).

Blatta americana Linn., Syst. Nat. (ed. X) I, p. 424, No. 4 (1758).

For synonomy see Kirby, Syn. Cat. Orth. I, p. 140, and Shelford, Genera Ins. Fasc. 109, p. 18.

A cosmopolitan cockroach that occurs both about buildings and in the forests. A single specimen taken at Nadi during the month of July is classed here. It is contained in the College of Hawaii collection.

Periplaneta australasia (Fabricius).

Blatta australasia Fabr., Syst. Ent. p. 271, No. 5 (1775).

For synonomy see Kirby and Shelford, l. c.

A cosmopolitan species of the forests rather than of the cities, but by no means absent from the latter locality. Reported from the Fijis, but not present in the collections examined.

Diploptera dytiscoides (Serville).

Blatta dytiscoides Serv., Hist. Ins. Orth. p. 102 (1839).

For synonomy see Kirby, Syn. Cat. Orth. I, p. 176 (1904).

Habitat.—Quite general over the Oriental region. Muir collected it at Rewa, Fiji, in 1906.

Several other cosmopolitan roaches undoubtedly are to be met with in these islands, as for example *Leucophoea surinamensis* (Linn.), *Rhyparobia maderae* (Fabr.) and *Nauphoeta cinerea* (Oliv.), all of which are common in adjoining islands.

PHASMOIDEA.

Pterobrimus depressus Redtenbacher.

Pterobrimus depressus Redt., Ins. Fam. Phasm. p. 43 (1906).

Habitat.—Fidji-Inseln (Coll. Redt. and Mus. Hamburg). Not in the collection studied.

Chitoniscus lobipes Redtenbacher.

Chitoniscus lobipes Redt., Ins. Fam. Phasm. p. 178, pl. VI, fig. 15 (1906).

Habitat.—Viti, Fidschi-Inseln (Coll. Redt.). This insect is likewise absent from the various collections examined by me.

Chitoniscus lobiventris (Blanchard).

Phyllium lobiventre Blanch., Voy. Pole Sud. Zool. IV, p. 359, Orth. pl. I, fig. 9 ♂ (1853); Westw. Cat. Phasm. p. 174, pl. 39, fig. 5 ♀ (1859).

Chitoniscus lobiventris Stål, Recens. Orth. III, p. 105 (1875); Redt., Ins. Fam. Phasm. p. 179 (1906).

Habitat.—Fiji Isls. (Mus. Hamburg, Mus. Paris, etc.). Not among the specimens now studied.

Chitoniscus feejeeanus (Westwood).

Phyllium feejeeanum West., Proc. Ent. Soc. Lond. (3) II, p. 17 (1864).

Chitoniscus feejeeanus Kirby, Syn. Cat. Orth. I, p. 420 (1904).

Habitat.—A single ♀ specimen of this Fijian insect is at hand. It was taken at Suva in August, 1913, (College of Hawaii).

Nisyrus spinulosus Stål.

Nisyrus spinulosus Stål, C. R. Soc. Ent. Belg. XX, p. lxvi (1877); Brunn., Fam. Phasm. pp. 359, 360, pl. XVI, fig. 13 (1908).

Habitat.—Viti-Inseln (Coll. Brunner, Mus. Hamburg, Mus. Berlin, Mus. Stuttgart). Absent from the Fiji material at hand.

Nisyrus dipneusticus (Wood-Mason).

Cotylosoma dipneusticum Wood-Mason, Ann. Mag. Nat. Hist. (5) I, p. 101 (1878); Waterhouse, Ann. Nat. Hist. XV, p. 498 (1895).

Habitat.—The only reference to this insect's habitat is Taviuni, Viti-Inseln (Mus. Hamburg).

Nisyrus amphibius Stål.

Nisyrus amphibius Stål, C. R. Soc. Ent. Belg. XX, p. lxvii (1877); Brunn., Fam. Phasm. p. 360 (1908).
Habitat.—Viti-Inseln (Mus. Hamburg).

Nisyrus carlottae (MacGillivray).

Prisopus carlottae MacGill., Zoologist, XVIII, p. 714 (1860); Brunn., Fam. Phasm. p. 361 (1908).
Habitat.—Viti-Inseln (Mus. Hamburg).

Megacrania phelaus (Westwood).

Platycrania phelaus Westw., Cat. Phasm. p. 113, pl. 27, fig. 5 ♀ (1859); Kirby, Trans. Linn. Soc. Lond. (2) vi, p. 470 (1896).

Megacrania phelaus Kaup., Berl. Ent. Zeitschr. XV, p. 38 (1871); Brunn., Fam. Phasm. p. 370 (1908).
Habitat.—Fidschi-Inseln (Westw.).

Graeffea coccophagus (Newport).

Alophus coccophagus Newp., Phil. Trans. 1844, p. 288, pl. 14, fig. 4.

Lopaphus coccophagus Westw., Cat. Phasm. p. 99 (1859).

Graeffea purpuripennis Brunn., Dr. Graeffes Reisen in Viti-Levu, figs. 1 ♂, 2 ♀ (1868).

Anophelepis fulvescens Sauss., Rev. et Mag. d. Zool. 1869, p. 4; Ib. Mel. Orth. III, p. 117, pl. 2, figs. 3, 4 (1869).

Habitat.—Australasia. There are 2 female specimens at hand from Rewa (Muir in April); also a couple from Suva taken in August, 1913 (Coll. College of Hawaii).

Graeffea lifuensis Sharp.

Graeffea lifuensis Sharp, Acc. of Phasm. in Willey Zool. Results, p. 80, pl. 9, fig. 21 (1898); Redt., Ins. Fam. Phasm. p. 371 (1908).

Habitat.—Two females and a male of what is apparently this insect are at hand from Suva, where they were collected in August, 1913 (College of Hawaii).

Graeffea minor Brunner.

Graeffea minor Brunn., Dr. Graeffes Reisen in Viti Levu. p. 47 (1868); Kirby, Syn. Cat. Orth. p. 386 (1904).

Habitat.—Fiji Islands (Coll. Brunner, Mus. Hamburg).

Podacanthus typhon Gray.

Podacanthus typhon Gray, Ent. Austr. I, pl. 2, fig. 1 (1833); Serv., Hist. Ins. Orth. p. 230 (1839); Burm., Handb. Ent. II, p. 581 (1838); Westw., Cat. Phasm. p. 117 (1859).

Habitat.—Fidschi-Inseln (Coll. Brunner).

Hermarchus differens Redtenbacher.

Hermarchus differens Redt., Fam. Phasm. p. 445 (1908).
Habitat.—Viti (Mus. Paris).

Hermarchus appolonius (Westwood).

Phibalosoma appolonius Westw., Cat. Phasm. p. 181, pl. 40, fig. 4 ♀ (1859).

Phibalosoma pythonius Westw., Cat. Phasm. p. 73, pl. 35, fig. 3 ♂.

Hermarchus pythonius Stål, Recens. Orth. III, p. 89.

Habitat.—Fiji Islands. A single ♂ from Suva, taken in August, 1913, is referred here (College of Hawaii).

Hermarchus pythonius (Westwood).

Phybalosoma pythonius Westw., Cat. Phasm. p. 73, pl. 12, fig. 1 ♀ (1859).

Hermarchus pythonius Stål, Recens. Orth. III, p. 89 (1875); Brunn., Fam. Phasm. p. 446.

Habitat.—Fidschi-Inseln (Coll. Brunner, Mus. Paris, Mus. Hamburg, Hofmus Wien).

Hermarchus virga Redtenbacher.

Hermarchus virga Redt., Fam. Phasm. p. 446 (1908).

Phybalosoma pythonius var. Westw., Cat. Phasm. p. 73 (1859).

Habitat.—Fidschi-Inseln (Coll. Brunner, Mus. Paris).

Hermarchus novae-britanniae (Wood-Mason).

Phyllium novae-britanniae Wood-Mason, Ann. Mag. Nat. Hist. (4) XX, p. 76 ♀ (1877).

Hermarchus novae-britanniae Brunn., Fam. Phasm. p. 447, pl. XXI, fig. 6 (1908).

Habitat.—Fidschi-Inseln (Coll. Brunner, Mus. Genf, Mus. Hamburg, Mus. Paris, Mus. Berlin).

Hermarchus inermis Redtenbacher.

Hermarchus inermis Redt., Fam. Phasm. p. 448, pl. XXI, fig. 5 (1908).

Habitat.—Fidschi-Inseln (Coll. Brunner, Mus. Hamburg, Mus. Stuttgart).

Acrophylla chronus (Gray).

Diura chronus Gray, Ent. Australia, pp. 20, 26, pl. 5, fig. 2 (1833).

For synonomy see Brunner and Redt., Fam. Phasm. p. 457.

Habitat.—Fidschi-Inseln (Coll. Brunner).

MANTOIDEA.

Hierodula fuscescens (Blanchard).

Mantis fuscescens Blanch., Voy. Pole Sud. Zool. IV, p. 354, pl. i, fig. 5 (1853).

Habitat.—Although recorded as belonging to these islands, it is not contained in the material examined.

Undoubtedly several other mantids will be found to occur in these islands.

LOCUSTOIDEA.

Thyrsus tiaratus Bolivar.

Thyrsus tiaratus Bolivar, Ann. Soc. Ent. Belg. XXXI, pp. 187, 254, pl. 5, fig. 21 (1887); Hancock, Genera Ins. Orth. Acrid. Tetr. Fasc. 48, p. 50, fig. 19 (1906).

Habitat.—Although confined to the Fiji Islands, this species is not represented among the forms studied.

Paratettix pullus Bolivar.

Paratettix pullus Bolivar, Ann. Soc. Ent. Belg. XXXI, pp. 188, 272, 281 (1887).

Habitat.—Two specimens are at hand from Rewa (Muir, 1906).

Paratettix feejeeanus sp. nov.

Decidedly smaller that *P. pullus*, from which it differs in having the pronotum and wings much abbreviated and scarcely reaching the apex of the hind femora and tip of the valves of the ovipositor in the females; in the males only about as long as the abdomen. Color variable, mostly testaceous, more or less varied with fuscous.

Length of body, ♂, 5.5 mm., ♀, 7.5 mm.; of pronotum, ♂, 5.75 mm., ♀, 6 mm.; of hind femora, ♂ and ♀, 4.25 mm.

Habitat.—This insect was taken at Rewa in April, 1906, by Muir; and at Nausori during June and July, 1913 (Coll. College of Hawaii). Types in the collection of L. Bruner.

Aeolopus tamulus (Fabricius).

Gryllus tamulus Fabr., Ent. Syst., Suppl. p. 195 (1798). For synonomy see Kirby, Syn. Cat. Orth. III, p. 192.

Habitat.—This insect is widely distributed in the Oriental region. Specimens of both sexes are at hand from Nadi, where they were taken in June, 1913 (College of Hawaii).

Locusta australis (Saussure).

Pachytylus australis Sauss., Mem. Soc. Geneve, XXVIII, pp. 51, 118 (1884).

Locusta australis Frogg., Agric. Gaz. N. S. Wales, XIV, p. 1106 (1903); Kirby, Syn. Cat. Orth. III, p. 229 (1910).

Habitat.—Three males and 2 females were taken at Rewa by Muir in April 1906, and 2 pairs are labelled Nadi, June, 1913 (College of Hawaii).

Oedipoda (?) liturata Le Guili.

Aedipoda liturata Le Guill, Rev. Zool. 1841, p. 295. See Kirby, Syn. Cat. Orth. III, p. 242.

Habitat.—An insect under the above name is referred to in Fiji. It is not contained in the collections investigated.

Cyrtacanthacris vittaticollis (Stål)?

Acridium vittaticolle Stål, OEfv., Vet. Akad. Forh. XXXIV (10), p. 53 (1877); Finot, Sur. Genre Acridium, p. 73 (1907).

Habitat.—The above named insect is native in the Philippines. A pair of specimens referred here with some doubt bear the locality label "Nadi," where they were taken in June, 1913 (Coll. College of Hawaii).

Cyrtacanthacris sp.

A second and considerably larger species of this genus coming from the same locality, is also at hand. It is a female, and was also taken during the month of June and is contained in the College of Hawaii collections. This latter insect may be new. It resembles quite closely the large *Schistocera americana* and allies. It might bear the name temporarily of *Cyrt. feejeeana.* Its dimensions are as follows: Length of body, ♀, 56 mm.; of pronotum, 11 mm.; of tegmina, 57 mm.; of hind femora, 34 mm.

Undoubtedly still other species of locusts or short-horned grasshoppers occur in these islands.

TETTIGONOIDEA.

Gryllacris dubia Le Guill.

Gryllacris dubia Le Guill, Rev. Zool. 1841, p. 293; Kirby, Syn. Cat. Orth. II, p. 145 (1906).

Habitat.—This insect, while reported from Fiji, is not among the material examined by me.

Gryllacris ferruginea Brunner.

Gryllacris ferruginea Brunn., Verh. Zool.-bot. Ges. Wien, XXXVIII, pp. 316, 317 (1888); Kirby Syn. Cat. Orth. II, p. 146 (1906).

Habitat.—Nausori, Aug. 29, 1913 (College of Hawaii), and Rewa (Muir, 1906).

Euconocephalus australis (Bolivar).

Conocephalus australis Bol., Viaje al Pacif., Ins. p. 90 note (1884).

Habitat.—Specimens of this insect are present from Rewa (Muir) and Nadi (College of Hawaii). Kirby claims that it is the same as the *Conocephalus extensor* of Walker (see Syn. Cat. Orth. II, p. 250).

Euconocephalus lineatipes (Bolivar).

Conocephalus lineatipes Bol., Ortopt. Afr. Mus. Lisboa, p. 225 (1890); Redt., Mon. Conocephal. p. 95.

Habitat.—Fidji-Inseln (Redt.). Specimens from Rewa collected by Muir in 1906 are also referred here.

Salomona antennata Redtenbacher.

Agroecia rugifrons Redt., Mon. Conocephal. pp. 156, 157 (1891); Karny, Revis. Conocephal. p. 73 (1907).

Habitat.—Viti Levu, Fidji-Inseln (Walker, Brunner, Mus. Hamburg). Not contained among the material at hand.

Salomona antennata Redtenbacher.

Salomona antennata Redt., Monog. Conocephal. pp. 156, 158 (1891); Kirby, Syn. Cat. Orth. II, p. 265 (1906); Karny, Revis. Conocephal. p. 73 (1907).

Habitat.—Viti-Levu, Fidji-Inseln (Coll. Brunner). Not among the material at hand.

Salomona brongniarti Brunner.

Salomona brongniarti Brunn., Abhandl. Senckenb. Ges. XXIV, p. 270 (1898); Kirby, Syn. Cat. Orth. II, p. 265 (1906).

Habitat.—Fiji Islands. Not present in the collections studied.

Xiphidion modestum (Redtenbacher).

Xiphidium modestum Redt., Mon. Conocephal. pp. 182, 196 (1891).

Anisoptera modestum Kirby, Syn. Cat. Orth. II, p. 277 (1906).

Xiphidion modestum Karny, Revis. Conocephal. p. 91 (1907).

Habitat.—Quite generally distributed in the Oceanic islands. Fidji-Inseln (Coll. Brunner, Mus. Geneva). Not in the material at hand.

Xiphidion affine (Redtenbacher).

Xiphidium affine Redt., Monog. Conocephal. pp. 183, 199 (1891).

Anisoptera affine Kirby, l. c. p. 278 (1906).

Habitat.—Fiji Islands. Specimens are at hand from Rewa (Muir, Mch. and April, 1906), and Nadi (June, 1913, Coll. College of Hawaii).

Phisis echinata (Redtenbacher).

Teuthras echinatus Redt., Monog. Conocephal. p. 226, fig. 96 (1891).

Phisis echinata Kirby, Syn. Cat. Orth. II, p. 286 (1906); Karny, Revis. Conocephal. p. 104 (1907).

Habitat.—Fidji-Inseln (Coll. Brunner). Missing from the collections before me.

Phisis rapax (Redtenbacher).

Teuthras rapax Redt., Monog. Conocephal. pp. 226, 227 (1891).

Phisis rapax Kirby, l. c. p. 104 (1907).

Habitat.—Fidji-Inseln (Coll. Brunner). Not in the collections at hand.

Hexacentris australis Redtenbacher.

Hexacentris australis Redt., Monog. Conocephal. pp. 234, 236 (1891); Kirby, l. c. p. 287 (1906); Karny, l. c. p. 107 (1907).

Habitat.—Specimens of this insect were taken at Rewa in March, 1906, by Muir.

Morisimus oceanicus (Pictet et Saussure).

Tympanoptera oceanica Pict. et Sauss., Icon. Saut. Vertes, p. 20, pl. 2, fig. 12 (1892).

Aprion oceanicus Brunn., Mon. Pseudophyll. pp. 74, 78, pl. 3 fig. 31 (1895).

Morisimus oceanicus Kirby, Syn. Cat. Orth. II, p. 305 (1906).

Habitat.—Fiji. Not in any of the collections studied.

Ocica lutescens Walker.

Ocica lutescens Walker, Cat. Derm. Salt. B. M. II, p. 246 (1869); Kirby, Syn. Cat. Orth. II, p. 357 (1906).

Habitat.—This insect is recorded only from the Fiji Islands. None are in the collections studied.

Diaphlebus bivittatus Redtenbacher.

Diaphlebus bivittatus Redt., Verh. Zool.-bot. Ges. Wien. XLII, p. 193 (1892).

Habitat.—This and the following three species of the genus are all described from the Fiji Islands. None of them are represented.

Diaphlebus marmoratus Redtenbacher.

Diaphlebus marmoratus Redt., l. c. pp. 193, 194, pl. 3, fig. 2 (1892); Kirby, Syn. Cat. Orth. II, p. 357 (1906).

Habitat.—Fiji (Coll. Brunner).

Diaphlebus brevivaginatus Karsch.

Diaphlebus brevivaginatus Karsch, Berl. Ent. Zeitschr. XXXVI, p. 343 note (1892).

Habitat.—Fiji Islands.

Diaphlebus (?) uniformis Brunner.

Diaphlebus (?) uniformis Brunn., Abhandl. Senckenb. Ges. XXIV, p. 257 (1898); Kirby, Syn. Cat. Orth. II, p. 357 (1906).

Habitat.—Fiji Islands.

Elaeoptera nitida Redtenbacher.

Elaeoptera nitida Redt., Verh. Zool.-bot. Ges. Wien, XLII, p. 196 (1892); Kirby, l. c. II, p. 358 (1906).

Habitat.—Fiji Islands. Not represented.

Elaeoptera lineata Redtenbacher.

Elaeoptera lineata Redt., l. c. p. 196, pl. 3, fig. 3 (1892); Kirby, l. c. p. 358 (1906).

Habitat.—Fiji. Likewise absent from these collections examined.

Ityocephala nigrostrigata (Walker).

Pseudophyllus nigrostrigatus Walker, Cat. Derm. Salt. B. M. V. Suppl. p. 44 (1871).

Ityocephala nigrostrigata Redt., Verh. Zool.-bot. Ges. Wien, XLII, p. 22, pl. 3, fig. 11 a, b (1892).

Habitat.—Fiji (Coll. Brunner). Not in the material studied.

Furnia insularis Stål.

Furnia insularis Stål, Bihang. Svenska Akad. IV, p. 57 (1876); Kirby, Syn. Cat. Orth. II, p. 468 (1906).

Anaulacomera insularis Brunn., Mon. Phaneropt. pp. 280, 295 (1878).

Habitat.—Two ♀♀ and a nymph are referred here (Muir, Mch. 1906).

Furnia incerta (Brunner).

Anaulacomera incerta Brunn., Mon. Phaneropt. pp. 280, 295, pl. 6, fig. 85 a-e (1878).

Furnia incerta Kirby, Syn. Cat. Orth. II, p. 468 (1906).
Habitat.—Fiji (Brunner, Kirby).

Furnia malaya Stål (?)

Furnia malaya Stål, Bihang Svenska Akad. IV (5), p. 57 (1876).

Anaulacomera malaya Brunn., l. c. pp. 280, 295 (1878).
Habitat.—Two specimens, ♂ and ♀, taken at Rewa in March, 1906, by Muir are referred here.

GRYLLOTALPOIDEA.

Curtilla africana (Beauvois).

Gryllotalpa africana Beauv., Ins. Afr. Amer. p. 229, pl. 2 c, fig. 6 (1805).

Gryllotalpa orientalis Burm., Handb. Ent. II, p. 739 (1838).

Curtilla africana Kirby, Syn. Cat. Orth II, p. 6 (1906).

This insect seems to be generally distributetd throughout Australasia. Although no specimens are at hand, it most certainly will be found to occur in the Fiji Islands.

GRYLLOIDEA.

Nemobius luzonicus Bolivar.

Nemobius luzonicus Bol., Ann. Soc. Esp. XVIII, p. 418 1889); Kirby Syn. Cat. Orth. II, p. 16 (1906).

Habitat.—Two ♀ specimens of *Nemobius* are referred to Bolivar's *N. luzonicus,* although they do not agree in all respects with his description. They come from Nausori, where they were taken in June and July, 1913 (College of Hawaiai).

Apiotarsus gryllacroides Saussure.

Apiotarsus gryllacroides Sauss., Mem. Soc. Geneve, XX, p. 105, pl. 14 (XXIII), figs. 1-7 (1877); Kirby, Syn. Cat. Orth. II, p. 20 (1906).

Habitat.—Fiji Islands. Not in the material now examined.

Gryllus oceanicus Le Guill.

Gryllus oceanicus Le Guill, Rev. Zool. 1841, p. 293; Kirby, Syn. Cat. Orth. II, p. 33 (1906).

Gryllus innotabilis Walker, Cat. Derm. Salt. B. M. I, p. 47 (1869); Sauss., Mem. Soc. Geneve, XXV, p. 158 (1877).

Habitat.—Fiji Islands: Rewa (Muir); Suva, Aug. 1913 (Mus. College of Hawaii). This insect also is quite widely distributed in the various islands of the Pacific.

Ornebius novarae (Sassure)?

Liphoplus novariae Sauss., Mem. Soc. Geneve, XXV, p 315 (1877).

Ornebius novarae Kirby, Syn. Cat. Orth. II, p. 58 (1906).

Habitat.—A ♂ specimen collected by Muir at Rewa during April, 1906, is referred here with some doubt.

Ornebius sp.

Habitat.—A ♂ specimen of a second species of the genius not yet determined was also taken at Lautoka in June, 1913 (College of Hawaii).

Arachnocephalus maritimus Saussure.

Arachnocephalus maritimus Sauss., Mem. Soc. Geneve, XX, p. 313 (1877); Kirby, Syn. Cat. Orth. II, p 60 (1905).

Habitat.—Oceanica; Fiji Islands. Not at hand now.

Oecanthus rufescens Serville.

Oecanthus rufescens Serv., Hist. Ins. Orth. p. 361 (1839); Sauss., Mem. Soc. Geneve, XXV, p. 456 (1878).

Gryllus (Oecanthus) gracilis Haan, Teminck, Verhandel., Orth. p. 236, pl. 20, fig. 8 (1842).

Habitat.—Oriental region, including Fiji, but not represented in the material studied.

Oecanthus lineatus Walker.

Oecanthus lineatus Walker, Cat. Derm. Salt. B. M. I, p. 96 (1869); Sauss., Mem. Soc. Geneve, XXV, p. 455 (1877); Kirby, Syn. Cat. Orth. II, p. 74 (1906).

Habitat.—Specimens of this species are at hand from Nadi, Lautoka and Rewa.

Trigonidium flavipes Saussure.

Trigonidium flavipes Sauss., Mem. Soc. Geneve, XXV, p. 465, pl. 16 (XLVII), fig. 2i, e, pl. 19 (LXXX), fig. 1 (1878); Kirby l. c. p. 78 (1906).

Habitat.—Muir collected this insect at Rewa in 1906.

Metioche insularis (Saussure).

Homoeoxiphus insularis Sauss., Mem. Soc. Geneve, XXV, p. 470 (1878).

Metioche insularis Kirby, Syn. Cat. Orth, II, p. 79 (1906).

Habitat.—Specimens of this small cricket are present from Nadi and Nausori, taken in June, 1913 (College of Hawaii), and from Rewa, 1906 (Muir).

Cyrtoxipha maritima (Saussure).

Cyrtoxiphus maritimus Sauss., Mem. Soc. Geneve, XXV, p. 478, pl. 17 (XLIX), fig. 3, pl. 19 (LXXIX), fig. 3 (1878).

Habitat.—Fiji is among the islands listed as the habitat of this insect.

Cyrtoxipha fulva (Saussure).

Cyrtoxiphus fulvus Sauss., Mem. Soc. Geneve, XXV, p. 481, pl. 17 (XLIX), fig. 5 (1878).

Cyrtoxipha fulva Kirby, Syn. Cat. Orth II, p. 82 (1906).

Habitat.—Fiji. Not in the material being studied.

Cyrtoxipha straminea (Saussure).

Cyrtoxiphus stramineus Sauss., Mem. Soc. Geneve, XXV, p. 482 (1878).

Habitat.—Credited to Fiji, but not among the specimens at hand now.

Hydropedeticus vitiensis Miall and Gils.

Hydropedeticus vitiensis Mial and Gils., Trans. Ent. Soc. Lond. 1902, p. 284, pls. 7, 8 (1902).

Habitat.—The present species is confined to the Fiji Islands. It is aquatic in its habits, as are some of the neotropical representatives of *Nemobius*.

Cardiodactylus novae-guineae (de Haan).

Gryllus (Platydactylus) novae-guineae Haan, Temminck, Verhandl. Orth. p. 233 (1842).

Cardiodactylus novae-guineae Sauss., Mem. Soc. Geneve, XXV, p. 519, pl. 17 (LV), f. 1 (1878); Kirby, Syn. Cat. Orth. II, p. 88 (1906).

Habitat.—Quite generally distributed over Australasia. A single ♂ was collected at Rewa, Fiji, in 1906 by Muir.

Heterotrypus tripartitus Saussure.

Heterotrypus tripartitus Sauss., Mem. Soc. Geneve, XXV, p. 548 (1878); Kirby, Syn. Cat. Orth. II, p. 91 (1906).

Habitat.—This is another small gryllid that seems to be confined to the Fiji group of islands. It is not in the collections now being reported upon.

Mnesibulus bicolor (De Haan)?

Gryllus (Phalangopsis) bicolor De Haan, Temminck, Verhandel, Orth. p. 235 (1842).

Calyptotrypus bicolor Sauss., Mem. Soc. Geneve, XXV, p. 587 (1878).

Mnesibulus bicolor Bolivar, An. Soc. Esp. Hist. Nat., XVIII, p. 427 (1889); Kirby, Syn. Cat. Orth. II, p. 95 (1906).

Habitat.—A single ♀ cricket collected in 1906 by Muir is referred here with considerable doubt. Its ovipositor is fully as long as the hind femora, a character that does not agree with Saussure's measurement for *bicolor*. It may be new, but if so is quite nearly related to *bicolor*.

Mnesibulus (?) sp.

A second but much smaller species of this or a closely related genus is contained in material collected by Muir at Rewa in 1906. It is rather mutilated, hence not readily determinable nor describable.

Madasumma (?) sp.

The collection made by Muir at Rewa in 1906 contains still another cricket that seems difficult to determine even as to its generic affinities. It is apparently a female, but has the subgenital plate enormously developed into an elongate scoop-like arrangement that is deeply and rather widely longitudinally canaliculate below. Above, and partly hidden by the upturned sides of the apparatus just described, seems to be a dark-colored ovipositor of about the same length as the plate. Its apex is blunt and quite robust.

No attempt will be made at this time to name or describe this insect.

Hemiphonus vittatus Saussure.

Hemiphonus vittatus Sauss., Mem. Soc. Geneve, XXV, p. 621, pl. 18 (LXVII), figs. 1-6 (1878); Kirby, Syn. Cat. Orth. II, p. 101 (1906).

Habitat.—Northern Australia and the Fiji Islands. Not now before me.

Anisotrypus furcatus Saussure.

Anisotrypus furcatus Sauss., Mem. Soc. Geneve, XXV, p. 632, pl. 17 (LVIII), figs. 1-4 (1878); Kirby, Syn. Cat. Orth. II, p. 102 (1906).

Habitat.—This is another species of gryllid that is confined to Fiji and not represented in the collections at hand.

Podoscritus insularis Saussure.

Podoscritus insularis Sauss., Mem. Soc. Geneve, XXV, p. 639 (1878); Kirby l. c. p. 104 (1906).

Habitat.—It would appear that some one in the past collected the gryllids of Fiji quite carefully. This species is also absent from the collections now studied.

Aphonomorphus vitiensis (Saussure).

Aphonus vitiensis Sauss., Mem. Soc. Geneve, XXV, p. 661, pl. 19 (LXXI), figs. 2, 2a (1878).

Aphonomorphus vitiensis Kirby, Syn. Cat. Orth. II, p. 105 (1906).

Habitat.—Fiji. Not contained in the material now being reported upon.

Aphonomorphus depressiusculus (Saussure)?

Aphonus depressiusculus Sauss., Mem. Soc. Geneve, XXV, p. 662, pl. 19 (LXXI), figs. 1, 1a (1878).

Habitat.—A single female specimen in the collection of the College of Hawaii is referred to this species with some doubt. It is rather smaller than the measurements given by Saussure. It comes from Nadi, where it was taken during Aug. 1913.

DERMAPTERA.

Anisolabis maritima (Gene).

Forficula maritima Gene, Ann. Sci. Nat. Regn. Lomb. Venet. II, p. 224 (1832).

For the chief references to this insect see Kirby, Syn. Cat. Orth. I, p. 17 (1904).

Although a cosmopolitan insect, no Fiji specimens are contained in the material studied. A little collecting along the beach of any of the islands would certainly disclose it.

Anisolabis annulipes (Lucas).

Forficula annulipes Lucas, Bull. Soc. Ent. France (2) V, p. lxxxiv (1847).

For synonomy see Burr, Genera Ins. Fasc. 122, p. 19 (1911).

There are no Fiji specimens of this cosmopolitan species in the collections examined, but there can be little doubt but that it occurs in the islands.

Labidura riparia (Pallas).

Forficula riparia Pallas, Reise Russ. Reichs. II, Anh. p. 727 (1773).

For the very extensive synonomy see Burr, Genera Ins. Fasc. 122, pp. 36-37.

This cosmopolitan earwig most assuredly occurs in the Fiji Islands, although no specimens are at hand from there.

Chelisoches morio (Fabricius).

Forficula morio Fabr., Syst. Ent. p. 270, No. 6 (1775).

For synonomy see Burr, Genera Ins. Fasc. 122, p. 65 (1911).

Habitat.—The present species occurs throughout the Oriental region. Specimens are at hand from Nadi. They were taken during the months June, July and August, 1913.

A careful search for Dermaptera over the various islands of the group will undoubtedly result not only in the discovery of the four here listed, but also of several additional forms.

Review of the Autochthonous Genera of Hawaiian Delphacidae.

BY F. MUIR.

"A flood of light may be thrown on the theoretical problem of the origin of species by the study of the probable actual origin of species with which we may be familiar or of which the actual history or the actual ramifications may in some degree be traced."—*David S. Jordan.*

INTRODUCTORY.

During the latter half of January, 1915, I accepted an invitation to spend a couple of weeks with Mr. W. M. Giffard at his house at Kilauea Hawaii; during my stay we spent considerable time collecting in the neighborhood and made a hurried trip to the lava flows of South Kau. Most of my collecting was confined to Homoptera, but Mr. Giffard gave more attention to Hymenoptera; between us we collected nineteen species of Delphacids, four of which I describe as new species and one as a new sub-species. Upon naming up this material I soon became interested in several problems and found it necessary to revise the genera. Unfortunately my time was very limited, as field work in the Orient compelled my early departure from Honolulu, and this paper has had to be finished in the Orient, away from collections and libraries.

The material I had at my disposal, besides that collected at Kilauea, mentioned above, was cotypes of certain species belonging to the Bishop Museum, collections made by Messrs. Swezey, Giffard and Fullaway during the last several years and a few odd specimens left over by the late Mr. Kirkaldy from material collected by Dr. R. C. L. Perkins. It was unfortunate that I was not able to examine the types of Kirkaldy's species, now in the British Museum, as there is some doubt as to certain of them.*

PART I.

SYSTEMATIC.

The first Hawaiian Delphacid to be described was *Delphax pulchra* by Stål in 1854; it is now known as *Nesosydne ipomoeicola* Kirkaldy (*pulchra* being preoccupied in *Delphax*). In 1904 Kirkaldy described *Aloha ipomoeae* as a new genus and species, and also *Megamelus leahi,* which he afterward placed in *Nesosydne.* In 1907, 1908 and 1910 a number of new species and genera were described by the same author in the Proceedings of this Society and in the Fauna Hawaiiensis. In 1907 Swezey described the extraordinary genus

*Subsequently I have examined long series collected by Mr. W. M. Giffard at Kilauea, Hawaii, and Tantalus, Oahu. These were collected very carefully to verify the reported food plants; they have enabled me to correct certain errors and prevented some synonymies. I hope Mr. Giffard will present the Society with full notes on these collections.

Dictyophorodelphax. Dr. R. C. L. Perkins revised the family in his interesting Introduction to the Fauna Hawaiiensis in 1913. Notes on captures and life histories have appeared in the Proceedings of this Society at various times (1905 to date). These references, along with this present paper, constitute the whole of the literature of the autochthonous genera of the Hawaiian Delphacidae.

In dividing the species into genera Kirkaldy used characters already in use in continental areas and gave them the same values. An examination of the male genitalia discloses the fact that this system brings together heterogenous forms and separates several allied forms. By using the size of the first joint of the antennae, instead of the condition of the frontal carinae, for primary divisions these forms are brought together. *Leialoha* and *Nesodryas* have the first joint of antennae very short and wide, and are composed of very closely allied forms, whereas the rest of the *Alohini* have the first joint longer than wide and form a larger group of allied forms containing several well-defined smaller groups, the exact relationship of which it is difficult to decide. In the table of genera *Proterosydne* is included, as it is the only foreign genus of the tribe, with one American and one Australian species. For specific characters the ultimate appeal is made to the external male genitalia. Owing to the variability of color in many species and the tendency of the females to immaculacy, the females of many species are difficult to separate. For this reason I have refrained from erecting new species on females, although there are several in the collections that are undescribed. One specimen collected by Swezey at Nahiku, Maui, has a single frontal carina, but otherwise it is identical with *Nesorestias;* thus it constitutes another genus.

Kirkaldy's sub-genus *Leialoha* I have separated, as a genus, from *Aloha,* leaving the latter with *ipomoeae* and *myoporicola* and placing with them *Nesopleias artemisiae, N. dubautiae* and several new species. *Nesopleias nimbata* I have placed under *Nesorestias,* as they only differ in the greater reticulation of tegmina, a character I do not consider as of generic value. The difference between *Nesodryas* and *Nesothoe* is, at most, only of sub-generic value; the type of the former *(N. freycinetiae)* is not typical of the other species, but is an extreme form, either divergent or convergent.

While working on material from the Hawaiian Islands one finds that in many instances "species" have not the same value as among continental faunas, and one hesitates to give many forms that status, but it is necessary for both systematic and biological studies that such forms be separated and named; whether as species, sub-species or varieties must be left to the idiosyncracies of the describer.

In the Fauna Hawaiiensis Kirkaldy enumerates forty-six species (omitting two, *Nesopleias artemisiae* and *Nesosydne leahi*) under six genera. The present paper adds twenty-seven species and three sub-species to the list, thus bringing it up to seventy-eight; these are still under six genera, but somewhat differently arranged.

Genera of Alohini.

1\. (4) First joint of antennae very short, broader than long, second joint short and thick, often ovaliform or sub-ovaliform. (All macropterous.)

2\. (3) Two median frontal carinae, approximating at base or apex, or both, or even meeting together, but not forming a stalk. *Leialoha*

3\. (2) A single median frontal carina, forked at extreme base if at all. *Nesodryas*

(A.) Slender, elongate forms. Subgen. *Nesodryas*

(B.) Broader, more robust forms. Subgen. *Nesothoe*

4\. (1) First joint of antennae distinctly longer than broad, second joint cylindrical or only slightly enlarged in middle. (Mostly brachypterous, few macropterous).

5\. (8) Two median frontal carinae.

6\. (7) Tegmina reaching well beyond middle of abdomen. *Aloha*

7\. (6) Tegmina very short, not reaching to middle of abdomen. *Nesorestias*

8\. (5) One median frontal carina, forked or simple.

9\. (10) Head enormously elongate, longer than thorax and abdomen combined. *Dictyophorodelphax*

10\. (9) Head not elongate.

11. (12) Mesonotum with rounded disk, a depression dividing the disk from the posterior angle *Proterosydne*

12. (11) Mesonotum with flattened disk, no distinct depression dividing the disk from posterior angle. *Nesosydne*

LEIALOHA Kirkaldy.

Leialoha. Subgenus of *Aloha* Kirkaldy, 1910, Fauna Hawaiiensis II, 6, p. 579; type *naniicola* Kirk.

1. *L. naniicola* (Kirk.).

This species holds the same relationship to the typical *lehuae* as do the sub-species of *lehuae;* it will have to be included, along with *ohiae,* in a revision of the species when more material can be brought together.

The pygophor is typical of the genus and the styles are all on the same pattern, sickle-shape. The aedeagus is long, cylindrical, slightly curved and recurved; the crook at apex small, placed about 45 degrees to the stem, slightly widened at the apex, with three small spines; a small spine on right side near apex.

Figures from a specimen from Kalihi Oahu.

Pl. 2, fig. 1; Pl. 4, fig. 75.

2. *L. lehuae* (Kirk.).

This is one of the most interesting species of the genus and it appears to be the most polymorphic. At first I divided the specimens according to coloration, and then noticed that this grouping coincided with locality; an investigation of the aedeagus showed distinct structural differences, and I then decided to make them into species. There appears to be more than one species among the Oahu specimens, but a lack of time and material prevents me from making a thorough investigation, so for the present I leave the species divided into four sub-species, with the remark that *lehuae* is polymorphic and difficult to separate from *ohiae* except by the aedeagus.

(a) *lehuae* typical.

The aedeagus is small the crook at apex very small, a fair sized spine on right side near apex. This is dark brownish in color, the apical half of the hind tibiae and the hind tarsi yellowish; tegmen with infuscation over the greater portion leaving lighter hyaline spots at end of subcostal and first apical cells, in cubital and claval cells; granulations on veins fine.

Hab. Oahu; the typical specimen is from Popouwela, Oahu (Swezey, March); Kaala Mts. (Swezey, September). Female specimens from Lanai come near to this sub-species.

Pl. 2, fig. 2.

(b) *oahuensis* subsp. n.

This has the aedeagus with a long crook at apex with a small spine on right side near apex. Face, clypeus and vertex light brown, mesonotum and sides of pronotum darker reddish brown. Tegmina yellowish with fuscous markings from base to apex of clavus and then to apex of second and third apical cells; granulations on veins coarser than in *lehuae* typical.

Hab. Kalihi, Oahu (Swezey, May), typical; Niu, Oahu (Swezey, December).

Pl. 2, fig. 3.

(c) *hawaiiensis* subsp. n.

The crook at the apex of aedeagus is nearly at right angle to the body and bluntly pointed, a small blunt spine on right side near apex. Dark brown or nearly black, carinae of head and thorax lighter; tegmina hyaline with fuscous brown or black markings, these markings irregular over base, apex of clavus, middle of costal cell and over greater portion of 3–7 apical cells; veins dark with dark granules bearing black hairs.

Hab. Hawaii, Kilauea (Giffard and Muir, January); Waimea (Swezey, October).

Pl. 2, fig. 4.

(d) *kauaiensis* subsp. n.

Aedeagus with crook at apex thin and cruved, tapering to pointed apex and bearing very minute spines, a large spine on right side near apex. Dark brown; tegmina hyaline, whitish, heavily marked with fuscous brown, irregular over base to apex of clavus, in middle of costal cell and over radia, and over the greater portion of apical cells.

Hab. Waimea, Kauai (Swezey, February). A distinct variety of this from Lihue, Kauai (Swezey, March) is much lighter in color and has the markings on tegmina forming an irregular V-shape mark over middle, and a large area dark at apex. The brown of this variety is tinged with red; the aedeagus is near to *kauaiensis,* the crook not so curved and without the little spines; the granulations on tegmina hardly perceptible.

Pl. 2, fig. 5.

I regret that lack of time and material prevents me from making a more detailed study of this very interesting group, for here, I feel sure, we have species in formation. I refrain for the present from making these into species because it is highly probable that intermediate forms will turn up.

3. *L. ohiae* (Kirk.).

This is a light form of *lehuae,* the females being almost immaculate and tinged with red; the male I associate with them is slightly fuscous on tegmina over base, middle and apex of clavus and median portion of apical area. The aedeagus has the crook at apex at 45 degrees to main body and with its apex swollen; a small spine at right side before apex and a small blunt spine at apex. This latter character is found in some species of *Nesodryas.* Specimens under this name are from Oahu, Hawaii and Kauai.

Pl. 2, fig. 6.

4. *L. oceanides* (Kirk.).

I have seen only one female specimen of this species; it is distinguished by the white granulations on the veins of tegmina.

5. *L. pacifica* (Kirk.).

I have seen no specimens of this species.

NESODRYAS Kirkaldy.

Nesodryas Kirkaldy 1908 Pro. Haw. Ent. Soc. I (5), p. 201.

Nesothoe Kirkaldy, 1908, Op. C. p. 202.

The distinction of slender and robust forms is not sufficient to hold these two genera apart; at the most they can only be regarded as sub-genera.

1. *N. freycinetiae* Kirk.

Unfortunately Kirkaldy chose this extreme form as the type of the genus; both in general build and in genitalia it departs from the other species very considerably.

No spines on anal segment, anal segment long, smaller at base than apex; a large spine on each lateral edge of pygophor and two small curved ones, with bases contiguous, on medioventral edge; styles small with rounded apices slightly curved inward, broadest at base, outer edge nearly straight, inner edge slightly emarginate on apical half; aedeagus tubular, curved, with several large spines on apical half and one on right near base.

Pl. 2, fig. 16.

2. *N. giffardi* Kirk.

This is a development of the *Leialoha* group, somewhat near to *L. lehuae;* the styles are less sickle-shape, the basal portion being straighter, the aedeagus long, slender, tubular, slightly curved in middle, the crook at apex large, curved and bearing minute spines, the spine on right side below apex large; the apex is produced into a rounded knob; anal spines short, stout, laterally flattened, curved inward.

Pl. 2, fig. 7; Pl. 3, fig. 59.

3. *N. elaeocarpi* Kirk.

Styles near to those of *giffardi*, but slightly more curved, aedeagus stouter, especially toward base, crook slightly flattened and broadened at apex, spine on right large, another spine at apex curved downward.

Pl. 2, fig. 8; Pl. 3, fig. 57.

4. *N. eugeniae* Kirk.

Styles more curved than in *elaeocarpi*, especially at apex; aedeagus slender, crook large with small spines, spine on right large, a small, stout spine at apex; anal spines stout, convergingly curved but not greatly flattened laterally; pygophor somewhat diamond shape, the anal segment closely inclosed by pygophor.

Pl. 2, fig. 9; Pl. 3, fig. 60.

5. *N. dodonaeae* sp. n.

♂ Macropterous. Vertex, face, clypeus, genae, antennae and legs fuscous yellow or light brown, pro and mesonotum darker brown. Tegmina hyaline, whitish, fuscous over the posterior half from base to apex, a darker mark on hind margin near end of clavus, very fine granules on veins; wings hyaline, slightly fuscous, veins brown.

Spines on anal segment short, stout, convergingly curved; styles very near to *fletus*, but with tips slightly recurved; aedeagus with crook at an acute angle to body of aedeagus, its apex bilobed, a small spine at apex of aedeagus but none on side below apex.

Length 2.3 mm.; tegmen 3.3 mm.

♀ Similar to male.

Length 2.8 mm.; tegmen 3.6 mm.

Hab. Waimea, Kauai, feeding on *Dodonaea*. (Swezey, February.)

In general appearance this is somewhat like *dryope,* and by its more slender form would come into the *Nesodryas* subgenus.

Pl. 2, fig. 10.

6. *N. dryope* Kirk.

One male from Oahu with aedeagus missing, one from Glenwood, Hawaii (Giffard and Muir, January), which agrees in coloration, etc., with the Oahu specimen. The aedeagus of latter is figured. Anal spines short, surved; styles with nearly straight basal portion, the apex being nearly at right angles to it; aedeagus tubular, slender, curved and recurved, with two spines at apex forming a crescent. This should be compared with the aedeagus of an Oahuan specimen when possible.

Pl. 2, fig. 11; Pl. 3, fig. 62.

7. *N. fletus* (Kirk.).

Aedeagus thin, tubular, curved, making a long spiral, apex produced into a spine, a small spine on right side near apex; styles sickle-shape; anal spines short, stout, convergingly curved.

Pl. 2, fig. 12; Pl. 3, fig. 58.

8. *N. gulicki* sp. n.

Macropterous; stout form and comes into the *Nesothoe* sub-genus. ♂ Head brown, vertex, face and genae spotted with lighter brown or yellow, in middle of face three pair of spots coalesce making three small bands, clypeus darker brown; pronotum slightly darker than head with few light spots, mesonotum still darker with apex yellow, legs brown with incomplete yellowish bands, abdomen brown slightly marked with yellow. Tegmina opaquely white, an irregular fuscous band from near base of costa to near apex of clavus, and another from near the middle of this band to middle of costa, together forming an irregular V, third to last apical cells fuscous with the veins white, veins in rest of tegmina concolorous as membrane, veins bearing dark granules with black hairs; wings light fuscous with brown veins.

Genital styles near to that of *bobeae*, anal spines short, stout, broad, convergingly curved; aedeagus thin, tubular, slightly curved and recurved, crook straight, at about 45 degrees to body of aedeagus, with four small spines at apex, a small spine on right side below crook, apex forming a short, strong spine.

Length 2.6 mm.; tegmen 3.4 mm.

Hab. On *Metrosideros*, Kahuku lava flows, Kau, Hawaii, about 1800 feet elevation (Giffard and Muir, January). I honor this little insect by naming it after the Rev. J. T. Gulick, whose work on the Hawaiian land shells, and the evidence they lend to the theory of segregation in species formation, is a landmark in evolutionary literature.

Pl. 2, fig. 13.

9. *N. bobeae* (Kirk.).

Styles with apex about at right angles to basal three-fourths; aedeagus thin, tubular, a spine near apex on right side, apex forming a small knob.

Pl. 2, fig. 14; Pl. 3, fig. 61.

10. *N. maculata* sp. n.

♂ Macropterous; stout form as in sub-genus *Nesothoe*. Dark brown, the face with four small light bands, a few small light spots on lateral carinae, extreme apex also light, some light dots on outer carinae of pronotum; tibiae and tarsi banded. Tegmina hyaline, slightly whitish, posterior half of apical cells mostly fuscous, an irregular spotting with fuscous over the rest of the tegmina, a dark mark on hind margin near end of clavus, veins with large fuscous granules; wings light fuscous with darker veins.

Pygophor near to *bobeae* but the aedeagus somewhat flattened at apex, the spine on right side near apex large, curved and slightly flattened; styles very much as in *bobeae*.

Length 2.2 mm.; tegmen 2.8 mm.

♀ Similar to male.

Length 2.7 mm.; tegmen 3.0 mm.

Hab. On *Metrosideros* (?), Kahuku lava flows, Kau, Hawaii, elevation 1800 feet. (Giffard and Muir, January.)

Pl. 2, fig. 15.

11–12.

I have only seen females of *N. frigidula* and *N. perkinsi.*

13–18.

The following six species of the subgenus *Nesothoë* I have seen no specimens of: *hula, laka, pulani, terryi, pluvialis, silvestris.*

ALOHA Kirkaldy.

Aloha Kirkaldy, 1904, Entomologist, XXXVII, p. 177.
Nesopleias (in part) Kirkaldy, 1910, Fauna Hawaiiensis, II, 6, p. 582.

1. *A. ipomoeae* Kirk.

In size and coloration there is a fair amount of variation, specimens from Kahului, Maui, being very small, yellow and almost immaculate. The aedeagus of specimens from Hawaii, Oahu and Maui are practically identical and there is very little variation in the genital styles. All the macropterous specimens I have seen are females. The genital styles of this species are typical of a large group and are here seen in a simple condition. In flat view they look like a pair of short, thick legs with the heels turned inward. One of the chief modifications on this is for an elevation to arise near the inner edge a little below the apex, about where the ankle bone should be. For the sake of brevity and clearness I shall call this elevation the "ankle knob," the inner apical corner the "heel" and the outer apical corner the "toe."

The aedeagus is tubular, slightly flattened laterally, a row of spines at apex on dorsal side continuing a short distance on to right side, a short row on ventral side at apex.

Lanai, Maunalei (Giffard, February); Maui, Kahului (Swezey, August, on *Scaevola coriacea).*

Pl. 2, fig. 17.

2. *A. myoporicola* Kirk.

The genital styles in this species have a distinct ankle; the toe is short and pointed and the heel is pointed. The aedeagus is shorter and flatter than in *ipomoeae* and the spines different. Spines on anal segment medium size, straight. A series of female specimens from Lanai (Giffard, October) have the granulations on tegmina larger.*

Pl. 2, fig. 18.

3. *A. plectranthi* sp. n.

♂ Tegmina not reaching quite to the apex of abdomen. Head brown; vertex, apical portion of face and the clypeus darker between carinae; antennae yellowish; pro and mesonotum dark brown to nearly black; legs light yellow; coxae fuscous; abdomen brown, lighter at base and on hind margin of each segment. Tegmina light yellow, veins concolorous without granules or hairs, a dark mark at end of clavus and end of costal cell spreading inwards; apical margin and apical veins lighter.

Pygophor very similar to *ipomoeae;* anal spines short, broad at base, laterally compressed; styles near to *ipomoeae* but with toe shorter and blunter; aedeagus distinct.

Length 2 mm.; tegmen 1.3 mm.

♀ Lighter than male; in immature specimens all light yellow

Length 2.6 mm.; tegmen 1.9 mm.

Hab. Koko Crater, Oahu, on *Plectranthus* (Swezey, March; Osborn, April).

At the time Mr. Swezey was at Koko Crater he could find no signs of Delphacids on this plant, but from some specimens of *Plectranthus* which he brought back with him nymphs hatched out in Honolulu. Some two weeks later Mr. Osborn

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*NOTE:—There is a second type of genitalia in which the anal spines are longer and nearer together and the aedeagus longer, more slender and the spines somewhat differently arranged. At present I cannot consider it a distinct species.

visited the same spot and searched in vain for these insects, but from plants he brought back numbers of nymphs hatched. No parasites hatched from these eggs. The absence of nymphs or adults from these plants while the eggs were present in such numbers is curious, and would indicate that some enemy made away with them upon their hatching. Ants *(Pheidole megacephala)* were abundant all over the food plant and are the only enemy we can attribute the absence of nymphs and adults to. A large series of adults was obtained by rearing the nymphs which hatched from eggs in the plants collected.

Pl. 2, fig. 19.

4. *A. kirkaldyi* sp. n.

♂ Tegmina reaching just to the end of abdomen. Near to *A. ipomoeae* but with face broader, with carinae and lateral edges more arcuate. Pronotum, vertex, face and clypeus yellowish, fuscous on pronotum between carinae and on outer edges; mesonotum dark brown; legs yellowish, with indistinct fuscous longitudinal mark on femora, abdomen yellow with brown spots, mostly on sides. Tegmina hyaline, with indistinct fuscous mark across middle, darker and narrower on hind margin at apex of clavus, wider but more indistinct on costa; three or four small brown dots on apical margin; veins whitish on basal and apical portions.

The genitalia differ considerably from *A. ipomoeae*, the spines on anal segment being longer and thinner, the styles flattish and curving to a point at apex; the aedeagus also differs.

Length 2.2 mm.; tegmen 1.6 mm.

♀ The female I associate with this is light brown with slight infuscation on abdomen; the infuscation on tegmina much more indistinct.

Length 2.7 mm.; tegmen 2.0 mm.

Hab. Punaluu, Oahu (Swezey, June).

I name this species after Mr. G. W. Kirkaldy, to whom we are indebted for so much of our knowledge of Hawaiian Delphacidae.

Pl. 2, fig. 20; Pl. 3, fig. 63.

5. *A. swezeyi* sp. n.

♂ In structure this agrees with *artemisiae* except in genitalia. Vertex, face and clypeus brown, darker along outer edges of carinae, surface slightly granulated, antennae yellowish; pro and mesonotum brown, latter darker than former, legs lighter brown, abdomen brown with yellowish pleura, anal segment yellowish. Tegmina reaching nearly to end of abdomen, all apical cells present; hyaline, yellowish, veins yellowish, a fuscous spot at apex of costal cell, another at apex of clavus, spreading out along cubitus. Pygophor deeper than broad, no spine on ventral edge, emargination on dorsal margin only half surrounding anal segment, a pair of large, inwardly pointing spines on anal segment in a medio-lateral position; styles longer than broad, apex broad and slightly excavate, inner angles slightly drawn out, outer edge curved inwards toward base, inner edge slightly excavate along apical two-thirds, where it is slightly elevated along border; apical portion of aedeagus laterally flattened and pointed.

Length 2 mm.; tegmen 1.5 mm.

Hab. Palolo, Oahu (Swezey, December).

I can place no female with this species at present.

Pl. 2, fig. 21.

6. *A. wailupensis* sp. n.

♂ The median carinae of face converging apically, where they are obscure. Vertex, face, clypeus and antennae light brown, darker between carinae; pro and mesonotum light brown, carinae and posterior edge of pronotum darker, legs lighter brown, posterior femora darker, abdomen dark brown, base light. Tegmina reaching to end of abdomen, semi-opaque, yellowish, slightly fuscous at base, fuscous at end of costal cell and at apex of clavus, veins fuscous except at apex where they are yellowish, a few hair-bearing black granules along veins.

Pygophor oval, no spines on ventral margin, emargination of dorsal edge deep, more than half surrounding the anal segment; no spines on anal segment; styles long, narrow, widest at base and at apex where the angles are produced; aedeagus tubular, curved, with a few small spines at apex on dorsal side, behind which it is slightly excavate.

Length 2.5 mm.; tegmen 1.8 mm.

♀ In the female I associate with this species the abdomen is lighter and the femora darker, the tegmina are less fuscous and the veins have no granules; the median carinae of face are more distinct.

Length 3.2 mm.; tegmen 2.2 mm.

Hab. Wailupe, Oahu. (Swezey, January.)

Pl. 2, fig. 22.

7. *A. flavocollaris* sp. n.

♂ Tegmen reaching to end of abdomen. Vertex dark brown, lighter at base; face dark brown, lighter at apex; clypeus dark brown, lighter at base and a little on median carina; antennae yellow, pronotum yellow, mesonotum dark brown, legs yellow with brown femora; abdomen yellow with fuscous markings. Tegmen fuscous yellow, darkest toward apex of clavus.

Pygophor but little deeper than wide, anal segment sunk well into pygophor, spines on anal segment large, simple, inwardly turned and diverging; styles very much like those of *artemisiae* but narrower at apex and not so twisted; the aedeagus different.

Length 2.5 mm.; tegmen 1.8 mm.

Hab. Kaala Mountains, Oahu. (Swezey, September.)

In this species we have the aedeagus flattened laterally, a condition found in the following four species.

Pl. 2, fig. 23.

8. *A. dubautiae* (Kirk.).

Nesopleias dubautiae Kirkaldy, 1910, Fauna Hawaiiensis, II, (6) p. 583.

This is described by Kirkaldy as being a very variable species, but in the long series I have examined this is not very evident. In the male the dark band across the tegmen is narrow on the hind margin and broad on the anterior margin, the costa being yellow; this leaves a subquadrate yellow mark over the basal portion of the clavus when tegmina are at rest; the female almost immaculate or with a fuscous spot near end of clavus on hind margin. The spines on the anal segment strong, wide apart, curved inward; the aedeagus differs from that of *artemisiae*, but the genital styles are difficult to separate.

Hab. Lanihula, Oahu (Swezey, October); Pacific Heights, Oahu (Swezey, May); Palolo, Oahu (Swezey, December); Olympus, Oahu (Swezey, January).

Pl. 2, fig. 26.

9. *A. artemisiae* (Kirk.).

Nesopleias artemisiae Kirkaldy, 1910, Proc. Haw. Ent. Soc., II, (3) p. 118.

The male of this species can be recognized from *dubautiae* by the dark marking on the tegmina extending to the apex and the subquadrate light mark at apex of clavus not noticeable. The spines on the anal segment are near together and the aedeagus recognizable. One male specimen from Kaala Mountains has the tegmina uniformly dark fuscous brown.

Pl. 2, fig. 27.

10. *A. campylothecae* sp. n.

♂ Tegmen reaching to near end of abdomen. Light yellow; tegmina yellow with median third occupied with black band, indistinct on costal margin, the edges of the band uneven; last joint of tarsi fuscous.

Pygophor deeper than broad, ventral edge produced into minute lip, dorsal edge subangularly excavate with anal segment well enveloped; spines on anal segment curved inward; styles intermediate between *artemisiae* and *swezeyi;* the aedeagus with a distinct barb at apex and an angular projection on ventral edge about middle.

Length 2.2 mm.; tegmen 1.4 mm.

♀ Yellow; tips of tarsi fuscous; tegmina immaculate or with slight fuscous mark on hind margin about middle.

Length 2.8 mm.; tegmen 1.8 mm.

Hab. Wailupe, Oahu, on *Campylotheca.* (Swezey, January.)

Pl. 2, fig. 25; Pl. 4, fig. 64.

11. *A. kaalensis* sp. n.

♂ Tegmina reaching nearly to end of abdomen. Yellow, abdomen slightly fuscous, tip of last tarsal joint black; tegmina yellowish with black band, the band extending from a little before the middle to near the apex. One specimen much darker all over and the dark band more extensive.

Pygophor little deeper than wide, dorsal edge subangularly emarginate, anal segment sunk below edges of emargination, spines on anal segment pointing inward, short, stout, with a distinct tooth; styles near to *campylothecae* but little narrower on basal half, the outer apical corner more pointed, the knob on inner edge little more prominent; aedeagus near that of *campylothecae* but without the barb at apex and with a small spine near orifice of ejaculatory duct.

Length 2.2 mm.; tegmen 1.7 mm.

♀ The females I associate with the above are uniformly light brown or fuscous yellow, the abdomen slightly fuscous.

Length 2.9 mm.; tegmen 1.8 mm.

Hab. Kaala Mountains, Oahu. (Swezey, September.)

Pl. 2, fig. 24.

NESORESTIAS Kirkaldy.

Nesorestias Kirkaldy, 1908, Proc. Haw. Ent. Soc., I, (5) p. 201.

Nesopleias (in part) Kirkaldy, 1910, Fauna Haw., II, (6) p. 582.

1. *N. filicicola* Kirk.

This differs from the species of *Aloha* by the very short tegmina of a coriaceous texture and with reticulated surface. Anal spines short, thick, straight, bases contiguous, diverging; styles on the plan of *A. ipomoeae;* aedeagus flattened laterally, a cock's comb of three spines on dorso-apical area and a single one on ventral area near apex, a large one on left side near apex. I should consider this as a development of the *ipomoeae* group.

Pl. 2, fig. 28; Pl. 4, fig. 76.

2. *N. nimbata* (Kirk.).

Nesopleias nimbata Kirkaldy, 1910, l. c.

This has the same short tegmina as *filicicola* but not so coriaceous or with such distinctly reticulated surface. Anal spines very long and thin, slightly diverging towards apices; styles somewhat like those of *A. kirkaldyi* but shallowly emarginate on outer edge; aedeagus laterally flattened, three small spines on dorso-apical area, a large blunt one on dorso-apical area, four or five on ventro-apical area and a large one on ventro-basal area, a large spine on right side toward apex.*

Whilst these two species are congeneric, the question arises whether they are homophyletic, or if one has branched from the *ipomoeae* group and the other from the *kirkaldyi* group.

Pl. 2, fig. 29; Pl. 4, fig. 77.

DICTYOPHORODELPHAX Swezey.

Dictyophorodelphax Swezey, 1907, Proc. Haw. Ent. Soc., I, (3) p. 104.

1. *D. mirabilis* (Swezey).

By the single frontal carina this species should come near one of the *Nesosydne* group, but the aedeagus has greater affinity to *Nesorestias filicicola,* so that there is the possibility of the single carina being of independent origin.

Anal segment sunk well into pygophor, anal spines very minute; pygophor very shallow; styles broad at base, curved, with long spine at apex nearly at right angle to broad basal portion; aedeagus flattened laterally, deep for basal two-thirds, a "cock's comb" of five spines on dorso-apical area and some five or six small spines on left side near apex.

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*In specimens taken by Mr. Timberlake off *Phegopteris* the spine on right side of aedeagus is not so large and the ventral spine thinner.

NESOSYDNE Kirkaldy.

Nesosydne Kirkaldy, 1907, Proc. Haw. Ent. Soc., I, (4) p. 161.

Type *koae.*

1. *N. koae* Kirk.

This species is at present known from Oahu and Hawaii; female specimens from Waimea, Kauai (Swezey, February) may be the same, but the fact that the species attached to the phyllodia of koa in that island is distinct from that on Oahu or Hawaii makes it probable that the green species is also distinct.

Both the nymphs and adults are of the same bright green as the young leaves of *Acacia koa* on which they feed; a few stray specimens are occasionally taken from the phyllodia.

The type locality of this species is Tantalus. In specimens from this locality the anal spines are fairly long and slender, the aedeagus slightly compressed, slightly curved in profile especially along the ventral edge and towards the base, being broadest in the middle; a row of strong spines curves from an apical-dorsal point across the right side to a ventro-basal point, on the left side a less well defined row of spines runs from apex to near base near to the ventral edge.

Specimens from Kilauea, Hawaii, are characterized by being darker, especially on the mesonotum; the aedeagus is not so greatly curved on the ventral edge and the anal spines are shorter and thicker.

Fig. 32. This figure is not so broad in the middle or so strongly curved on ventral edge as it should be.

2. *N. rubescens* Kirk.

Nesosydne koae var. *rubescens* Kirkaldy, 1907, Proc. Haw. Ent. Soc., I, p. 161; 1908, t. c., p. 202; 1910, Fauna Haw., II, (6) p. 584.

This I consider to be a distinct species from *koae* and treat it accordingly. It is attached to the phyllodia of *Acacia koa* and is colored in accordance with its habitat both in the nymphal and adult stages; a few stray specimens are occasionally found on the young leaves.

The type locality is Tantalus, Oahu, where the average color is a light reddish brown with lighter carinae. The anal spines long and thin; aedeagus straight to near base, the apical opening on the right side, a dorsal row of strong spines runs from apex to near base, a small irregular group of spines occupy a medio-ventral position on right side and a few spines near apex on the left side extending in an imperfect line to near middle; the number of spines on the sides are variable. Figure 30.

pulla var. n. The Kilauea, Hawaii, specimens are darker in color, especially the mesonotum of the males, which is sometimes nearly black, the anal spines stouter and shorter, the dorsal row of spines on the aedeagus is represented by a few irregular spines, the spines on the left side form a more complete row along the ventral surface. It is distinct and constant enough for a varietal name.

3. *N. pseudorubescens* sp. n.

♂ Macropterous. Light brown, lighter over frons and on carinae, abdomen dark brown or nearly black. Tegmina hyaline, veins dark brown with small granules of same color bearing black hairs, yellowish over basal portion of costal, radial and median basal cells and over clavus, apical portion of clavus and over hind margin to apex fuscous. Anal spines long and straight; styles short and broad, of the same type as *Aloha ipomoeae;* aedeagus very similar to that of *N. anceps*, but the line of spines on dorsum not turning on to right side and the spines on ventral side not so distinct and forming two or three uneven rows or a cluster (not shown in figure).

Length 2.8 mm.; tegmen 3.2 mm.

♀ Lighter in color, especially on the abdomen, and inclining to greenish.

Length 3 mm.; tegmen 3.5 mm.

Hab. On the phyllodia of *Acacia koa;* at present only known from the small koa reservation at "29 Miles," Olaa, Hawaii. (Giffard and Muir, January, 1915; Giffard, 1916, January.)

In coloration this species is very similar to *rubescens,* but the fuscous hind margin from clavus to apex is very distinctive and the short, broad styles make the male easy to recognize; the genitalia come nearer to *anceps,* which is very differently colored, is brachypterous and is only known from Glenwood where there is no koa.

Pl. 2, fig. 34.

4. *N. koae-phyllodii* sp. n.

♂ Macropterous. Brown, a few light dots on face, abdomen with fuscous markings. Tegmina hyaline, yellowish, veins concolorous with membrane with distinct brown granulations.

Pygophor and styles as in *koae;* anal spines long, thin, touching at base and a little beyond, then diverging and pointing basally; aedeagus with a row of spines on ventral side, another on dorsal near apex, continuing across right side to a ventral point beyond middle, on the left side a row of spines from near apex to near base along a ventro-median line.

Length 2.2 mm.; tegmen 3 mm.

♀ Macropterous. Infuscation on abdomen less extensive, ovipositor darker than body.

Length 3.3 mm.; tegmen 3.5 mm.

Hab. On the phyllodia of *A. koa*, Waimea, Kauai. (Swezey, February.)

A specimen from Waianae, Oahu (Fullaway), I place here provisionally; in it the anal spines are long, straight and wider apart at base, the aedeagus stands between *koae* and *koae-phyllodii*.

Pl. 2, fig. 31.

5. *N. swezeyi* sp. n.

♂ Antennae reaching to apex of clypeus, first joint more than half the length of second; furcation of frontal carina at extreme base. Tegmina not reaching quite to end of abdomen. Head light brown or yellow, slightly fuscous between carinae; pro and mesonotum dark chocolate brown, the same color extending on to the coxae of first and second legs, rest of legs light brown, hind legs slightly fuscous; abdomen brown with base, middle line on dorsum and slight specks on pleura lighter. Tegmina hyaline, very pale brown, a dark brown mark on hind margin at end of clavus, fading off into the surrounding membrane, base of tegmina slightly darker, veins concolorous as membrane, with very minute granules.

External genitalia figured. Aedeagus with a row of spines from a dorso-apical point across the right side to a ventro-median point; a small bunch of spines in a ventro-apical position extending in a row along a ventro-lateral line to past middle on left side.

Length 2.5 mm.; tegmen 1.9 mm.

Hab. Mount Olympus, Oahu (Swezey, November).

Described from a single male specimen.

Pl. 2, fig. 33; Pl. 4, fig. 68.

6. *N. anceps* sp. n.

♂ Brachypterous, tegmina reaching almost to end of abdomen. Frontal carina simple; antennae reaching beyond base of clypeus, first joint distinctly more than half the length of second.

Head light yellow, dark brown between carinae on face and on genae, and slightly on clypeus; pro and mesonotum shiny dark brown, pleura and first and second coxae brown; legs yellowish, hind femora fuscous; abdomen brown, yellowish at base and on pleura. Tegmina hyaline, slightly yellowish, a fuscous mark from base of costa across to apex of cubitus, darkening and spreading out more at latter point, a dark mark at apex of costal cell, basal edge of clavus dark, veins concolorous as membrane, very fine granules bearing black hairs.

The genital styles are between the type of *koae* and *blackburni*, —the "ankle" forming a ridge running from inner apical corner to near base; anal spines large, curved; aedeagus slightly flattened, widest on apical half, a row of spines along dorsum to past middle where it turns across the right side, another row along ventral side.

Length 2.5 mm.; tegmen 1.9 mm.

Hab. Glenwood, Hawaii. (Giffard and Muir, January.)

Pl. 2, fig. 34.

7. *N. pele* Kirk.

One specimen from Kilauea, Hawaii (Giffard and Muir, January), which I refer to this species and figure external genitalia. The aedeagus on the type of *koae*, a few spines along the ventro-apical area and a few on dorsal continuing on right side. The styles are shorter and broader with the apices squarer than in *koae*, and the "ankle knob" forming a small pyramid.

Antennae only reaching a little beyond base of clypeus, first joint slightly less than half the length of second. Macropterous.

Pl. 2, fig. 36; Pl. 4, fig. 78.

8. *N. oahuensis* sp. n.

♂ Frontal carina simple; antennae reaching beyond base of clypeus, first segment more than half the length of second; brachypterous, tegmina reaching about one-fourth from apex. Head and antennae yellowish, blackish between carinae of face and clypeus and on genae in front of antennae; pro and mesonotum brownish, carinae yellowish, extending more or less into disk; abdomen dark brown, yellowish at base and down middle of dorsum and on pleura; tegmina yellowish with brown mark at end of costal cell, and a plainer one at end of clavus, veins concolorous as membrane with small black hairs.

Shape of pygophor very much like *nephrolepidis;* anal spines long, curved back upon themselves about middle; styles and aedeagus figured.

Length 3.1 mm.; tegmen 1.7 mm.

Hab. Tantalus, Oahu (Giffard, January).

Pl. 2, fig. 37.

9. *N. cyrtandrae* sp. n.

Frontal carina simple; antennae reaching beyond middle of clypeus, first joint considerably more than half the length of second; brachypterous, tegmina reaching to base of pygophor.

Stramineous; head, especially between carinae, fuscous. Tegmina hyaline, stramineous, veins fuscous with minute granules with small black hairs, a small dark mark at end of costal cell and a larger one at apex of clavus.

Genital styles more complex, but aedeagus on same plan as *koae*.

Length 2.1 mm.; tegmen 1.4 mm.

Hab. Nahiku, Maui, off *Cyrtandra* (Swezey, September).

Pl. 3, fig. 38; Pl. 4, figs. 67, 69.

10. *N. gouldiae* Kirk.

Antennae reaching to apex of clypeus, first segment more than half the length of second. No spines on anal segment, ventral apical edge lipped and turned down; styles widest at base, apical half narrow, inner apical corner slightly produced; aedeagus on the type of *koae*, but membranous on ventro-apical area.

Pl. 3, fig. 39; Pl. 4, fig. 72.

11. *N. nephrolepidis* Kirk.

The only male I have seen, and from which my figures are made, is a specimen from Ookala, Hawaii, and may prove to be a different species from the typical Oahu specimens. Kirkaldy's figure shows the styles foreshortened and therefore difficult to recognize.

Anal spines large, laterally flattened, tapering to a fine point, parallel to near tip where they slightly diverge; aedeagus with circle of spines near apex. Antennae reaching to near apex of clypeus, first segment more than half the length of second.

Pl. 3, fig. 40; Pl. 4, fig. 79.

12. *N. blackburni* sp. n.

♂ Brachypterous, tegmina reaching about to apex of abdomen. Antennae reaching nearly to apex of clypeus, first segment more than half the length of second; frontal carinae simple. Carinae of head, antennae, sides of genae below antennae and sides of clypeus yellowish brown, between carinae of vertex, frons and clypeus and genae in front of antennae dark brown; pro and mesonotum and coxae of front and middle legs dark chocolate brown, rest of thorax yellowish, legs light brown with faint longitudinal fuscous mark along femora and a faint band toward apex of tibiae, tarsal joints fuscous; abdomen dark brown, yellowish at base. Tegmina hyaline, yellowish, a dark brown mark at end of clavus and another at end of costal cell spreading across disk and forming a band, lightest in middle, veins concolorous as membrane with very minute granules or with none, base of claval margin dark.

The "ankle knob" of styles developed to a slightly curved blunt point; spines on anal segment medium size, flattened laterally, sharply pointed; aedeagus sharply bent near apex, a semicircle of spines running from dorsal point near apex, across right side to a ventro-apical point.

Length 2.8 mm.; tegmen 2 mm.

♀ Brachypterous, tegmina not reaching apex of abdomen. In general color lighter than male.

Length 2.9 mm.; tegmen 2.3 mm.

Hab. Hawaii on Mamaki *(Pipturus albidus*)*; Olaa (Perkins, November, No. 635); Kilauea (Giffard, July; Giffard and Muir, January); Waimea (Swezey, October).

This is the most common Delphacid around Kilauea in January; it does not agree with any published description. It varies in color to very light forms in which the carinae of pro and mesonotum are light, and even all the head and thorax without dark markings; the markings on tegmina are sometimes reduced to a small spot at end of clavus and another at end of costal cell, but the dark color on veins does not always fade with that in cells; in some cases the infuscation extends to near base and apex along veins. It is possible that this is *umbratica* Kirkaldy, but the description is useless for identification.

Pl. 2, fig. 41; Pl. 4, figs. 70, a–b.

13. *N. perkinsi* sp. n.

♂ Brachypterous, tegmina reaching to near apex of abdomen; antennae reaching beyond middle of clypeus, first segment more than half the length of second; furcation of frontal carina about middle of frons.

Head dark brown, antennae and carinae light brown; pronotum dark between carinae, which are light, the lateral portions lighter than middle; mesonotum dark brown; abdomen dark brown, lighter at base, on pleura and a mark down middle of dorsum; pleura of thorax and front and middle coxae dark, rest of legs light brown or

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*Mr. Giffard has taken this off of *Stenogyne* and *Clermontia*. There is also a long-winged form which is somewhat darker than the short-winged ones, the tegmina light brownish with darker veins.

yellow. Tegmina hyaline, faintly brown, a dark brown mark at apex of clavus and a very faint one at end of costal cell; margins of tegmina, except at end of clavus, light yellow, veins concolorous as membrane, apical veins slightly lighter, no granulations.

The aedeagus is bent much more than in the preceding species, a ring of spines toward apex, formed of some eight or nine spines on right side and four on left side.

Length 2.6 mm.; tegmen 1.8 mm.

Hab. Haleakala, Maui, 5000 feet elevation.

From one male specimen (No. 636) of Dr. R. C. L. Perkins, October, 1896.

Pl. 2, fig. 42; Pl. 4, fig. 73.

14. *N. wailupensis* sp. n.

♂ Brachypterous, tegmina not reaching quite to end of abdomen. Antennae reaching to near apex of clypeus, first joint considerably more than half the length of second, furcation of frontal carina about a third from base. Head fuscous or black between carinae, antennae and carinae light brown or yellowish, thorax brown or fuscous brown with light carinae, legs fuscous brown, front tibiae with darker band at apex; abdomen dark brown, light at base and a small line down dorsum. Tegmina light brown, margins whitish, except at apex of costal cell and apex of clavus where it is brown, this brown extending into membrane; veins fuscous except apical veins which are light, no granules, a few black hairs along apical margin and a few on nerves.

Pygophor very distinct, lateral edges angular, anal segment with large stout spines, wide apart and slightly diverging, ventro-apical edge lipped; styles long and narrow; aedeagus tubular, slightly curved, a small group of spines on ventro-apical point and a few on left side near apex, four or five along middle on dorsal side, four or five in a corresponding ventral position and a few along the right side.

Length 3.3 mm.; tegmen 2.3 mm.

♀ Brachypterous, tegmina not quite reaching apex of abdomen.

Length 3.7 mm.; tegmen 2.5 mm.

Hab. Wailupe, Oahu (Swezey, January). Some specimens (immature?) are nearly all yellowish, the tegmina with only the dark mark at apex of clavus and apex of costal cell.

Pl. 3, fig. 43; Pl. 4, fig. 66.

15. *N. pipturi* Kirk.

Anal spines long, thin, pointed, nearly straight, slightly diverging apically; aedeagus small, tubular, slightly curved and pointed apically. There appears to be some variation in the spines on aedeagus; in some they are absent, in others irregular around middle or arranged in more or less of a line. These variations appear to follow localities, but want of time and material prevent me from following up the question.

Pl. 3, fig. 45.

16. *N. chambersi* Kirk.

Antennae not reaching to middle of clypeus, first segment less than half the length of second. Aedeagus long, cylindrical, slightly curved and recurved, with a short, broad spine at apex on dorsal side and a few on ventral side on apical half. Feeding on *Raillardia*, Kilauea, Hawaii (Giffard and Muir, January).

Pl. 3, fig. 44.

17. *N. osborni* sp. n.

This is a light colored form, very near *chambersi*. The genital styles are narrower and the apical corners more produced and sharper, especially the outer one; aedeagus is very different. In the figured specimen, the only male I possess, it is possible that the apical portion is broken, but the base is so different from *chambersi* that I have no hesitation in giving it a specific status.

Hab. Crater of Haleakala, Maui; taken from among dead leaves round the roots of *Raillardia*, on which it probably feeds. (Osborn, January.)

Pl. 3, fig. 46.

18. *N. cyathodis* Kirk.

Antennae very short, first segment less than half the length of second. Very minute spines on anal segment; styles near to *chambersi* but narrower at apex and rounder on outer, basal edge; aedeagus small, tubular, curved, without spines.

Pl. 3, fig. 48.

19. *N. fullawayi* sp. n.

♂ Brachypterous, tegmina reaching about one-third from apex of abdomen. Antennae not reaching beyond base of clypeus, first joint less than half the length of second; frontal carina simple. Light brown; carinae of head lighter, with a few lighter spots between carinae of face; thorax slightly darker than head; legs light, longitudinally marked with fuscous; abdomen marked with darker spots. Tegmina uniformly light brown. Genital organs practically the same as *cyathodis*.

Length 1.7 mm.; tegmen 1 mm.

♀ Similar to male, but abdomen not mottled with darker spots.

Length 2 mm.; tegmen 1 mm.

Hab. Kamoku, Molokai (Fullaway, July). Also specimens of females from Iao Valley, Maui (Swezey, August), which I cannot separate from the Molokai, and two female specimens from Haleakala Crater, Maui (Osborn, January; Fullaway, July), which only differ in being darker.

20. *N. incommoda* sp. n.

♂ Frontal carina simple; antennae reaching a little beyond the base of clypeus, first segment slightly less than half the length of second; tegmina reaching nearly to end of abdomen. Light brown or yellowish, slightly darker between carinae, abdomen slightly darker. Tegmina yellowish, veins slightly darker with minute granules. Anal spines short, stout, wide apart; styles approaching *cyathodis*, but "heel" pointed and "toe" rounded, "ankle knob" slight; aedeagus long, tubular, swollen at base, curved downward, four spines along right side and a few on left, a few minute spines near apex.

Length 2.5 mm.; tegmen 1.6 mm.

♀ The female I place with this male was taken at the same time. The abdomen is not quite so dark and the infuscation between carinae not so plain. In one specimen there is a slight fuscous spot at end of clavus.

Length 3.2 mm.; tegmen 2 mm.
Hab. Kaumuohona, Oahu. (Muir.)

Pl. 3, fig. 47.

21. *N. leahi* (Kirk.).

Megamelus leahi Kirkaldy, 1904, Entomologist, 176.

Nesosydne leahi Kirkaldy, 1908, Proc. Haw. Ent. Soc., 202.

The shape of pygophor and styles as in *raillardiae*, anal spines stout, medium length, slightly converging; aedeagus with row of spines on right side from a dorso-apical point to a point a little beyond middle near ventral side, a short row along the ventro-apical line and three small spines near apex on left side.

This description is taken from specimens from Waimea, Kauai (Swezey, February) feeding on *Lipochaeta*. I have seen no males from Oahu, so this may be a distinct species.

Pl. 3, fig. 49.

22. *N. raillardiae* Kirk.

Antennae very short, first segment less than half the length of second; aedeagus very short, flattened, deep at base, a small row of spines on ventral side near apex, another on dorsal slightly on right side, none on left side.

Pl. 3, fig. 50.

23. *N. ipomoeicola* Kirk.

Antennae reaching beyond middle of clypeus, first segment more than half the length of second. Aedeagus tubular, flattened on dorsal surface at apex, a stout spine on each side of the flattened area; anal spines short, stout, wide apart and pointing backward.

Kirkaldy's figure of the styles in this species is not very clear. This species is widely distributed in the archipelago and appears to have several distinct subspecies or varieties which only more material will fully elucidate. In one form there are three spines around the apex on the ventral side (Kilauea, Hawaii, Giffard and Muir, January); in another very distinct form the flattened surface is practically absent and the two large spines are quite close to the apex (Kilauea, Hawaii, Giffard and Muir, January). This last variety is distinct enough to be given a specific name.

Pl. 3, figs. 51 a–c.

24. *N. halia* Kirk.

Antennae reaching nearly to apex of clypeus, first segment more than half the length of second. The aedeagus appears to be an extreme development of *ipomoeicola*, the dorsal, flattened portion becoming membranous; on the right edge of this membranous surface there are three spines, the basal one large and bifurcate, the left having only one feebly furcate spine.

Pl. 3, fig. 52.

25. *N. giffardi* sp. n.

♂ Frontal carina forking a little beyond middle; antennae reaching nearly to middle of clypeus, first joint more than half the length of the second; tegmina reaching about middle of abdomen. Brown, face and clypeus darker between carinae; posterior edge of abdominal segments darker. Tegmina light brown, a small dark mark at apex of clavus, veins concolorous as membrane, very minute granules with black hairs. No spines on anal segment, ventral edge lipped; styles long and narrow; aedeagus large, laterally flattened, base very deep, apex deep, two spines on dorsal surface about middle and a series of large spines around the rim of the dorsal portion of apex.

Length 2.7 mm.; tegmina 1.5 mm.

♀ One specimen which agrees in structure and color I place with this male.

Length 3 mm.; tegmina 1.15 mm.

Hab. Tantalus, Oahu (Giffard, March); ♀ Pacific Heights, Oahu (Swezey, March).

Pl. 3, fig. 54; Pl. 4, fig. 74.

26. *N. montis-tantalus* sp. n.

♂ Frontal carina forking at extreme base; antennae reaching to middle of clypeus, first joint considerably more than half the length of second; tegmina reaching about one-fourth from end of abdomen. Light brown, fuscous between carinae on face and clypeus, abdomen dark brown, base, median line and some medio-lateral spots on dorsum lighter. Tegmina light brown, with a darker mark from base of costa to apex of clavus a small dark mark at apex of costal cell, veins concolorous as membrane with a few fine black hairs. Shape of pygophor much like that of *giffardi;* apex of anal segment slightly emarginate, each corner produced into a short, broad, blunt point; no anal spines; styles long, thin, tapering to a point; aedeagus on plan of *giffardi* with three spines on medio-dorsal position and two on ventral side near base, two small spines at apex on dorsal side and four on right side.

Length 2.3 mm.; tegmen 1.5 mm.

♀ Similar to male, but lighter, the fuscous mark across tegmen very faint.

Length 2.5 mm.; tegmen 1.4 mm.

Hab. Mount Tantalus, Oahu (Giffard, November).

Pl. 3, fig. 55.

27. *N. sharpi* sp. n.

♂ Brachypterous, tegmina reaching nearly to end of abdomen; antennae reaching nearly to apex of clypeus, first joint considerably longer than half the second; furcation of frontal carina at extreme base.

In coloration this species is very like *wailupensis;* legs are a little more fuscous, especially the hind tarsi. In shape the aedeagus is near *wailupensis;* the anal segment is truncate at apex with a large curved spine from each corner; styles long, thin, with apices truncate and slightly expanding; the aedeagus on a plan somewhat like *giffardi* or *halia*, flattened laterally, the apex ventrally drawn out into a long point, and dorsally on right side produced into a bifurcate prong with a small short spine below; on right side there are four spines in a small curved row; the dorsal surface, except the basal fourth, is membranous.

Length 2.9 mm.; tegmen 2.2 mm.

♀ In structure the same as male; in coloration difficult to separate from *wailupensis.*

Length 3.7 mm.; tegmen 2.3 mm.

Hab. Oahu, Punaluu (Swezey, June, September); Kaumuohona (Muir).

This species is named after Dr. David Sharp, whose work on the "Fauna Hawaiiensis" has placed all Hawaiian entomologists under a debt of gratitude.

Pl. 3, figs. 53 a–b; Pl. 4, fig. 65.

28. *N. rocki* sp. n.

♂ Brachypterous, tegmina not quite reaching apex of abdomen; frontal carina forking about one-third from apex; antennae reaching beyond base of clypeus, first joint more than half the length of second.

Brown, basal half of clypeus lighter than apical portion, carinae of head light brown or yellowish, pro and mesonotum light brown, carinae and lateral portions of pronotum fuscous, pro and mesopleura dark extending on to coxae, a round mark on metapleura; abdomen brown, base and mark down dorsum lighter, legs light brown, tegmina light brown or yellowish, a dark mark at end of costal cell and end of clavus, basal portion of claval margin dark, veins fuscous with minute granules bearing black hairs.

Pygophor ovate; anal segment short, without spines; styles in lateral view bent nearly at right angle a little above middle, narrow, truncate at apex; aedeagus forming a boat-shaped trough, the left edge higher than right with five spines near apex and two about middle, right edge without spines, a series of spines forming irregular rows across ventral surface.

Length 3 mm.; tegmen 2 mm.

♀ Slightly lighter in color than male.

Length 3.3 mm.; tegmen 2.1 mm.

Hab. Konahuanui, Oahu (Swezey, February); also one ♀ from Palolo Valley, Oahu (Swezey, January), which agrees in structure but is much lighter in color.

This species is named after Mr. J. F. Rock, whose work on Hawaiian trees has been a great assistance to Hawaiian entomology.

Pl. 3, fig. 56; Pl. 4, figs. 71, a–b.

29. *N. monticola* Kirk.

Antennae not reaching beyond base of clypeus, first segment about half the length of second. I have only seen females and can only judge of its position by those; it is very similar to *chambersi* but has no granules on tegmen.

30. *N. haleakala* Kirk.

Have only seen females; antennae reaching little beyond middle of clypeus, first segment more than half the length of second.

31. *N. argyroxiphii* Kirk.

I have only seen one damaged female without antennae.

32. *N. nephelias* Kirk.

I have only seen females of this species; antennae reaching well beyond middle of clypeus, first segment more than half the length of second.

33. *N. procellaris* Kirk.

I have only seen one female specimen of this species; the antennae reach nearly to tip of clypeus and the first segment is more than half the length of second.

34–38

The following five species are unknown to me: *N. umbratica, N. hamadryas, N. palustris, N. nubigena, N. imbricola.*

PART II.

Biogenetic.

Whilst acknowledging the great importance of experimental zoology, I still believe that the words of Dr. Jordan, quoted at the head of this Review, hold good, and for this reason the fauna and flora of the Hawaiian, and other long-isolated, Islands are of extreme interest.

Dr. Perkins, in his Introduction to the Fauna Hawaiiensis, has surveyed the insect fauna of the Archipelago in a masterly manner, and touched upon some of the fundamental problems connected with its origin and evolution. It remains for Hawaiian entomologists to periodically survey each family in the light of increased knowledge, see how far the new facts support old theories, or what new theories they lend their aid to, and to indicate in what direction more details should be accumulated. The following is an attempt at such a survey of the species dealt with in the first part of this paper.

The family of Delphacidae, as represented in the Archipelago, exhibits the same phenomena as are observed in most of the families represented in the native fauna. In it one finds a few foreign species, some of which are introductions since the advent of the white man; a certain number of native species of foreign genera, which may eventually be discovered elsewhere; and a large number of species forming closely related autochthonous genera, the species themselves being often polymorphic groups of individuals forming races, varieties or subspecies, which in many cases show distinct geographical or topographical grouping, as do many of the recognized species.

All these phenomena are well exhibited in the family under review. In *Perkinsiella saccharicida* and *Peregrinus maidis* we have two foreign species introduced into the Islands in quite recent times, both of economic importance, and the former, on account of the work done in its control by introduced parasites, of great biological interest. Three species of *Kelisia (sporobolicola, paludum* and *swezeyi)* represent the native species of foreign genera, all living in the lowlands on grasses and sedges, a habitat and food not used by the species of the autochthonous genera; these may eventually be found to be foreign species. It is the species forming the autochthonous genera that present the greatest interest and with which this Review deals.

Hawaii Oceanic or Continental?

Before considering the origin of the Hawaiian fauna it is first necessary to come to a decision as to the character of the Archipelago. Is it a purely oceanic area with a fauna (and flora) descended from a limited number of immigrants, who arrived by natural means of dispersal over large ocean areas,

— the flotsam and jetsam method as it has been called,— or is it a continental area, at one time connected up to a continental area and sharing its fauna (and flora), but having become separated at a certain period, the fauna (and flora) thus isolated having evolved into what we now find? Most of the biologists who have discussed this subject have inclined to the former opinion, but a few have held the latter.

Prof. H. A. Pilsbry accounts for the presence of certain primitive land shells and the absence of certain more modern groups by postulating a continental Pacific area in late Palaeozoic or early Mesozoic times. The northern portion of this area, of which the Hawaiian Islands are the remnants, became isolated first, the southern portion having broken up at a somewhat later date, the present land shells being the representatives of the fauna of that period.

The insects in no way support this theory and in some ways oppose it. If the insects represented that early era we should be rich in Orthoptera and Neuroptera, and especially rich in Blattidae; they should show some of the primitive characters of the species of the Carboniferous age, and among the Hemiptera there should be traces of *Protohemiptera* and *Palaeohemiptera* belonging to the Permian age. If our Islands came under the influence of the Triassic insects we should have forms of Chrysomelidae, Buprestidae and other families which are not represented. The superfamily Fulgoroidea, besides the species of Delphacidae, is represented by only two genera of Cixiidae, the world-wide *Oliarus* and the autochthonous monotypic *Iolania.** We cannot consider these as primitive forms or as representative of early Mesozoic times.

The most remarkable thing about the Hawaiian fauna is the absence of many large groups, some of which are worldwide. The enormous family of Scarabaeidae is entirely unrepresented; Lucanidae is only represented by a single autochthonous genus with one or two closely related species; Chrysomelidae is not represented by any species we can consider native. In these cases we can understand that the feeding habits of the young and the poor flight of the adult would prevent them traveling any long distance over sea. Similar cases can be drawn from each of the large orders of insects, as Dr. Per-

*I have specimens from Fiji which I consider belong to this genus.

kins has shown, and parallel cases could be drawn from the rest of the fauna and from the flora. If we postulate a continental area to account for the presence of certain land shells and for the absence of others, we confront a vastly greater task to account for the absence of vast groups of animals and plants.

Most paleogeographers insist on a larger land area in the Southern Pacific than exists at present and on an extension of the northwestern portion of South America, or the western coast of Central America, in a northwesterly direction. Such land areas would greatly alter ocean currents and increase the probabilities of "drift" reaching the Hawaiian Islands from those regions.

Prof. Pilsbry's opposition to the flotsam and jetsam method of stocking islands breaks down considerably when he admits such a method to stock low islands of the Pacific and in such cases as *Tornatellina* in the Galapagos.

After considering the evidence of the fauna and flora, and of geology and hydrography, it appears to me that the theory of the continental nature of the Hawaiian Archipelago is the less tenable, as it raises greater problems than it is called upon to solve. Therefore in the following Review I shall consider that the Islands are oceanic; that the fauna is descended from immigrants which arrived at different periods, and that the Islands are of enormous antiquity, instead of the alternative continental theory which would make our fauna the descendants of continental type which flourished in late Palaeozoic or early Mesozoic times.

Origin of the Hawaiian Alohini.

In the systematic portion of this Review it has been shown that the species can be divided into two groups. In one group, *Leialohae,* consisting of *Leialoha* and *Nesodryas,* the first joint of the antennae is very short; in the other, *Alohae,* consisting of *Aloha, Nesorestias, Dictyophorodelphax* and *Nesosydne,* the first joint of the antennae is much longer. A study of the male genitalia leads to the conclusion that they are of independent origin and form two distinct phylogenetic groups. The form of the aedeagus, the styles and the mechanism for coordinating their movements with that of the anal segment are different.

The *Alohae* consists of several groups of very distinct insects; even the genus *Nesosydne* contains groups of diverse species. This would indicate a very ancient immigration. Another point of interest is that a majority of these species are brachypterous.

The*Leialohae* consists of two genera, separated by the double or single nature of the frontal carina, but the species of both groups are closely related; the species or subspecies around *lehuae* being still in a very indefinite condition. This would indicate a much more recent immigration. The species of this group are all macropterous. *Leialoha lehuae* and allied species are attached to *Metrosideros,* a genus of tree that there are reasons to believe, so Mr. J. F. Rock informs me, does not belong to the most ancient portion of the Hawaiian flora. The only species of this tribe known outside of the Hawaiian Islands are one in Australia and one in South America, so we must look to one or the other of these localities for the ancestors of the Hawaiian *Alohini.*

The above stated facts lead me to believe that the Hawaiian *Alohini* are descended from two separate immigrants, the ancestor of the *Aloha* group having arrived at a very much earlier date than the ancestor of the *Leialoha* group. Although the latter is the more recent immigrant, yet it is not a more highly specialized form,— rather the reverse, for the short basal joint of the antenna is the more primitive in ontogeny.

Lines of Evolution.

In dividing these species into genera Kirkaldy followed the general usage of considering the nature of the frontal carinae as of primary importance. This brought *Leialoha* next to *Aloha* and *Nesorestias,* and *Nesodryas* next to *Nesosydne* and *Dictyophorodelphax.* The general build of these insects does not admit of such an association, and the male genitalia demonstrates the affinity of *Leialoha* and *Nesodryas.*

Ontogeny indicates that the double frontal carina is the more primitive form, as the nymphs of all the species have two, the transition to a single carina, simplex or furcate, taking place at the last ecdysis. It thus becomes evident that the character of a single frontal carina has arisen separately in each group and has no phylogenetic significance. This line of evolution is not confined to the *Alohini,* but is found in each of the main divisions of *Delphacidae;* in the *Delphacini* it appears in several groups, evidently without any phylogenetic significance. In other families of Fulgoroidea it is also observed; in the *Derbidae* (i. e. *Vivaha* and *Kaha)* this narrowing of the frons is carried to such a degree as to suggest hypertely (if it were of any use at all). In *Zoraida* we have an extreme case of narrowing of the frons at the last ecdysis, not by an actual lessening of the surface, but by a longitudinal invagination of the frons, the lateral edges forming the entire frons in the adult. It is highly probable that in *Viviha* and *Kaha* a reverse process takes place, the face evaginates and collapses together. At present the nymphs of these two genera are unknown.

In the elongation of the head of *Dictyophorodelphax* we have a process which has taken place in other groups of Delphacidae (i. e. *Tropidocephala* and *Embolophora)* and in other families of Fulgoroidea.

The specific characters can be divided into two groups, chroötic* and phallic. The former consist of slight variations in length of antennae, length of furcation of frontal carina, length of tegmina, slight differences of texture of tegmina, and in differences in coloration. Among these characters I can detect no direct line of evolution which would fit more than one character, so that we must admit a great deal of parallel development. The phallic characters are more definite. *Leialohae* is a group in which the aedeagus appears to proceed from a form with a small crook at apex and a small spine on the right side near apex, to a form in which these are very long and narrow, and to a form in which a third spine appears at apex. In one group of *Nesodryas* the third spines become larger, while in the other group the crook disappears; *N. freycinetiae* appears to be an extreme development of the latter. The genital styles appear to proceed from a sickle-shape to a much straighter form.

In the *Alohae* the diversity is much greater and some distinct groups are formed, some of which are very isolated. In *Aloha ipomoeae* we have a fairly primitive type, and also in *Nesosydne koae,* the latter having several allied forms; in

*Sharp and Muir (Trans. Ent. Soc. Lond. 1912, III, p. 602) used this term to indicate the body wall apart from the phallic structure.

Aloha flavocollaris the aedeagus is flattened and deepened considerably at base, as is also the case in the four allied species (*kaalensis, campylothecae, dubautiae* and *artemisiae*). *Nesosydne ipomoeiocola* appears to lead to *halia* and this to *sharpi, giffardi* and *montis-tantalus*. *N. rocki* is very isolated. *N. nephrolepidis, blackburni* and *perkinsi* may indicate a phylogenetic group, and *N. incommoda* may lead to *cyathodis*. *Nesorestias* may be a development of *Nesosydne kirkaldyi*. *Dictyophorodelphax* is extremely isolated, but appears to have affinities to *Nesorestias filicicola*.

In *Aloha ipomoeae* the genital styles are fairly simple. The line of evolution appears to be in the development of the "ankle knob" which leads to a complexity of structure; another line of evolution is the narrowing of the styles.

It would be perfectly legitimate to call all these species phallic species, for the chroötic characters are very slight in comparison with the phallic.

Factors in Evolution.

Death Factors. Although no case of egg parasitism has been placed on record, yet the presence of Mymarids about bushes containing Delphacids indicate that such exist; judging by conditions elsewhere I should say that they play an important part in reducing the numbers of the Delphacids. Species of Pipunculidae, Dryinidae and Stylopids are common and play a very important part in the balance of these insects. Species of native predaceous Heteroptera are common in some localities; what part native birds and lizards play I cannot judge, as my experience in the field is too limited. At the present time the introduced ant (*Pheidole megacephala*) plays a very important part in the districts in which it can thrive, and it is likely it will lead to the extinction of certain species.* Judging by the little we know of the death factors it is highly probable that the chief mortality falls upon the eggs and nymphs and can have little or no effect upon adult characters, except by correlationship.

Natural Selection. None of the structural chroötic specific or generic characters show signs of direct utility, and therefore cannot be accounted for directly by Natural Selection.

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*Note:—See remarks under *Aloha plectranthi*.

It has been suggested, with very good reasons, that brachypterous forms are more prolific than macropterous; this, if correct, would account, on selective lines, for the predominance of brachypterous forms in our Delphacid fauna; this would likewise lead to stricter segregation and thence to species formation.

The elongation of the head of *Dictyoporodelphax mirabilis* may also represent the result of Natural Selection, for Kershaw has shown that among some Homoptera there is a great expansion of the stomach, which sends diverticula into every available portion of the body. In *D. mirabilis, Pyrops candelaria* and some other species one of these diverticula enters the head and fills the entire enlarged portion. It appears as if some physiological necessity (perhaps on account of the nature of the food) made an enlargement of the stomach advantageous. But if Natural Selection has brought about a monotypic evolution in this case it has not given it any advantage over other species, for *D. mirabilis* has an exceedingly restricted range.

When we consider coloration there are certain cases which look as if Natural Selection could have played some part. The nymphs and adults of *Nesosydne koae* live on the young green leaves of *Acacia koa* and are similarly colored; *N. rubescens, N. pseudorubescens* and *N. koae-phyllodii* live on the dark-colored phyllodia of the same tree and are brownish or reddish brown in color. *Nesosydne raillardiae* is colored like the leaves of its food-plant, and the dark body and whitish tegmina of *N. cyathodis* are very cryptic when associated with its food on the lava flows around Kilauea. It would be of interest to know the habitat of *N. fullawayi in* Molokai, which is practically only a color variety of *N. cyathodis.* The dark colors of the *Leialoha* group, attached to *Metrosideros,* are also cryptic in association with the main appearance of their habitats. The great majority of the species of *Alohini* are indefinite in coloration and there is a great amount of variation, especially among the females, so that it is impossible to insist upon any protective coloration — unless the variation and indefiniteness themselves are protective.

When we turn to the phallic characters we confront a very difficult problem, for we know absolutely nothing about the manner in which these organs function in the Delphacidae. At one time I held an opinion similar to Prof. V. L. Kellogg, that it was a case of many keys to open one lock; but after an extensive study, along with Dr. David Sharp, of these organs in Coleoptra, and their function during copulation, I was forced to change my opinion, for the evidence shows that in many cases the key fits its lock, and its own lock only. In these cases the coadaptation is between the membranous internal sac and its armature and the membranous uterus. In the Derbidae I have observed a coadaptation between the genital styles and anal segment and certain knobs and depressions on the female, a coadaptation I did not suspect until I observed the sexes in copula. How far some of the minor changes (i. e. *N. koae, N. koae-phyllodii* and *oahuensis)* would prevent fertilization it is impossible to say at present, but that such structures as the aedeagi of *N. koae, N. perkinsi, N. raillardiae, N. ipomoeicola, N. halia, N. sharpi* and *N. giffardi* could all perform the same mechanical operation in a similar manner is highly improbable. On the other hand, to account for these structures along with a coadaptation in the female by Natural Selection is to me unthinkable; the more one tries to follow out in thought such an operation the greater the difficulty becomes.

Isolation. Our collections are not complete enough for us to judge of the full effect of isolation on species formation, but enough is known to demonstrate that isolation and species formation coincide to a very large extent. A few species are dispersed over two or more islands, others over one island, but a large number have very limited habitats. *D. mirabilis* is a good example of this limited range, it being found only on a small ridge a few feet wide and not more than a quarter of a mile long.* According to our present collections Oahu has 42 species, Hawaii 20, Kauai 12, Maui 11, Molokai 7 and Lanai 5. This does not represent the richness of, but only the amount of collecting done in each island.

In spite of this it is possible that a study of the distribution of these insects in the Archipelago may lead to some interesting results, if it be borne in mind that more extensive collecting is likely to modify the present conclusions. That more species will be found in the Island of Hawaii, when the

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*Mr. Timberlake has since found it on the Lanihuli ridge, on the western side of Nuuanu Valley, and Mount Kaala of the Waianae Range.—Ed.

same amount of collecting is done in other districts as has been done in the vicinity of Kilauea, is nearly certain. Little or no Delphacid collecting has been done in Kohala or Kona and very little in Hamakua. Oahu has not yet been exhausted, and the other Islands have only been worked in a few localities.

One thing which the tables show up very distinctly, which is not likely to be greatly modified by more extensive collecting, is the high percentage of single-island endemism. Out of the 78 species and subspecies recorded 65 (83.3%) are confined to single islands, 9 (11.5%) are common to two islands, 3 (3.8%) to three islands and 1 (1.3%) to five islands. In comparing the two groups the *Alohae,* with 84.6%, is slightly above the *Leialohae* (with 80.8%) in single-island endemism and below (.96 to 1.5) it in two-island endemism; considering that the *Leialohae* are all macropterous and most of the *Alohae* brachypterous, one might have expected a greater difference. It indicates, if the relative antiquity of the two groups be not considered, that the power of flight, while reducing topographical evolution, had not influenced geographical evolution; that is to say, the power of flight had been sufficient to enable species to move about freely on an island, but had not been sufficient to enable them to pass freely from island to island.

Kauai has only one endemic *Alohae,* whilst it has 5 *Leialohae;* Oahu stands with 24 and 8, and Hawaii with 8 and 4, nearly the same proportion as the total species in each island, a natural condition when the number common to two or more islands is so small. This might indicate that the immigrant ancestors of the *Alohae,* arriving from the south or southeast, landed upon one of the more southeasterly islands and only a few have been able to reach the more isolated nor'-western island of Kauai. The fact that only two species of the genus *Aloha* are known outside of Oahu, and one of these the ubiquitous *A. ipomoeae,* may be due to our ignorance, but it lends support to the idea that Oahu may have been the original point of colonization and the center of distribution. The *Leialohae* are better flyers and so a greater proportion has reached Kauai. But why evolution in Kauai should have been more active among the *Leialohae* than among the *Alohae* is not evident.

In the table of two-island endemism we find that Kauai has one species common with Oahu and one with Molokai, but nothing with the other islands, a fairly natural result from their geographical position. Oahu has nothing common with Maui, an unnatural state of affairs, and three with Hawaii. The *Alohae* have 5 cases of two-island endemism and the *Leialohae* 4, again indicating the greater power of flight of the latter.

In the 3 cases of three-island endemism the *Alohae* have 2 species and the *Leialohae* 1 *(L. ohiae),* all three being macropterous. The only case of more than three-island endemism is *Aloha ipomoeae,* which, from morphological reasons, the writer has considered as the most primitive of the group and a likely ancestor of them all. *Leialoha ohiae* is also possibly the most primitive of the *Leialohae* and may be the ancestor of that group.

The study of the distribution of these insects gives no support to the theory that the *Alohae* are of greater antiquity in the Archipelago than the *Leialohae;* this theory finds its support in the proportional amount of evolution in the two groups. The brachypterousness of the *Alohae* may be constitutional and this may have led to a greater amount of evolution.

It is to be hoped that in the near future enough material will be accumulated from the different islands to enable us to draw juster conclusions and to more clearly indicate the evolution of these insects in the Archipelago.

The reason why isolation should cause variation is not yet understood. That the norm of a few isolated specimens should differ from the norm of the species only accounts for an alteration of the norm within the limits of variation of the species, but leaves the reason for variation beyond that limit unexplained.

The Kau lava flows are very instructive, as they show the manner in which *"kipukas,"* or small isolated areas, are cut off by the lava flows surrounling them. These *kipukas* are centers of segregation and must have played an important part in the evolution of our fauna, especially with wingless insects. When we consider the enormous age of our islands and the number of such isolated spots which must have been formed during the building up of them, we can realize to some little extent the enormous help isolation could have been to species formation.

Orthogenesis. The fact that parallel development, such as the reduction of the two frontal carinae to one, has taken place not only within the *Alohini* but also within other sections of the Delphacidae, would lead one to suppose that there is a fundamental law acting in each group. Even if it could be shown that this reduction was of a utilitarian nature, and thus open to the influence of Natural Selection, it would suggest that a common cause brought about the variation in each group.

Lamarckian factors. Of true Lamarckian factors I can see no evidence among the material under discussion, unless short wings originated through disuse. I have also suggested that the development of the elongated head in *Dictyophorodelphax* may be due to mechanical causes.

Mendelism. Mendel's law states the manner in which characters are inherited in balanced crosses, and explains why certain characters are not "swamped" by crossing. Around this law there has grown up certain theories of genetic factors. According to certain Mendelian workers all variation is due to the loss of one or more inhibiting factors. This is a belief which I cannot prevent anyone from holding who wishes to do so, but I hope such believers will not try to prevent me from disbelieving it. When I think of the primeval cell containing all the genetic factors and inhibitors of all past, present and future specific characters my credulity breaks down. Even when I consider the invisible complexity of the aedeagus of the original ancestor of the *Aloha* group, as necessitated by this theory, my imagination fails me. If evolution were progressive only, then the theory of inhibiting factors would be simplified, but degeneration is as much a part of evolution as progression. The idea that the loss of inhibiting factors could bring about complexity and then, continued still further, bring about degeneration, appears to me very improbable. One would have to postulate double and triple sets of inhibiting factors.

If we consider the case of the transformation of two frontal carinae into one we must believe that the inhibiting factor is lost at the last ecdysis, for up to that period there exists two carinae. In other cases where ontogeny follows the same course as phylogeny we must suppose the inhibiting factors to be present in the germ and to be lost during development.

Another belief among these workers is that "pure lines" cannot vary, and Johannsen's experiments with beans is used as proof. To me these experiments appear as confirmation of Natural Selection, for here we have a varying species which, by selection, can be formed into two or more forms, exactly as required by Darwin's theory. To maintain that if one of these "pure lines" were isolated upon an island, where it could increase and spread over a fairly large area, it would never vary is a belief without evidence to support it. Such a belief requires us to maintain that the few immigrants, which formed the foundations of our insect fauna, were all "impure lines," from which the species, as we now know them, have been sifted out, or that they are all the results of cross-breeding.

In criticising Darwin's Natural Selection theory it is sometimes argued that his "variations" are not inheritable, whereas the whole theory of Natural Selection demands that they should be if they are to take any part in evolution. To divide "variations" into "mutations" and "fluctuations" and say that Darwin only dealt with the latter is to totally misrepresent Darwin's work. DeVries' "mutations" appear to me to be synonymous with Darwin's "sports."

Characters which we may now consider as genetic may originally not have been so. The case of *Artemia* will illustrate my meaning: supposing it was to lose the power of living in fresh water, then the characters it assumed in salt water would be genetic

Weismann's theory of the continuity of the germ cells, and his distinction between germ and soma cells, has been used by many writers to support certain theories relating to genetic factors, and the fact is sometimes lost sight of that soma cells are only germ cells modified during the course of ontogeny, and that cell association has an important role in this modification, as polyembryony shows. The capacity of reproducing the whole organism possessed by germ cells is not lost by the soma cells of certain organisms, and is not entirely lost by living cells whilst cell division takes place.

Causes of Variation.

The key to evolution lies in the causes of variation, as has been stated by many writers, and of these causes we know next to nothing. That there are many such causes I have little doubt, and efforts to prove that only one is in operation are not likely to meet with much success. Investigations into the physico-chemical nature of organism promises to reveal interesting results. Cell association is another subject of great interest, whether we are considering ontogeny or phylogeny. In this connection polyembryony is instructive, for here we see a group of cells which left in association will form one organism, each cell forming a certain part, but if these cells be separated each one becomes a complete organism. Regeneration appears to be similar to polyembryonism. Another instructive case is the absence or presence of certain cells, such as the testes, in an organism. Every biologist should be familiar with the many cases of this nature on record. A recent case is that of Dorothy of Orono,* the Ayrshire cow; this animal assumed characters of the male, both in structure and behavior, and the only abnormality that could be observed was a slight difference in the follicles so that no corpora lutea were formed.

When collecting at Kilauea in January, I was surprised to find a number of male specimens of Delphacids in which the external genital organs were abortive or improperly developed. In all such cases I found that the testes had been destroyed by parasites, either by *Pipunculus* or *Stylopids;* when parasites were present but no damage done to the testes there was no malformation of the external genitalia. The chief alterations were in the reduction of the aedeagus, the reduction or absence of the anal spines, the reduction of the genital styles and of the mechanism that coordinates the movements of the anal segment, aedeagus and genital styles. If the destruction of these cells can bring about such a distinct alteration as this it shows that there is a very intimate association between them and the external genitalia, and that the development of the latter depends upon the nature of the former. Is it not possible that a change in the nature of these cells, either chemically or physically or both, may bring about a change in the form of the genitalia, and that the aedeagus is the most susceptible of the genital organs to such changes? We might even speculate further and consider a correspond-

*Pearl and Surface, Science 1915, No. 1060, p. 616.

ing change to take place in the females of the same family, due to the alteration of the germ-plasm of the parent.*

Future Lines of Work.

In spite of the great amount of collecting done by Messrs. Perkins, Swezey, Giffard and, in a lesser degree, others, our collections are still very imperfect. Many species are represented by females only, and others only by single specimens; the number of species yet to be found I think is quite large, as so many are exceedingly local and collecting has only been done in a very few localities in the Islands. A fuller representation may change our ideas on minor points, but I do not think it will alter the main conclusions as drawn from our present collections. Breeding experiments to show the stability of certain characters would be of interest, especially if cross-breeding can be accomplished.

In all future specific work a study of the aedeagus will be essential, so a few words as to the method I use for examining this structure may be of use. With fresh, or, if dried then thoroughly relaxed, specimens, it is easy to dissect the entire pygophor off of the abdomen; soaking or boiling in caustic potash will thoroughly clear it of all fats and then, with the aid of a pin, the base of the aedeagus can be pushed forward from inside; this will cause the anal segment to move upward, the styles to move downward and the aedeagus outward, so that all the organs become fully exposed; or the anal segment, aedeagus and styles can be dissected as one piece away from the pygophor. These should be mounted on the same card-point as the specimen. The specimen is perfect for all practical purposes and the genitalia fully exposed.

A "biological survey" of the Islands is advocated in certain quarters, mostly by those whose knowledge of what has already been accomplished is very limited. The botanists, ornithologists, conchologists and entomologists have surveyed their respective fields very efficiently, and now the task is one of detail and of close collecting. There is small hope for the ornithologists adding very much to their knowledge, either of

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*Over thirty varieties of lateral lobes of *Cetonia aurata* are figured by Curti (Entom. Mittelungen II, 1913, No. 11, p. 340) from various localities. It would be of interest to know if an equal amount of variation existed in the internal sac.

new forms or of distribution; the botanists and entomologists have still much to learn in those directions, and a fuller knowledge will lead to a better understanding of the phylogeny of the various groups; that such added knowledge will change the aspect of our fauna and flora is exceedingly unlikely.

Note.

The following new *Nesosydne* has been found by Mr. P. H. Timberlake since the completion of the above:

Nesosydne lobeliae sp. n.

♂ Brachypterous; antennae reaching to about middle of clypeus, first joint more than half the length of second; median frontal carina furcate at extreme base or only thickened over that area; length of vertex about twice the width; hind legs considerably longer than body, first joint of tarsus longer than other two together, spur nearly as long as first tarsal joint, narrow, with 12 teeth on hind margin.

Brown or fuscous brown, carinae of head and thorax, clypeus, legs and ventral surface of thorax lighter, base of abdomen and line along dorsum lighter. Tegmina hyaline, tinged with light brown, veins darker with minute granules bearing black hairs; a dark fuscous spot at apex of subcostal cell and another at apex of clavus.

Pygophor broadly open, similar to *N. sharpi;* anal segment also very similar to that species, but the spines forming a broad, flat process at each ventral corner with a small spine at apex; styles very like those of *N. wailupensis*, but slightly shorter and broader; aeadegus thin, tubular, slightly curved upward, a row of small spines from dorsal point on apex across left side to a ventral point about middle, another similar row on right side with the spines larger and extending more basally, the last three spines along the ventral surface.

Length 3 mm.; tegmen 2 mm.

♀ Similar to male.

Length 3.5 mm.; tegmen 2.4 mm.

Hab. Oahu, Kaumuohona ridge, Koolau Mountains, on *Lobelia hypoleuca* Hbd. One male and a series of females (P. H. Timberlake, April). Type in coll. H. S. P. A. Exp. Sta.

This species comes next to *N. wailupensis.*

TABLE NO. 1.

Leialohae.	Kauai	Oahu	Molokai	Lanai	Maui	Hawaii
Leialoha						
naniicola	....	X	....	....	....	X
lehuae	....	X	....	X	....	....
oahuensis	....	X	....	....	....	....
hawaiiensis	....	....	....	....	....	X
kauaiensis	X	....	....	....	....	....
ohiae	X	X	....	....	....	X
oceanides	X	....	....	....	....	....
pacifica	X	....	X	....	....	....
Nesodryas						
freycinetiae	....	X	....	....	....	....
giffardi	....	X	....	....	....	....
elaeocarpi	....	X	....	....	....	....
eugeniae	....	X	....	....	....	....
dodonaeae	X	....	....	....	....	....
dryope	....	X	....	....	....	X
fletus	....	....	....	....	X	....
gulicki	....	....	....	....	....	X
bobeae	....	X	....	....	....	....
maculata	....	....	....	....	....	X
frigidula	....	....	....	....	....	X
perkinsi	....	X	....	....	....	....
hula	X	....	....	....	....	....
laka	....	....	....	....	X	....
piilani	....	....	X	....	....	....
terryi	....	X	....	....	....	....
pluvialis	X	....	....	....	....	....
silvestris	....	....	....	X	....	....
Alohae.						
Aloha						
ipomoeae	X	X	....	X	X	X
myoporicola	....	....	....	X	....	X
plectranthi	....	X	....	....	....	....
kirkaldyi	....	X	....	....	....	....
swezeyi	....	X	....	....	....	....
wailupensis	....	X	....	....	....	....
flavocollaris	....	X	....	....	....	....
dubautiae	....	X	....	....	....	....
artemisiae	....	X	....	....	....	....
campylothecae	....	X	....	....	....	....
kaalensis	....	X	....	....	....	....

TABLE NO. 1.—(Continued.)

	Kauai	Oahu	Molokai	Lanai	Maui	Hawaii
Nesorestias						
filicicola	....	X	....	....	....	....
nimbata	....	X	....	....	....	....
Dictyophorodelphax						
mirabilis	....	X	...	....	....	....
Nesosydne						
koae	X	X	...	....	....	X
rubescens	....	X	....	....	....	X
koae-phyllodii	X	...	....	....	....	...
pseudo-rubescens	....	....	....	....	....	X
swezeyi	....	X	....	....	....	....
anceps	....	....	....	....	....	X
pele	....	....	....	....	....	X
oahuensis	....	X	....	...	....	....
cyrtandrae	....	....	....	...	X	....
gouldiae	....	X	....	....	....	....
nephrolepidis	....	X	....	....	....	....
blacburni	....	....	....	....	....	X
perkinsi	....	....	....	....	X	....
wailupensis	....	X	....	....	....	....
pipturi	....	X	X	....	....	....
chambersi	....	....	....	....	....	X
osborni	....	....	....	....	X	....
cyathodis	....	....	....	....	....	X
fullawayi	....	....	X	....	X	....
incommoda	....	X	....	....	....	....
leahi	X	X	....	....	....	....
raillardiae	....	....	....	....	....	X
ipomoeicola	X	X	....	....	....	X
halia	....	X	....	....	....	....
giffardi	....	X	....	....	....	....
montis-tantalus	....	X	....	....	....	....
sharpi	....	X	....	....	....	....
rocki	....	X	....	....	....	....
monticola	....	....	....	....	X	....
haleakala	....	....	....	....	X	....
argyroxiphii	....	....	....	....	X	....
nephelias	....	....	....	X	....	....
procellaris	....	....	X	....	....	....
umbratica	....	....	...	....	....	X
hamadryas	....	X	....	....	....	....
palustris	....	....	X	....	....	....
nubigena	....	....	X	....	....	....
imbricola	....	....	....	....	X	....

TABLE NO. 2.

Total Species in Each Island.

Islands—	Leialohae.	Alohae.	Total.
Kauai	7	5	12
Oahu	12	30	42
Molokai	2	5	7
Lanai	2	3	5
Maui	2	9	11
Hawaii	7	13	20
	32	65	97

Single-island Endemism.

Islands—	Leialohae.	Alohae.	Total.
Kauai	5	1	6
Oahu	8	24	32
Molokai	1	3	4
Lanai	1	1	2
Maui	2	7	9
Hawaii	4	8	12
	21	44	65

Two-island Endemism.

Islands—	Leialohae.	Alohae.	Total.
Kauai+Oahu	0	1	1
" +Molokai	1	0	1
" +Lanai	0	0	0
" +Maui	0	0	0
" +Hawaii	0	0	0
Oahu+Molokai	0	1	1
" +Lanai	1	0	1
" +Maui	0	0	0
" +Hawaii	2	1	3
Molokai+Lanai	0	0	0
" +Maui	0	1	1
" Hawaii	0	0	0
Lanai+Maui	0	0	0
" +Hawaii	0	1	1
Maui+Hawaii	0	0	0
	4	5	9

Three-island Endemism.

Islands—	Leialohae.	Alohae.	Total.
Kauai+Oahu+Hawaii	1	2	3

Five-island Endemism.

Islands—	Leialohae.	Alohae.	Total.
Kauai+Oahu+Lanai+Maui+Hawaii	0	1	1

PLATE 2.

NOTE:—Figs. 1 to 56 all drawn to same scale; figs. 57 to 67 all to same scale; figs. 68 to 77 and 79 all to same scale.

1. Leialoha naniicola, aedeagus.
2. " lehuae, aedeagus.
3. " oahuensis, aedeagus.
4. " hawaiiensis, aedeagus.
5. " kauaiensis, aedeagus.
6. " ohiae, aedeagus.
7. Nesodryas giffardi, aedeagus.
8. " elaeocarpi, aedeagus.
9. " eugeniae, aedeagus.
10. " dodonaeae, aedeagus.
11. " dryope(?), aedeagus.
12. " fletus, aedeagus.
13. " gulicki, aedeagus.
14. " bobeae, aedeagus.
15. " maculata, aedeagus.
16. " freycinetiae, aedeagus.
17. Aloha ipomoeae, aedeagus.
18. " myoporicola, aedeagus.
19. " plectranthi, aedeagus.
20. " kirkaldyi, aedeagus.
21. " swezeyi, aedeagus.
22. " wailupensis, aedeagus.
23. " flavocollaris, aedeagus.
24. " kaalensis, aedeagus.
25. " campylothecae, aedeagus.
26. " dubautiae, aedeagus.
27. " artemisiae, aedeagus.
28. Nesorestias filicicola, aedeagus.
29. " nimbata, aedeagus.
30. Nesosydne rubescens, aedeagus.
31. " koae-phyllodii, aedeagus.
32. " koae, aedeagus.
33. " swezeyi, aedeagus.
34. " pseudo-rubescens, aedeagus.
35. " anceps, aedeagus.
36. " pele(?), aedeagus.
37. " oahuensis, aedeagus.

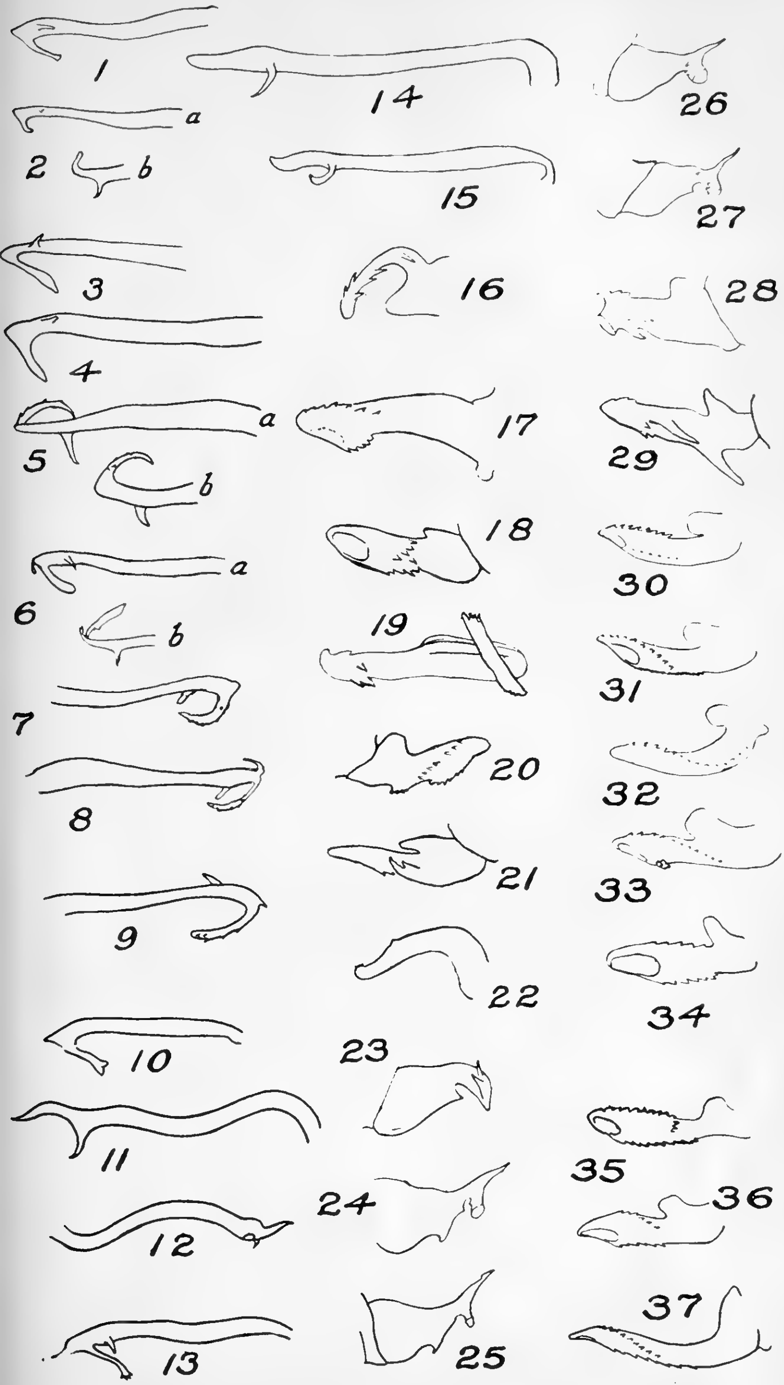
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PLATE 3.

38.	Nesosydne	cyrtandrae, aedeagus.
39.	"	gouldiae, aedeagus.
40.	"	nephrolepidis, aedeagus.
41.	"	blackburni, aedeagus.
42.	"	perkinsi, aedeagus.
43.	"	wailupensis, aedeagus.
44.	"	chambersi, aedeagus.
45.	"	pipturi, aedeagus.
46.	"	osborni, aedeagus.
47.	"	incommoda, aedeagus.
48.	"	cyathodis, aedeagus.
49.	"	leahi, aedeagus.
50.	"	raillardiae, aedeagus.
51.–a	"	ipomoeicola, aedeagus.
b	"	" aedeagus.
c	"	" aedeagus.
52.	"	halia, aedeagus.
53.–a	"	sharpi, right side, aedeagus.
b	"	" left side, aedeagus.
54.	"	giffardi, aedeagus.
55.	"	montis-tantalus, aedeagus.
56.	"	rocki, aedeagus.
57.	Nesodryas	elaeocarpi, full view of pygophor.
58.	"	fletus, full view of pygophor.
59.	"	giffardi, left genital style.
60.	"	eugeniae, left genital style.
61.	"	bobeae, left genital style.
62.	"	dryope(?), left genital style.
63.	Aloha kirkaldyi, full view of pygophor.	

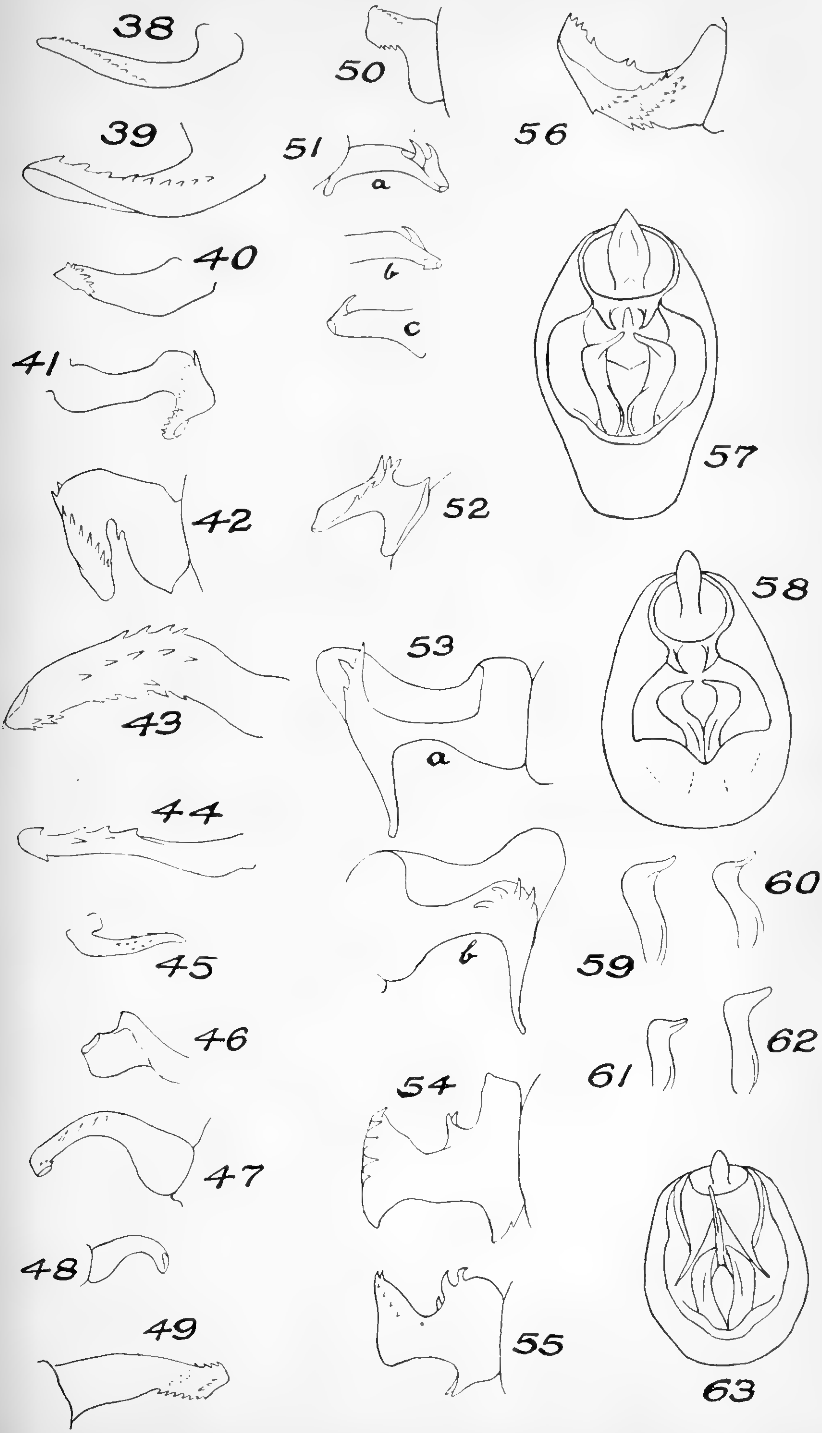
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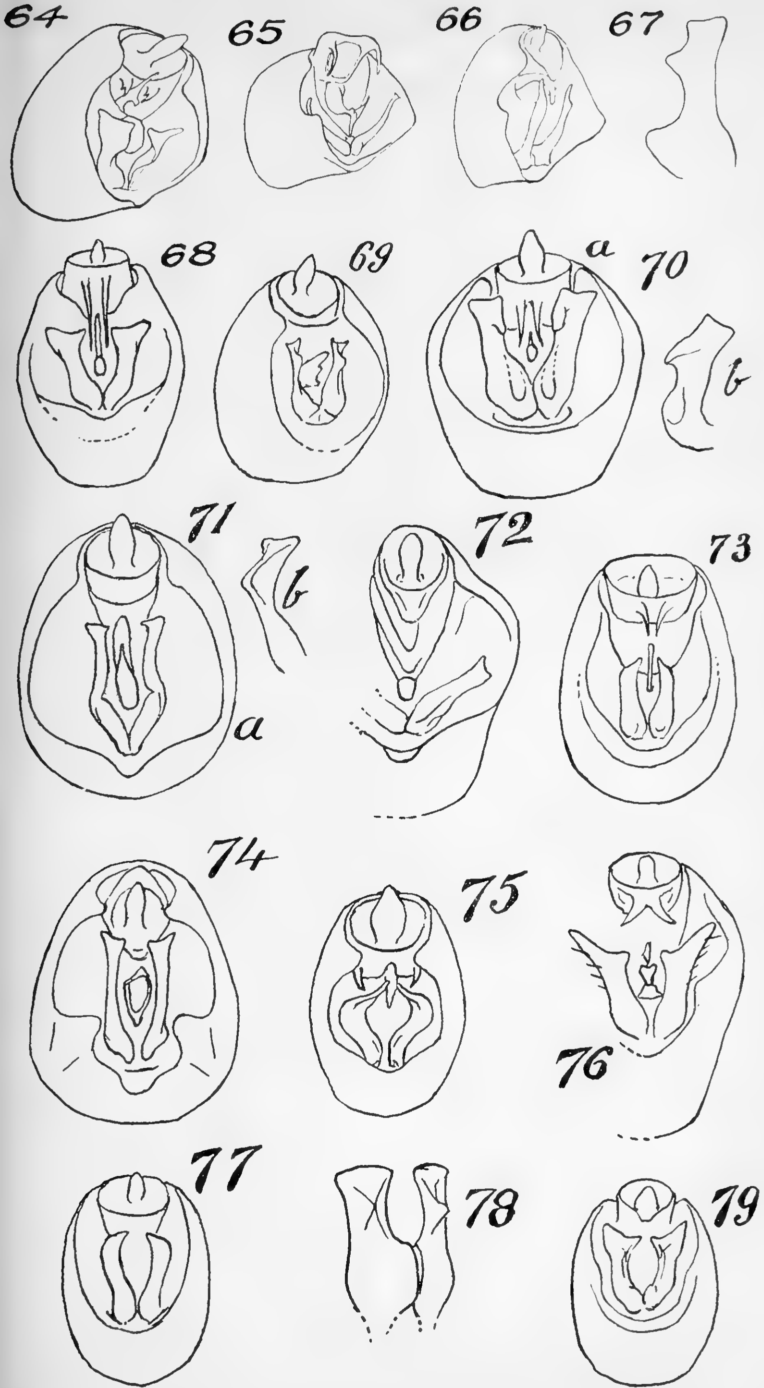
PLATE 4.

64. Aloha campylothecae, three-quarters view of pygophor.
65. Nesosydne sharpi, three-quarters view of pygophor.
66. " wailupensis, three-quarters view of pygophor.
67. " cyrtandrae, side view of right style.
68. " swezeyi, full view of pygophor.
69. " cyrtandrae, three-quarters view of pygophor.
70.–a " blackburni, full view of pygophor.
b " " side view of right style.
71.–a " rocki, full veiw of pygophor.
b " " side view of right style.
72. " gouldiae, full view of pygophor (right half).
73. " perkinsi, full view of pygophor.
74. " giffardi, full view of pygophor.
75. Leialoha naniicola, full view of pygophor.
76. Nesorestias filicicola, full view of pygophor (right half).
77. " nimbata, full view of pygophor.
78. Nesosydne pele, three-quarters view of styles.
79. " nephrolepidis(?), full view of pygophor.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NOVEMBER 4th, 1915.

The one-hundred-twenty-second regular meeting of the Society was held in the usual place, President Ehrhorn in the chair. Other members present: Messrs. Back, Illingworth, Kuhns, Pemberton, Potter and Swezey.

In the absence of the Secretary, Mr. H. T. Osborn, who would be away from Honolulu for the remainder of the year, Mr. O. H. Swezey was elected to serve as Secretary-Treasurer for the rest of the year.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Mr. Ehrhorn, who had recently returned from a vacation trip to California, remarked on conditions in the valley regions, it being the dry time of the year was very unfavorable for insect collecting. He also gave some account of his visit to the State insectary at Sacramento, and to the Panama-Pacific Exposition at San Francisco. At the latter place he had noted an interesting collection of insects in the School Exhibit from Bolivia, and in the exhibit of the Field Museum there were valuable life history exhibits.

Epyris sp.—Mr. Swezey exhibited a specimen of a large Bethylid which he had caught on a cane leaf at the Experiment Station, October 27th. It is apparently this genus, and is a foreign insect not previously observed here. It is much larger than any of the native Bethylids.

Andricus quercus-californicus (Bass.).—Mr. Swezey exhibited a large gall collected from the Oregon oak at Eugene, Oregon, in July, 1915, and specimens of the Cynipid causing it. The specimens were obtained by cutting open the gall, in which were seven cells or chambers near the center, five of which contained each a single Cynipid, while the other two contained parasites, *Tetrastichus standfordiensis* Ful., 16 and 17 respectively in each cell.

Synergus sp.—Specimens of what appeared to be a new species of this genus of Cynipidae were exhibited by Mr. Swezey. They were reared from small spherical galls on the sterile catkins of *Castinopsis chrysophylla*, collected on the summit of Mt. Tamalpais, California, August 7th, 1915.

Himalaya Butterflies.—Mr. Swezey exhibited a collection of 75 species of beautiful butterflies from the Himalaya Mountains. They were collected by Mr. Macintosh of Darjeeling, India, and were obtained through Mr. J. F. Rock of the College of Hawaii, who visited Mr. Macintosh the previous year.

DECEMBER 2nd, 1915.

The one hundred-twentythird regular meeting of the Society was held in the usual place, President Ehrhorn in the chair. Other members present: Messrs. Back, Giffard, Illingworth, Mant, Swezey, and Wilder.

Minutes of previous meeting read and approved.

Treasurer's report for 1915 read and accepted.

ENTOMOLOGICAL PROGRAM.

Kilauea moths.—Mr. Swezey reported on the examination of a collection of moths made at lights by Mr. Giffard at his bungalow, Kilauea, Hawaii, in October, 1915. There were 44 species, four of which had not previously been collected by him there. These were: *Adrapsa manifestalis, Phlyctaenia pachygramma, Scoparia* sp., and *Archips punctiferanus,* and will be additionss to the list published in Pro. Haw. Ent. Soc.,II, No. 5, p. 233, 1913.

The following corrections should be made in that list: On page 233 add "*Hyssia niphadopa* (Meyr.)"; two specimens were overlooked amongst the lot of *Eriopygodes euclidias* (Meyr.). On page 234 there should have been 3 specimens mentioned of *Agrotis selenias* Meyr. *Agrotis cinctipennis* should be omitted and "*Agrotis chersotoides,* one specimen" should be inserted.

Epyris sp.—Mr. Swezey reported having caught on a window at the Experiment Station, another specimen of this large Bethylid exhibited by him at the previous meeting.

*Gonatocerus mexicanus.**—Mr. Swezey corrected a state-

*Specimens of this parasite sent to Dr. L. O. Howard were compared by Mr. Crawford with *G. gibsoni,* which was bred in Arizona from the same host. They were found identical; hence, *gibsoni* is a synonym, having been described more recently.—Ed.

ment made by him at the October meeting to the effect that this Jassid egg-parasite had been introduced to Hawaii by Mr. Koebele. He had recently received a letter from Dr. Perkins, in which it was stated that Mr. Koebele did not try the introduction of any leaf hopper egg-parasites from Mexico at the time mentioned, and that this species of *Gonatocerus* must have come of itself, probably along with its host.

Tyroglyphus longior infesting flour.—Prof. Illingworth reported having recently received a package of flour that had been standing for some time, and was swarming with these mites. After keeping the flour for a few days in the laboratory the pest became noticeably less, and it was found that one of the large predaceous species was rapidly devouring them. This pest has a great variety of food substances, such as dried meats, cheese, cereals, drugs, dried fruits, bulbs, etc. They are said to attack raw sugar, among other things, but Mr. Illingworth had not observed them in this food in the Islands.

The cadelle (Tenebroides mauritanicus) destroying paper. — Prof. Illingworth reported having recently had his attention called to the work of the larvae of this beetle on botanical drying blotters, by Mr. J. F. Rock.

The blotters had been piled up for some time and the larvae had worked their way in around the edges, in some cases three or four inches. Apparently their main object in entering the paper was to find a suitable place to pupate. In constructing the pupating cell the larvae chewed up the paper, forming cocoon-like nests, which fastened the sheets together. In many cases the borings had extended right through the sheets.

This is a widely distributed grain beetle, though the larvae are often predaceous. Their habit of boring into the wooden walls of the grain bins, to pupate, suggests a reason for them selecting the stack of paper for this purpose.

No grain of any kind was in the room where the beetles were found, though they possibly were feeding on some of the nuts or seeds of the botanical collection. He had previously reared this species from Brazil nuts.

Descriptions of New Hawaiian Odynerus.

BY WALTER M. GIFFARD.

Odynerus monas Perk. var. *aeneus* var. nov.

Black, coloration of first and second segments of the abdomen very variable from almost all black to having the first and second segments of the abdomen almost all red or else spotted red at the sides. The structure of the second ventral segment is also very variable, some examples indicating a very light but distinct depression whilst others show none at all or at most this character is represented by a very faint and interrupted line. The head and thorax are very finely, sparsely and shallowly punctured, the median impressed line in all the examples examined continuing through the post scutellum. The tibiae and tarsi have a distinctly fusco-testaceous appearance, and the wings are very shining fuscous, having in certain aspects a very bronzy iridescence.

Hab.—Above Manele, Lanai, approximately 1000 feet elevation, flying over wild "ilima" flowers. 12 males and 3 females, February and May, 1908 (Giffard). Not uncommon. Variety type in author's collection.

Obs.—Undoubtedly only a variety or insular form of *O. monas* Perk. of Molokai. The remarks expressed by me in the Proc. Haw. Ent. Soc., II, No 5, p. 231, lead me to separate this Lanai wasp as a variety only.

Odynerus kauensis sp. nov.

Extremely like the description of the Molokai *O. monas* Perk.* in form and sculpture, the red color markings of the abdomen being also very variable and in some instances almost all black. It differs from that species in having the wings darkly infuscate and a deep violaceous blue iridescence; mandibles mostly red; basal segment of the abdomen laterally more evenly curved from the petiole (not so abrupt as in *O. monas*) and the ventral depression of the second segment somewhat wide and deep, meeting the apices of the costae obliquely. Male and female, length 7–8 mm.

Hab.—Near Honuapo, Kau, Island of Hawaii, at a low elevation; flying over scrubby and stunted growths on ancient a-a lava flows. 10 males and 1 female, May and December, 1910; April, 1911 (Giffard). Types in author's collection.

Obs.—This species is evidently scarce, but few specimens being captured after repeated visits to the locality during 1910 to 1914; I have never met with it elsewhere on the Isl-

*Proc. Haw. Ent. Soc., I, Pt. 2, p. 73.

ands. Although the thoracic puncturation of this species follows the description of *O. monas* of Molokai, yet the specimens I have examined appear to present a more roughened or coarser surface of the thorax than the one typical example of *O. monas* which I have been able to compare with these. I have therefore hesitated to separate this Kau species from *O. monas* because of the great similarity to the latter in form, color and puncturation as described.* The constant very darkly infuscate and violaceous blue iridescence of the wings; the color of the mandibles and the somewhat deep and wide depression of the second ventral abdominal segment, however, induces me to consider it a different species, but allied to the Molokai species.

Odynerus litoralis sp. nov.

Black, with the clypeus almost entirely and the apical margins of the first and second abdominal segments always broadly bright yellow. A large frontal spot between the base of the antennae and a smaller one behind the eyes of the same color. Thorax and abdomen when viewed laterally clothed with appressed sericeous pubescence. Clypeus ample, angulate, apex depressed and acutely dentate, deeply and broadly emarginate. Mandibles shiny black, the basal tooth being emarginate at apex or with two cusps. Head and thorax dull, closely, evenly and deeply punctate, the minute system of puncturation being deep and distinct, more so in front of the head than on mesonotum. Scutellum and post scutellum distinctly but less evenly punctuate. Propodeum sub-rugose except the posterior concavity which is rugulose and feebly and sparsely punctate. Abdomen with the basal segment unevenly and shallowly punctate; second segment above simply convex, beneath, the costae are long, but in most instances ill-developed, with the depression moderate, wide at the base and shallow. Length, 8–9 mm.

The female has the same coloration as the male excepting that the clypeus is always black and the post scutellum sometimes spotted with yellow. The structure differs in the clypeus, the apex of which is less dentate and emarginate, the emargination, however, being very distinct; in the thorax, which is less deeply punctate, and in the second ventral abdominal segment, which has the costae stronger and better developed. Length, 9–10 mm.

Hab.—Waialua and Waianae (Kaena Point), Island of Oahu, along the seacoast. 1 male, Wainae, April, 1907 (Gifford); 9 males and 8 females, Waialua, March, April, May, 1911 (Giffard). Types in the author's collection.

Obs.—This species is undoubtedly allied to *O. newelli* Perk. of Hilo, Island of Hawaii, and also to *O. smithii* Perk.

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*Proc. Haw. Ent. Soc., II, No. 5, pp. 231–232.

of Lanai, Maui and Molokai, both of the last named species also being coast species on their respective islands. The material differences are (1) in the coloration of the clypeus and the apical margins of the first and second abdominal segments, which are always largely and widely bright yellow (the clypeus in the male of *O. smithii* is entirely black or at most very occasionally with a flavous spot, whilst that of *O. newelli* has two or sometimes one spot only); (2) the clypeus is different in structure and much more dentate; (3) the head and mesonotum are more evenly and more distinctly, and the scutellum more sparsely punctate; (4) the propodeum is less rugose; and (5) the second ventral abdominal segment has the costae longer. Like *O. newelli* the mesonotum is clothed, when viewed laterally, with appressed sericeous pubescence, whilst on the contrary *O. smithii* has this clothed with erect but short hairs. The mandibles of all three species indicate their close affinity because of the peculiar rudimentary basal tooth, which, thus far, I have not yet noticed in other Hawaiian species.

Notes and List of Insects Trapped in Alameda and Santa Clara Counties, California, During a Short Auto Trip Whilst Speeding Along the Main Roads.

BY WALTER M. GIFFARD.

Following a prolonged illness, when it was not possible for me to tramp and collect insects during a recent sojourn in San Francisco, it occurred to me that the monotony of my daily automobile rides along the boulevards and main roads in the valleys of Alameda and Santa Clara Counties might be made less monotonous if I were to adopt some method of capturing some of the small insect life which was visible on sunny and otherwise favorable days. Unfortunately the idea came to me towards the close of my vacation, and I was in consequence able to carry out the simple scheme I had planned on two occasions only: once in the Niles Canyon and Livermore Valleys and once in the Valley of Santa Clara. The total time occupied in capturing the specimens hereafter referred to approximated in all three hours, being otherwise occupied

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during the auto trips in question. The method referred to is the simple one of using the ordinary collecting muslin net as a trap, holding it at the side of the speeding car when the speed is not over twelve or fifteen miles per hour and the wind blowing only sufficiently strong to fill the net with air. I am now sorry that I did not think of this interesting experiment before when touring through other sections of California, as I am sure the results would have been very gratifying. In the three hours trapping above referred to (August, 1915), the following insects were captured and later mounted for determination. The *Coleoptera* were determined by Dr. Blaisdell of San Francisco, the *Hymenoptera* by Harry S. Smith of the State Insectary, Sacramento, and the *Hemiptera* by Prof. Van Duzee of the State University. To these gentlemen I am indebted for their kindly assistance. Of the *Coleoptera* there are eight families, consisting of sixteen genera and eighteen species, totaling forty-three specimens. Of the *Hymenoptera* there are five families, consisting of fourteen genera and sixteen species, totaling twenty-eight specimens. Of the *Hemiptera* there are six families, consisting of nine genera and nine species, totaling eighteen spcimens. The numerous Dipterons were undetermined. The grand total comprises three orders, nineteen families, thirty-nine genera and forty-three species. In all eighty-nine specimens, excluding Dipterons.

Hereunder is a full list of all the determinations made of the insects collected at the three hours previously referred to, viz.:

HEMIPTERA.

Saldula interstitialis Say. (1 specimen).
Leptocoris trivittata Say. (1 specimen).
Lygus pratensis Linn. (1 specimen).
Triphleps tristicolor White (1 specimen).
Nyysius ericeae Schill. (*minor* Wht.), (2 specimens).
Stictocephala wickhami V. D. (1 specimen).
Agallia cinerea (5 specimens).
Fuscelis exitiosus Uhl. (1 specimen).
Corina sp. (5 specimens).

DIPTERA.

Many specimens of undetermined Dipterons.

COLEOPTERA.

STAPHYLINIDAE	
Platystethus americanus Er.	(8 specimens.)
Aleschara bimaculata Grav.	(6 ")
Quedius debilis Horn.	(1 ")
Philonthus nigritulus Grav.	(1 ")
Gnypeta sp.	(1 ")
Oxytelus niger Lec.	(1 ")
Oxypoda sp.	(4 ")
Atheta sp.	(1 ")
Species undetermined.	(4 ")
CHRYSOMELIDAE	
Diabrotica soror Lec.	(4 ")
ANTHICIDAE	
Anthicus punctulatus Lec.	(1 ")
Anthicus lecate, Casey.	(1 ")
BRUCHIDAE	
Bruchus pruininus Horn	(1 ")
PARNIDAE	
Dryops productus Lec.	(1 ")
CARABIDAE	
Apristus laticollis Lec.	(1 ")
HISTERIDAE	
Saprinus lubricus Lec.	(2 ")
COCCINELLIDAE	
Hippodamia ambigua Lec.	(2 ")
Hippodamia convergens Guer.	(1 ")
Coccinella californica Mann.	(2 ")
Total:	43 specimens.

Total determined: 8 families, 16 genera, 18 species.

HYMENOPTERA

PROCTOTRYPOIDEA

DIAPRIIDAE

Unknown genus related to *Galesus* (1 specimen).

CERAPHRONIDAE

Megaspilus sp. (1 specimen).

CHALCIDOIDEA

CHALCIDIDAE

Hockeria sp. (1 specimen).

PTEROMALIDAE

Pteromalus sp. (1 specimen).

EURYTOMIDAE

Eurytoma sp. (8 specimens)

VESPOIDEA

VESPIDAE

Polybia flavitarsis Sauss. (1 specimen).

SPHECOIDEA

TRYPOXYLONIDAE

Trypoxylon sp. (1 specimen).

PEMPHREDONIDAE

Stigmus sp. (1 specimen).

APOIDEA

ANDRENIDAE

Halictus catalinensis Ckll. (6 specimens).
Halictus sp. (1 specimen).
Andrena sp. (1 specimen).

BOMBIDAE

Bombus californicus Smith. (1 specimen).

ANTHOPHORIDAE

Melissodes sp. (1 specimen).

PROSOPIDAE

Prosopis episcopalis Ckll. (1 specimen).

MEGACHILIDAE

Anthidium sp. (2 specimens).

Total:	2	genera	*Proctotrypoidea.*
	3	"	*Chalcidoidea.*
	1	"	*Vespoidea.*
	2	"	*Sphecoidea.*
	6	"	*Apoidea.*

14 genera, 16 species, 28 specimens.

ANNUAL ADDRESS.

Contributions to the Knowledge of the Dactylopiinae of Hawaii.

BY EDW. M. EHRHORN.

It seems to be the custom at the annual meeting of the Society for the President to read an annual address. In the past I note that these addresses generally contained some account of the insect fauna of these Islands, or dealt with the monographing of some special order, family or genus.

It is my pleasure today to be able to present to you as my address a contribution to the knowledge of the subfamily *Dactylopiinae,* suborder *Homoptera,* family *Coccidae.*

In dealing with this subject I must first call attention to the great difficulty which is met with in the determination of many species of this subfamily. Especially is this true of the genus *Pseudococcus,* the so-called mealy bugs. Many descriptions are quite inadequate to use for determination, and the literature is widely scattered. Much stress has been placed on the measurements of the segments of antennae and other appendages, and although usable at times, yet from general experience such measurements cannot be greatly relied upon. Many species have been described from dried specimens, others from specimens in alcohol. The color, secretion and size of such are only approximate at best. As all these insects,

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including the whole family *Coccidae,* are microscopic subjects, it means that carefully mounted specimens are necessary so that all the minute details, so necessary for study, are brought out distinctly. It means that clean work and lots of patience are necessary to accomplish good results.

During my study of these insects I have endeavored to make my observations on the living insect as much as possible, and, fortunately, of the various species found in these Islands, I have been able to get plenty of material. As the insects of this subfamily are not all stationary, I have found that collecting them in pill boxes is best. In the laboratory they are transferred into glass vials for closer study. Many of the *Dactylopiinae* secrete a mealy substance over their body which is very often rubbed off or disturbed by ants. In the study of my specimens I have endeavored to allow the various species, by resting, to construct the secretion, filaments and other appendages as much as possible. My method is as follows: I use round-bottom glass tubes of about $\frac{5}{8}$ inch diameter and 4 inches long, in which I place a tight-fitting piece of white cardboard, allowing about $\frac{1}{2}$ inch for cotton stopper. The cardboard does not reach the end of the tube, so that the insects placed in the vial have free access to both sides of the card, and can attach themselves to one or the other side of it. Adult females placed in these tubes have reconstructed the secretion in a few days. They have formed their eggsac; have produced eggs, or given birth to living young, as the case may be. Species well attended by ants with almost no secretion when taken, have developed this to such an extent that it gave the insect a very different appearance than when first collected. How easy it would have been to describe the insect as first found, and then perchance run across a lot unattended by ants and not recognize the species as the same.

The color of the various species can be thoroughly studied while in these vials. The variation in habit of producing the offspring, by being either oviparous, ovoviviparous or viviparous, can also be recorded, and this has been successfully done by the vial method. The structure of the eggsac, whether only used as a bed or whether used as a complete cover for the insect and eggs, is another matter worth recording.

In addition to these interesting observations on the living insects, it is very important to note their habitat on the plants, whether they are found on the leaves, stems, in cracks of the bark or on the roots.

I have also been successful in breeding immature specimens to the adult stage, both males and females, and it is interesting to note the variation in color of the male and female larvae of *Pseudococcus.*

SUBFAMILY DACTYLOPIINAE.

The *Dactylopiinae* are a subfamily of the *Coccidae* or scale insects of the suborder *Homoptera,* and, unlike the majority of coccids, are, with few exceptions, naked, soft-bodied insects. Their bodies are usually covered with some white powdery or cottony secretion, some living exposed on the plant, others enclosed in felted or glassy sacs. The sexes in the larval state resemble each other, but when full grown the male larva usually becomes more elongate, and at times changes color, and when full grown spins a cottony cocoon. The male is usually winged, although some apterous forms are known.

The adult female retains the larval form in most cases, especially among the true mealy bugs, increases in size, and produces more secretion, and other striking processes. Like the *Aphidae* they produce eggs or young. Owing to our semi-tropical climate, we find many of our species have continuous broods. Some species are very prolific and as many as four hundred eggs or young have been recorded. The adult male usually reaches maturity when the female is about one-third grown. In these Islands we have species which live above ground, while other species live below ground and yet other species are found above and below ground.

The first systematic account of the *Coccidae* of the Hawaiian Islands is recorded in the Fauna Hawaiiensis, Vol. III, Part 2, 1902, by the late G. W. Kirkaldy. In this account are enumerated 9 species of the *Dactylopiinae.* In Vol. II, Part 3, on page 127 of the Proceedings of the Hawaiian Entomological Society, Mr. J. Kotinsky enumerates 7 more species. I note that in Kotinsky's list *P. aurilanatus* is mentioned as having been introduced on an *Araucaria* and is believed to have been eradicated by destroying the plant. This species has not been recorded since, so that, eliminating that species, there were 15 species of *Dactylopiinae* known. In Vol. II, Part 4, page 149 of the Proceedings of our Society I added one species, *Phyllococcus (Cissococcus?) oahuensis,* making a total of 16 *Dactylopiinae* recorded up to that time.

In the present paper I am adding five genera, of which two are new to science, and nine species, making a total of 25 species of Dactylopiinae for these Islands.

Synopsis of Genera.

A Adult female stationary, enclosed in a glassy or horny, fringed ovisac. *Asterolecanium* Targ.

B. Adult female stationary, living within the ovisac or surrounded by waxy secretion, almost if not covering body. Antennae and legs either well developed or rudimentary.

1. Adult female enclosed in a felted sac. Caudal lobes well developed, body with dorsal and marginal spines. Antennae and legs well developed. Anal ring with eight hairs. *Eriococcus* Targ.
2. Adult female enclosed in a felted sac. Antennae rudimentary. Apodous. Anal orifice tubular with six hairs, secreting a long cotton tube. Caudal lobes not well developed. *Antonina* Sign.
3. Adult female resting in a mass of waxy secretion, sometimes enveloping the body, which is quite horny and dark reddish brown. Antennae rudimentary. Apodous. Last antennal segment of larva very large. *Chaetococcus* Mask.

C. Adult female living in cone-shaped galls on leaves. Body elongate oval, tapering, ending in a chitinous segment with well-developed caudal lobes, forming a funnel, in the center of which is situated the anal ring with six hairs. Antennae with seven asymmetrically formed joints. Legs short and stout, resembling crabs' claws. Anal region strongly chitinous. *Phyllococcus* n. g.

D. Adult female active, covered with mealy secretion, with or without ovisac. Anal ring with six hairs. Male pupa enclosed in a cottony sac.

1. Antennae normally eight-jointed, sometimes seven-jointed. Margin of body with filaments. Caudal lobes not strongly developed. *Pseudococcus* Westw.

2. Antennae eight-jointed, margin of body beset with projecting tubercules, bearing a number of stout short spines. *Tylococcus* Newst.
3. Antennae eight-jointed. Body usually longer than three times its width. Mentum short. Tarsus half as long as tibia. *Trionymus* Berg.
4. Antennae six-jointed. Caudal lobes well developed, each bearing a chitinous tooth or hook. Adult female enclosed in a brittle powdery white sac. *Geococcus* Green.
5. Antennae six-jointed. Adult female secreting much white meal or cotton. Caudal lobes not conspicuous. *Ripersia* Sign.

E. Adult female active. Dorsum thickly covered with fine hair, appearing glassy. Caudal lobes as in *Pseudococcus* with slender setae. Antennae seven-jointed (many individuals show only six joints). Derm with rows of large round pores on each segment, forming groups at margin. Anal ring with six hairs. *Nesococcus* n. g.

Synopsis of Species.

Genus *Asterolecanium* Targ.

Ovisac of female broadly oval. Margin with well-developed fringe. *bambusae* Boisd.

Ovisac of female much narrower, decidedly elongate, carinated in the middle, attenuated at caudal end of body. Infesting bamboo. *miliaris* Boisd.

Ovisac of female circular, usually depressed in the bark of plants, marginal fringe well developed. Infesting oleander, fig and many other plants. *pustulans* Ckll.

Genus *Eriococcus* Targ.

Adult female yellowish brown, enclosed in a closely felted white sac. Antennae and legs well developed. Anal ring with eight hairs. Infesting Araucaria species. *araucariae* Mask.

Genus *Antonina* Sign.

Adult female living at the base of leaves of bamboo, enclosed in a white felted sac. Body purplish black. *crawii* Ckll.

Adult female living at the base of leaves of grasses. Body dark blackish brown or purple. *indica* Green.

Genus *Chaetococcus* Mask.

Adult female imbedded in a white waxy secretion. Body dark brown, about 5 mm. long by 4 mm. broad. Living under the sheaths of bamboo. *bambusae* Mask.

Genus *Phyllococcus* Ehrhorn.

Adult female viviparous, of a dirty lemon color, slightly covered with white secretion. Living in cone-shaped galls. Antennae with seven asymmetrically formed joints. Legs short and stout, resembling crabs' claws. Anal region strongly chitinous. Anal ring with six hairs. Infesting leaves of *Urera sandwicensis* (Opuhe). *(Cissococcus?) oahuensis* Ehrh.

Genus *Pseudococcus* Westw.

Adult female oviparous, dull brownish yellow, marginal appendages short, of about equal length, those of caudal lobes longer. Egg sac more or less spherical. Eggs amber yellow. *citri* Risso.

Adult female ovoviviparous, resembling *P. citri,* but more convex and not as elongate. Marginal appendages not as stout. Color reddish brown. Infesting pineapple, sugarcane, banana, canna roots, nut-grass, and on roots of other plants. *bromeliae* Boisd.

Adult female viviparous, color yellow, thickly covered with white powdery secretion. Caudal appendages long and slender, marginal tufts filiform. Infesting ferns, caladiums, orchids, etc. *longispinus* Targ.

Adult female viviparous, light brown. Caudal appendages stouter than in *longispinus.* Dorsum with two dark markings running lengthwise with body. Infesting hibiscus, cotton, poinsettia, beans, etc. *virgatus* Ckll.

Adult female oviparous, dark purple, producing a globular cottony eggsac, almost covering insect. Infesting hibiscus, cotton, citrus, etc. *filamentosus* Ckll.

Adult female oviparous, elongate, narrow cephalad, of a light purplish color, covered with white secretion, giving body a grayish appearance. Four stout caudal appendages, those of margin wanting. Eggsac very elongate, when not disturbed resembling *Pulvinaria.* Infesting bulbs.
lounsburyi Brain.

Adult female oviparous, narrow, elongate oval, color gray, slightly covored with white powdery secretion. Cottony eggsac, not covering body. Infesting sugarcane.
saccharifolii Green.

Adult female viviparous, large elongate oval, convex, of a delicate pink color, producing a waxy cottony mass under body. Infesting sugarcane. *sacchari* Ckll.

Adult female viviparous, orange red, covered with a thick waxy secretion forming tufts on dorsum, like a small *Orthezia.* Infesting guava, persea, canna, palms, etc. *nipae* Mask.

Adult female viviparous, light yellow green. Margin of body with very long, slender, glassy filaments. Antennae and legs long and slender. Infesting *Straussia.* *straussiae* n. sp.

Adult female viviparous, pinkish brown, slightly covered with white secretion. Resembles *longispinus* in form, but marginal tufts wanting, only three last segments with short appendages. Caudal lobes with long setae. Found between folded leaves of *Acacia koa.* *swezeyi* n. sp.

Adult female viviparous, yellowish brown, male larva grayish green, caudal appendages as long or longer than body. Living in galls on *Santalum.* *gallicola* n. sp.

Adult female viviparous, light yellowish brown, slightly covered with secretion. Caudal appendages longer than body. Derm with many round pores and scattered hairs. Insects produce quantities of a white, fluffy, mealy substance between the foliage. Infesting *Freycinetia* and *Astelia.*
montanus n. sp.

Genus *Tylococcus* Newst.

Adult female viviparous, pink or pinkish brown, thickly covered with white powdery secretion, not hiding segmentation. Margin of body beset with long, coarse, white filaments, 17 on each side. Derm after treatment shows marginal tubercles each with a number of conical spines. Anal ring with six hairs. Antennae as in *Pseudococcus*. Infesting *Pandanus odoratissimus*. *giffardi* n. sp.

Genus *Trionymus* Berg.

Adult female oviparous, of a dark pink color, slightly covered with white powdery secretion, not hiding color nor segmentation. Antennae 8-jointed, short and stout. Eggsac longer and broader than body of female. Infesting grasses.
insularis n. sp.

Genus *Geococcus* Green.

Adult female oviparous, pale honey yellow, broadly fusiform, surrounded by whorls of fine, glassy hair. Forms a brittle, powdery white sac. Attacking the roots of trees and plants. *radicum* Green.

Genus *Ripersia* Sign.

Adult female viviparous, pale reddish brown, thickly covered with white mealy secretion hiding segmentation. Antennae six-jointed. Margin of body with thick, white, waxy tufts, which often coalesce. Infesting a variety of palms.
palmarum n. sp.

Genus *Nesococcus* n. g.

Adult female active. Dorsum thickly covered with fine hair, appearing glassy. Antennae seven-jointed (many individuals show only six joints). Legs short and stout, especially femur. Derm when cleared shows rows of large round pores on each segment of the body, these forming groups at margin. Caudal lobes as in *Pseudococcus* with slender setae. Anal ring with six hairs.

Adult female viviparous, light yellow green. Dorsum thickly covered with fine glassy hair. Antennae seven-jointed, but six-jointed individuals are found. Legs short and stout. Derm shows rows of large round pores which form groups near margin. Infesting leaves of *Pipturus albidus*.

pipturi n. sp.

Pseudococcus straussiae sp. n.

Adult female viviparous, light yellow green, acutely rounded cephalad, egg-shaped. Body very slightly covered with white secretion, not hiding segmentation. Margin with very slender, hairlike filaments about as long as the average width of the body. Four caudal setae present, the two inner pair 6 mm. long, the two outer pair not quite as long as body, glassy white. Insect very active, about 3 mm. long by 2 mm. broad. When placed in KOH body turns yellow with an orange tinge on the cephalic and caudal end of body. Antennae eight-jointed, very long and slender, almost aphis-like, and bearing very long, slender hairs. Joint 8 longest, but at times subequal with 3; joint 5 next; joints 2, 4 and 7 next and subequal; sometimes joint 7 is longer than 4. Joint 1 is shortest and about half as long as 6. Formula: 8, 3, 5 (2, 4, 7), 6, 1, or 8, 3, 5, 7 (2, 4), 6, 1. Legs long and slender, tarsus not quite half the length of tibia. Digitules of tarsus are long, fine hairs; those of claw are club-shaped hairs with flattened end. Caudal tubercles quite prominent, with very long setae about twice as long as the hairs of the anal orifice, also bearing two stout spines and several fine hairs all in a group of prominent round pores. Anal orifice small, with six long, fine hairs. Marginal segments with two stout, short spines in a group of round pores, which area is light brown and quite conspicuous.

Male of the usual *Pseudococcus* type, light yellowish brown. Thorax, head and end of abdomen dark reddish brown. Antennae ten-jointed; joint 3 longest, joints 1 and 2 stouter than the rest, and joint 2 almost egg-shaped. Caudal setae about one-quarter length of body.

Hab.—The species is viviparous and is found on *Straussia hawaiiensis*, at 1800 feet elevation on the Island of Oahu; and on *Myrsine* species at 2900 feet on the Island of Molokai. (Kuhns.)

Pseudococcus swezeyi sp. n.

Adult female viviparous; resembles *P. longispinus* in general appearance, but marginal filaments are not developed, only the last three segments bearing short flaments and the caudal lobes with long setae.

Adult female pinkish brown, about 2 mm. long by 1 mm. broad, quite flat, very active when disturbed. Body slightly covered with a thin, white, mealy secretion which does not hide the color nor the segmentation. Legs and antennae light yellowish brown. When placed in liquid potash body turns dark reddish brown and becomes clear after boiling. Antennae eight-jointed, with the 8th longest and 4 the shortest. Joints 1 and 2 are broader than 3, 4, 5, 6 and 7. Joint 8 swollen in the middle so as to be as broad as joints 1 and 2. Each joint with a few hairs, joint 8 with numerous hairs, some of which are quite stout. Joints 5 and 6 subequal. Formula: 8, 1, 2, 3, 7 (5, 6), 4. Legs quite stout. Femur quite swollen. Trochanter plus femur subequal with tibia plus tarsus. Tarsus one-half as long as tibia. Claw stout and sharply curved with dilated digitules. Digitules of tarsus long fine knobbed hairs. Trochanter has a very long stout hair, longer than the hind leg. Anal lobes not prominent, with long fine setae, thinner than the hairs of anal ring, which are stout and about subequal in length with the caudal setae. The lobes also have two very stout, long, conical spines and several long fine hairs surrounded by many round pores forming distinct light brown patches. There is also a similar patch on the penultimate segment near margin; the rest of the marginal patches bear two conical spines and a few round pores, but becomes less distinct as they approach the cephalic end. On the dorsum are numerous long fine hairs and round pores. Caudad of the anal ring is a double row of long fine hairs.

Male cocoon is of the usual type and firm of texture.

Male larva when ready to pupate is light grayish green.

Adult male of the usual type, of a dirty yellow green color. Thorax quite elevated above and of dark brown color; eyes red. Wings iridescent, showing a beautiful pink color in certain light. Caudal filaments snow-white, extending beyond the folded wings about half the length of the body; they are as long as the length of the body. Antennae and legs brown and quite hairy. Antennae ten-jointed, of the usual type; joints 1 and 2 stouter than the rest, joints 3 and 4 subequal and longer than 5, 6, 7, 8 and 9, which are subequal; joint 2 is subequal with 9, and joint 1 is the shortest.

Habitat.—Between folded leaves of *Acacia koa*, Mount Tantalus, Oahu, Hawaiian Islands. Collected by Mr. O. H. Swezey, for whom I take pleasure in naming the species.

Pseudococcus gallicola sp. n.

Adult female viviparous, about 2½ mm. long, with caudal setae 3½ mm. long, by 1¼ mm. broad, convex, varying from a grayish green to a yellowish brown color, with a faint dark line running lengthwise in the center of the dorsum. There are three pairs of filaments, which are quite pronounced, the two caudal ones being about twice as long as the two preceding pairs. The filaments on the four other segments are very short. When placed in hot KOH body turns dark reddish brown. Antennae eight-jointed, joint 8 longest. Joint 1 twice as broad as 2, both broader than the rest. Joints 1, 2 and 3 subequal, joint 1 being broader than long at its base. Joints 4, 5 and 6 subequal and a little shorter than 7. Joint 8 is one-third longer than joint 2. All joints bear a few hairs. Legs short and stout. Femur much swollen (middle leg). Femur plus trochanter about subequal with tibia plus tarsus. Claw stout, with short flattened digitules; those of tarsus are long fine knobbed hairs. Tibia more than twice as long as tarsus. Caudal lobes well developed, with setae about as long as hairs on anal ring, and also bearing two very stout conical spines in a group of round pores in which are also several long fine hairs. Anal ring large, with usual six hairs, which are stouter than the caudal setae. There is a marginal patch, similar to the one on the caudal lobe, on the penultimate segment. Marginal patches become less pronounced cephalad. There are numerous hairs and round pores scattered on the last segment, as well as on the cephalic portion of the body.

The galls, or rather pockets, in which the insect lives are usually on the upper side of the leaves. The young larvae station themselves on the underside of the very young, tender leaves, and by irritation cause a depression in the leaf, which grows very quickly, forming a deep, pocket-like gall. As the insect grows its caudal filaments protrude from the opening of the gall. Some galls are found on the underside of the leaves, but not very often.

Habitat.—In galls on leaves of *Santalum littorale,* seashore, and *S. ellipticum,* Palolo Valley, Oahu, Hawaii (O. H. Swezey).

Pseudococcus montanus sp. n.

Adult female viviparous, about 2 mm. long by 1 mm. broad, measuring with caudal filament 3 mm. long; of a light brownish yellow color. Body covered with a very thin secretion, which does not hide the color nor the segmentation. Antennae and legs light brown. Insects form in clusters between the leaves and produce quantities of white, fluffy, mealy substance, which contains the young. When placed in hot KOH body turns orange brown. Antennae eight-jointed, short and stout. Joint 8 longest, joints 1, 2 and 3 much stouter than the rest. Joints 1, 2 and 3 subequal. Joint 1 is about as broad as long. Joints 4 and 5 subequal. Joint 6 shortest. Joint 7 cup-shaped, a trifle longer than 6, but broader. Joint 8 fits into the cup of joint 7 like into a socket. All joints are quite hairy. Legs much longer than the antennae and very stout, especially the femur, which is very broad. All joints are hairy. Femur plus trochanter is subequal with tibia plus tarsus plus claw (middle leg). Digitules of tarsus, fine hairs with knob; those of claw, curved dilated hairs, reaching beyond claw. Trochanter with very long stout bristle about half as long as femur. All hairs on legs quite long and stout. Anal ring large, with very long stout hairs, much longer than the caudal setae, which are quite slender. Caudal lobes well developed, with two very stout conical spines, which are surrounded by several long stout hairs and small round pores. Each segment bears on its margin a pair of spines with a group of round pores forming distinct marginal patches, which diminish in size cephalad. Derm with very small round pores and scattered hairs.

Habitat.—On *Freycinetia arnotti,* Palolo Valley (O. H. Swezey), and on *Astelia veratroides* on Mount Olympus trail (P. H. Timberlake).

Tylococcus giffardi sp. n.

Adult female viviparous, thickly covered with white powdery secretion, not hiding segmentation. Body about 3 to 3½ mm. long by 1½ to 2 mm. broad. Margin beset with long, coarse, white appendages, 17 on each side, which are subequal in length, except the last 3 pairs near caudal end, which are much longer and more or less curved and about 2 to 2½ mm. long. The insect superficially has the appearance of an *Orthezia*. Color of body light pink or pinkish brown, which is easily seen on the ventral side. Legs and antennae light brown. When placed in potassium solution insect turns ferruginous brown, with a dark central spot in body and light margin. Antennae long and slender, of eight joints, of which the eighth is the longest. Joint 1 next, but very little shorter. Joints 6 and 7 subequal. All joints with long, stout hairs. Formula: 8, 1, 2, 3, 5, 4 (6, 7). Legs longer than antennae. Coxa broader than long. Trochanter plus femur very little longer than tibia plus tarsus plus claw. Tibia about twice as long as tarsus. Claw stout, with short flattened digitules, those of tarsus very long slender hairs. Anal orifice with six stout hairs, very little shorter than caudal setae. Caudal lobes very pronounced, quite broad, with many short, stout conical spines, varying in size, the longer ones in the center of the round-pore-area. Marginal processes or tubercles, not as prominent as those figured in the description of *T. madagascariensis* Newst., but quite pronounced.

Adult male of the usual type of Pseudococcini, with well developed caudal lobes, each bearing three long setae. Style short and stout. Antennae ten-jointed, of which joints 1 and 2 are subequal and the longest, and both are broader than the rest. Joint 3 is about twice as long as 4; the rest are subequal. Color of body reddish brown. Caudal setae snow-white; eyes black; legs and antennae of a lighter color than the body.

Habitat.—On the leaves of *Pandanus odoratissimus*, Honolulu, Hawaii. Differs from *T. madagascariensis* Newst. in not having as pronounced marginal tubercles, according to figure in text of description. Also in having more blunt spines on the tubercles. The antennae also vary in sequence of joints. I take pleasure in naming this species for my friend, W. M. Giffard, of Honolulu.

Trionymus insularis sp. n.

Adult female oviparous, about 2 mm. long by 1 mm. broad, of a dark pink color. Body slightly covered with white secretion, not sufficient to hide color or segmentation. Ovisac longer and broader than adult, loosely woven. Legs and antennae light brown. When placed in liquid potash body turns claret color. Antennae short and stout, eight-jointed, with joint 8 longest. Joint 1 twice as broad as long. Joints 1 and 2 subequal; joints 3 and 4 subequal; joints 5 and 6 subequal, and joint 7 very little longer than 6. Formula: 8 (1, 2), 7 (5, 6), 3, 4. All joints have a few hairs, which are quite long when compared with the length of the joints. On joint 7 there is one and on joint 8 four rather thick, stout, curved spines. Legs short and stout. Coxa and femur much stouter than tibia and tarsus. Femur one-third longer than tibia and tibia one-third longer than tarsus. Claw long and straight. Digitules of tarsus fine knobbed hairs, those of claw dilated hairs. The legs are quite hairy. Caudal lobes low, indicated by the long, slender setae. There are two long, fine spines and numerous hairs on each lobe. Anal ring large, with the usual six hairs, which are as thick and subequal in length with the setae. Derm thickly covered with short hairs and round pores; these are more numerous on the cephalic and caudal end of the body.

Young larva.—Antennae six-jointed. Jont 6 longest, about as long as 2, 3, 4 and 5 together. Legs long and stout, especially the femur. Caudal lobes not prominent, with long, fine setae and two sharp spines. Derm shows series of round pores on each segment and scattered over cephalic portion, also many fine hairs.

Habitat.—On *Deschampsia australis,* found in a Kipuka on the slopes of Mauna Loa, 6000 feet, Island of Hawaii (O. H. Swezey), and on *Cynodon dactylon* in various localities on the Island of Oahu, T. H.

Finding this insect in areas that have escaped lava flows (Kipukas) on the slopes of Mauna Loa would indicate that it has been on the Island for a long time. This species has been successfully transferred to *Paspalum conjugatum* in the laboratory for study.

Ripersia palmarum sp. n.

Adult female viviparous, pale reddish brown, about 3 mm. long, inclusive of caudal setae. Dorsum covered with dense white secretion, hiding segmentation. Marginal tufts very short but stout, getting longer caudad. Eight tufts at caudal end about 1 mm. long. These are sometimes curved upwards; sometimes they coalesce, forming plates which are very farinaceous. When placed in liquid potash body turns dark reddish brown, derm becomes transparent. Antennae six-jointed, stout and quite hairy. Joint 1 is broader than the rest and cone-shaped. Joint 6 is the longest; joints 1, 2 and 3 are subequal, as well as joints 4 and 5. Formula: 6, (1, 2, 3), 5, 4, or 6, (1, 2), 3 (4, 5). Legs are short and stout, a trifle longer than the antennae. Coxa broader than long. Femur about as long as tibia plus tarsus plus claw. Claw very stout. Tibia 1½ times longer than tarsus. Dorsum with rows of long fine hairs on each segment of body. Caudal lobes well defined, with two pairs of long setae, the outer pair about half as long as the inner pair, and five or six conical spines of various sizes and numerous stout hairs surrounded with many round and triocular pores. Marginal patches on the last four segments bearing groups of round pores with conical spines. Anal ring with six stout hairs about as long as caudal setae.

Larvae reddish brown, quite large when just hatched, active. Antennae and legs stout. Antennae six-jointed, the sixth the longest and as long as joints 2, 3, 4 and 5 together, which are subequal in length. Legs short and stout. Femur very stout. Tibia subequal with tarsus. Claw long and straight, abruptly curved. Caudal lobes well defined, with setae about twice as long as the hairs on anal ring. Rostral loop reaches beyond last pair of legs. Eyes red.

Male cocoon small, not densely felted.

Adult male.—Two forms have been found.

Apterous male very small, active, reddish brown, eyes red. Antennae eight-jointed, of which joint 8 is longest, about one-third longer than 2. Joints 1 and 2 are much broader than the rest, joint 2 being as broad as long. Joints 4, 5, 6, 7 are subequal. Legs long and slender, very little longer than antennae. Caudal lobes not very prominent, with short setae. Style quite pronounced.

Winged male similar to apterous form. Antennae nine-jointed. Joint 9 subequal with 2. Joint 2 is one-third longer than broad. Joint 3 with petiole. Joints 1 and 2 twice as broad as 3, 4 and 5. Joints 6, 7 and 8 are broader than 3, 4 and 5, but not quite as broad as 1 and 2. Joint 4 is shortest. All joints with numerous hairs and 8 with two stout bristles. Legs longer than antennae, quite stout. Femur plus trochanter equal to tibia. Tarsus about half as long as tibia. A few long hairs on femur and tibia on their margins. Tibia with two very stout spurs at its end. Tarsus with stout hairs on its inner margin. Digitules fine hairs. Claws very slender, long and straight, with sharp point, no digitules; at least none observed.

Habitat.—On various palms, *Cocos nucifera, Latania glaucaphylla, Thrynax* and *Areca lutescens,* at Honolulu, Hawaiian Islands. This species has more the appearance of a *Pseudococcus*, on account of the thick secretion on the body and the marginal tufts.

Nesococcus pipturi sp. n.

Adult female viviparous, about 1½ mm. long by 1 mm. broad, moderately convex, light lemon yellow, thickly covered with fine, glossy hairs on dorsum, not hiding color of insect. Segmentation indistinct. Legs and antennae same color as body, or a trifle darker. Ventral part of body naked. When placed in KOH body turns orange brown and derm becomes transparent after boiling. Dorsum thickly covered with slender bristles, and round pores on each segment near margin, formnig clusters of four or six pores as marginal patches. Antennae of seven joints, although specimens also show six-jointed antennae when third joint has not divided. Joint 7 longest, then joint 2. Joint 1 is twice as broad as long at its base. Formula of seven-jointed specimen is: 7, 2 (3, 4, 6), 1, 5, or 7, 2 (3, 4), 6, 1, 5. Each joint bears long, fine hairs, especially the last joint, which has numerous long, fine hairs. Antennae as well as the legs are short and stout. Femur is quite swollen. Tibia is two times longer than tarsus. Trochanter plus femur is subequal with tibia plus tarsus. Claw is long and sharply curved, with short, stout, curved, club-shaped digitules. The digitules of the tarsus are long, fine, knobbed hairs. The trochanter has a very long, fine hair on its outer margin, about as long as the inner margin of the femur. Rostral loop reaches midway between second and third pair of legs. Caudal lobes not very prominent, with short, fine setae, when compared with the hairs of the anal ring, which are one-third longer and are stout and very pronounced. On the lobes are two stout spines and some fine hairs or bristles. The marginal groups of round pores on the last segment consist of eleven round pores each. In front of the anal ring on the ventral surface is a cluster of stout hairs. Between the antennae are several stout hairs.

Habitat.—On *Pipturus albidus,* Mount Tantalus, Oahu, Hawaiian Islands. January 16, 1916 (O. H. Swezey.)

NOTE:—Since the Annual Meeting when this paper was presented, several new species have been discovered. They are embodied in the original paper.—ED.

Election of Officers for 1916 resulted as follows:

President .... J. F. Illingworth
Vice-President .... W. R. R. Potter
Secretary-Treasurer .... H. T. Osborn

Mr. Osborn being absent from Honolulu for the time being, Mr. O. H. Swezey was elected to serve as Secretary-Treasurer until Mr. Osborn's return.

Some New Hawaiian Coleoptera.*

BY DR. R. C. L. PERKINS.

The few species of Coleoptera described below are all of considerable interest and, with one exception, I am indebted for them to various friends in the Islands. It is for this reason that I am anxious that the descriptions be published. These descriptions were drawn up a considerable time ago and formed part of a much more extensive paper on Hawai-

*This paper was received from Dr. Perkins while this number of the Proceedings was being printed, and it seemed desirable to publish it at the present time.—ED.

ian Coleoptera, the publication of which has been delayed or postponed.

The species described belong to the Cerambycidae and Curculionidae and to genera already well-known in the Islands. Particularly interesting are the Cossonid *Heteramphus swezeyi,* the peculiar leaf-mining habits of which have already been published by Mr. Swezey; and that other member of the same group, *Dryotribus wilderi,* obtained on Midway Island by my friend Mr. G. P. Wilder. The typical species of *Dryotribus* — wrongly described by me in the "Fauna" as a new genus and species under the name *Thalattodora insignis* — is of extremely wide distribution and appears to be entirely attached to drift-wood. It occurs on several islands, at least, of the Hawaiian group, on the Australian coast, and in the West Indian Islands, apparently unchanged specifically, or practically so. Mr. Wilder found the form described below, not in drift-wood, but in the dead stem of some plant on Midway Island. The typical species I have found in the Islands on several occasions, but always in drift-wood and never away from the beach, and I have examined a West Indian example kindly given to me by Mr. G. C. Champion.

The description of one small species of that most difficult genus *Proterhinus* is included in this paper, because it is of rather special interest, being attached solely, so far as I know, to the rare and almost extinct tree *Kokia (Gossypium) drynarioides.* Only a few examples were found amongst vast numbers of the allied, widely distributed and polyphagous species *Proterhinus deceptor.*

Plagithmysus kuhnsi sp. n.

Head, thorax and femora black, the latter red basally, as also the whole of the hind tibiae; the tarsi, antennae and elytra more testaceous, the latter with the usual elongate, dark, wedge-shaped area, containing the lines of pale yellowish pubescence, which diverge anteriorly. These lines are similar in color to those of *Callithmysus koebelei.* Pronotum strongly crested and very densely punctured and scabrous, dull above, but laterally the surface becomes smooth and shining and the punctures distinct and separate, some parts being impunctate or nearly; the pubescence is sparse, whitish, and does not form bands. Elytra on the basal portion very densely sculptured and inconspicuously clothed with short white pubescence. The divergent pubescent lines are well defined. Hind tibiae with black pubescence, that on the femora short and white, but black or dark near the apex. Hind femora formed much as in male *P. darwinianus*, etc., but probably the example described is a female and the legs of the male may be more robust. Nothing is known as to the variation of the color of the legs, etc.

Length 18 mm. (including exposed tips of wings).

Hab.—Waianae Mountains, Oahu. Collected and given to me by Mr. D. B. Kuhns. I have seen trees of *Pipturus* riddled by the larvae of this species in the same mountains, but neglected to rear them. There it replaces *Callithmysus koebelei* of the Koolau Mountains.

Plagithmysus ignotus sp. n.

Of a dull red color, the legs concolorous, the bases of the femora not being notably pale compared with their other part. Head with very pale yellow pubescence, the pronotum with a very definite longitudinal band of the same on each side of the median crest, while the whole of its deflexed sides are similarly clothed. Consequently in dorsal aspect it appears to have four definite longitudinal bands. Antennae long and slender, the apical joint being four or five times as long as its greatest width. All the femora and tarsi with white, the hind tibiae with black hairs. Elytra at the base with very pale yellow pubescence and behind this on a darker area with the usual pale pubescent lines, divergent anteriorly. These lines are not continuous, but each consists of a series of regularly placed, small, pubescent spots, which form broken, but perfectly definite lines. Abdominal segments at the sides each with a spot of very dense pale pubescence, three similar spots continuing the series on each side of the thorax.

Length 15 mm. I am not certain as to the sex of the single specimen. It comes near to *P. munroi* and *P. aequalis,* but is quite distinct.

Hab.—Kauai (3,000 feet). Given to me by my friend Mr. G. C. Munro many years ago.

Acalles eugeniae sp. n.

Head, thorax and basal half of the elytra covered with ferruginous squamosity. The color is not uniform, being in some parts nearly orange and in others shading into whitish-ochreous. The rostrum is red. On the head are some markings formed by black squamosity; two small spots of the same color near the front margin of the pronotum, and another in the middle of the hind margin. The pale portion of the elytra enclose some black markings, tending to form an irregular curved band. The deep black squamosity of their apical half is at the sides continued right to the base (but this is only seen in lateral view), while at the extreme apex the squamosity is ferruginous. Femora black with a median pale ring and another at their base, the tibiae black on the basal, pale on their apical portion.

Rostrum dull and very densely punctured (no doubt a male character); the first funicle joint of the antennae elongate, distinctly longer than the elongate second joint and as long as the third and fourth together, the third and following ones moniliform. Pronotum from one-fourth to one-third longer than its basal width, with a strong longitudinal elevation on each side of the middle, these corresponding to the elevations of the second elytral interstices, the ridges irregular, approximated in front, but much more distant behind; two other ridges form most of the lateral outline of the pronotum in dorsal aspect and correspond with the elevated fourth interstice of the elytra, while an elevation on the deflexed sides forms a small part of this lateral outline on each side at about the middle of the length of the pronotum. Second, fourth and sixth interstices of the elytra strongly and unevenly raised, the highest points notably clothed with erect scales, so as to accentuate their height. Between each of the ridges two rows of coarse punctures or fovae can be seen, though the whole surface is densely covered with squamosity.

Length, excluding the rostrum, 5 mm.

Hab.—Manoa Valley near Honolulu.* Bred from a dead branch of *Eugenia* by my friend Mr. O. H. Swezey. Bred examples of *Acalles* are difficult to compare with captured specimens, which may be partly or largely denuded of their clothing, but I believe the above to be distinct from any of the Hawaiian type specimens, all of which I have examined.

Dryotribus wilderi sp. n.

Black, the antennae, legs and rostrum obscurely reddish. Like the typical species of the genus, but much more slender and elongate, the elytra being about three times as long as width at their base. The pronotum also is more elongate and less coarsely punctured, and the punctures of the elytra appear considerably coarser than those of the pronotum, while the general surface of the elytra between the punctures is much smoother or less corrugated.

Length 3.5 mm.

Hab.—Midway Island. A single specimen was found in a dead stem —not drift-wood—by Mr. G. P. Wilder, to whom I am indebted for this interesting form.

Heteramphus swezeyi sp. n.

Dark piceous or rufescent (when more or less immature), the antennae, tarsi and more or less of the tibiae in mature examples testaceous, the rostrum paler than the pronotum and elytra.

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*It has also been collected on Mount Tantalus by Mr. F. Muir, and in Palolo Valley by Dr. H. L. Lyon.—Ed.

Rostrum bare, finely punctured, the punctures becoming sparse or almost absent on the apical portion, which is dilated, the width becoming notably greater where the pterygia become outstanding. Eyes large, the space between them in dorsal aspect only about equal to the width of one of them. Pronotum bare, dull, with dense microscopic sculpture and copious punctures generally more or less irregular and coarse. Usually there is a vague depression near the base and sometimes also two vague lateral ones in front of this, sometimes too a more or less definite median impunctate line. The greatest width of the pronotum is nearly equal to its length; in front it is constricted and there about two-thirds as wide as along the hind margin. Elytra sparsely or irregularly clothed with flavescent setae on the interstices, these setae in parts extending to the base, and with seven rows of punctures, which vary somewhat in coarseness and also as to their closeness to one another in the striae.

Length 4–5 mm.

This species should be placed after *H. hirtellus* and *H. kauaiensis*, from which it differs remarkably in the bare thorax and in many other respects. Compared with those of the former, its eyes are very large, and this appears to be its most remarkable character.

Hab.—Mount Olympus, near Honolulu; bred from mines in *Elaphoglossum* by Mr. O. H. Swezey, as recorded by him previously (Proc. Haw. Ent. Soc., II, p. 210, 1913).*

Proterhinus moribundus sp. n.

Black, the antennae sometimes more or less rufescent, the legs, or at least the tibiae, generally so.

Basal joint of antennae very large, long and stout, subtriangular, as long as the next two together, the second joint being short and stout, the ninth somewhat larger than the eighth, but much smaller than the tenth. Pronotum globose, clothed with golden scales and for a large part covered with a dense patch of silvery squamosity. Elytra with the humeral angles distinct or a little produced, clothed like the pronotum with golden scales, but with more or less numerous spots of denser silvery squamosity and sparsely set with short, erect, white setae, the scutellar region bare. The femora are very stout and bear erect white setae, like those on the tibiae.

Length about 2.5 mm.

Hab.—Molokai, on the red-flowered native cotton tree.

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*Recently Mr. Swezey has bred this weevil from the same ferns at Punaluu, N.W. Koolau Mountains.—Ed.

Notes on the Hen Flea ("Echidnophaga gallinacea" Westw.)*

BY J. F. ILLINGWORTH.

[Presented at May Meeting.]

Recently an abundant infestation of my chickens led me to examine rather carefully the habits of this troublesome insect. As I reported at last meeting, I first discovered the larvae were being destroyed by our predaceous ant *(Pheidole megacephala)*. I found the dry dust which I kept on the roosting board swarming with the immature stages of this flea. I at once removed the dust and washed down the boards with the hose. Next morning the whole surface of the roosts was thickly covered with the eggs which had dropped, during the night, from the fleas on the hens. I washed down the roosting board daily, and found that the number of eggs deposited at night grew less and less. Within two weeks the adult fleas on the hens had practically disappeared.

Quantities of the newly laid eggs were collected in vials and the life history followed. The incubation period was very easy to determine, since fleas placed in the vials deposited eggs at once.

Some difficulty was at first experienced in feeding the larvae. Examining the attached fleas, I found that the blood from the hen was rapidly passing through them and being dropped in the form of small pellets of coagulated blood. I had already noticed that the food in the stomach of the larvae, collected on the roosting board, showed through the skin, a dark-red color; and had noted that other species of fleas were thought to feed upon this excrement of the parents. In the vials containing these dry pellets of blood mixed with the dust I was able to easily trace the entire development.

The larvae when ready to pupate became quite white, with the alimentary canal empty and the body stored with fat. The cocoon, made of the finest silk, is very thin, but serves

*This and the two following short papers were inadvertently overlooked when the copy went to the printers. The omission was not discovered until after the forms were made up, and so they are placed here, as they could not be inserted in proper chronological position.—Ed.

to hold together the particles of soil. Where the cocoons were made on the sides of the vials I was able to see through the thin web and note the transformations inside. The following gives a brief summary of the various stages:

March 7th	March 11th	March 17th	March 20th	March 25th	March 28th	March 29th
egg laid	Hatched	Pupaecell formed	Pupated	Pupae slightly dark color	Pupae very dark color	emerged

This makes a total of 22 days from egg to adult; other records gave from 21 to 26 days, hence the life cycle is about 3 or 4 weeks.

ACTIVITY OF ADULTS.

Fleas that emerged April 15th were put into a large glass jar with a young rooster. A careful chart was made of the top of the head, showing the distribution and sex of each of the fleas. It was found that the males move about during the night, being attached in different positions each morning—usually near females. They began dying after 2 days and at the end of 6 days all were dead—many of them in situ, with their beaks attached to the skin. The females, unless disturbed, remained attached in their original positions. After 18 days the first one died a natural death. The others died from three to four weeks after emergence, and a single female lived 40 days, producing eggs up to the time of her death, and, upon dissection, the ovaries were found to contain numerous developing ovules.

EGG LAYING.

Gelatin capsules were attached over several of the females to determine their egg-records. It was found that most of the eggs were laid at night,— under favorable conditions as many as 40 being deposited, while during the day only 2 or 3 were produced. Another interesting observation was that the females with males located near them laid many more eggs, and that their record dropped off decidedly, after 2 days, if the males were removed. Experiments were tried of introducing new males with females that had ceased laying, and it was found that they at once began laying again — producing from 24 to 32 eggs during the next night.

ABUNDANCE OF FLEAS.

To get some idea of the number of fleas in the soil of an infested henhouse, half a pint of the dry dirt from the floor was placed in a glass jar and the fleas were removed as fast as they emerged. The experiment was concluded at the end of about three weeks, with a total of 1,027.

RESISTANCE OF THE NEWLY-EMERGED FLEAS.

In order to determine how long the fleas can live in the dry soil, without a host, they were placed in open glass jars, after emerging, and left until they died. It was found that most of them lived for over a week, and many of them much longer, some continuing for 30 days.

In no case were eggs produced by the fleas before feeding upon blood. It is also interesting to note that though the females are very resistant before finding a host, they quickly succumb if removed after they have once fed upon blood, dying within a day or two. The males, on the other hand, are not disturbed by removal from the host, and actually live longer than they do while actively mating.

A New Cockroach to the Hawaiian Islands

(*Holocompsa fulva* Burmeister.)

BY J. F. ILLINGWORTH.

[Presented at November Meeting.]

At a previous meeting I reported finding a tiny roach in the sphagnum moss which was used for packing the large roaches (*Rhyparobia maderae*), which Bro. Matthias Newell sent from Hilo, Hawaii, on November 14, 1914.

This adult specimen resembled so closely the new-born young of the large species that I did not discover the difference for some days after they arrived. It lived for several months in the jar with the numerous specimens of the large species, feeding upon bread, bits of cooked meat, and insect remains, but was finally attacked by ants *(Pheidole megacephala)* and succumbed.

I classified the specimen as above, in Brunner's Nouveau Systeme des Blattaires, p. 348, and sent it to Professor Lawrence Bruner for verification, since the original was named from Africa. Professor Bruner writes:

"I have gone over the specimen somewhat carefully and find that you have very evidently placed the insect in *Holocompsa fulva* Burm. It is either this insect or a very closely related species. There have been two other species described that I do not happen to have the description of at present. One of these came from the South Sea islands, the other from Africa. The South Sea island species, I believe, was considerably larger than the present, hence I do not imagine that either of them could be the insect now being considered."

Notes on Life History of "Dermestes cadaverinus" Fab.

BY J. F. ILLINGWORTH.

[Presented at November Meeting.]

Recently (September 9, 1915) a collection of the large cockroaches *(Rhyparobia maderae)* which I had drying was attacked by these insects. Each morning I found a number of the beetles hidden away under the pinned roaches. Apparently the life history of this species has not been published, unless in one of the early European publications which is not available.

OCCURRENCE IN THE UNITED STATES.

Dr. Horace J. Jayne, in his paper "A Revision of the Dermestidae of the United States" (Proc. Amer. Philosophical Soc. Vol. XX, p. 353, 1883), records this species as occurring in Florida. A second reference by F. H. Chittenden, "Injurious Occurrence of an Exotic Dermestid in the United States" (U. S. Bur. Ent., Bul. n. s. No. 38, pp. 96–97), notes several attacks by this insect on silk cocoons, reel silk, and leather in the vicinity of New York. The dried infested silkworm cocoons had been imported from Shanghai, China.

The only other reference that I have located is by W. W. Froggatt, "Insects Infesting Woolen Tops" (Agr. Gaz. N. S. Wales, 23, p. 900, 1912). The author states that a consignment of woolen tops was found to be damaged by the cosmopolitan skin weevil *(Dermestes cadaverinus)*.

A number of the very young larvae of this species were found on the drying roaches September 13, 1915; these were placed in separate Syracuse watch-glasses and fed upon the remains of the damaged roaches. The development was very rapid, with this abundant food supply, and the early instars lasted only two or three days. As shown in the following table, the larval period consists of seven instars, and varies from twenty-eight to forty-one days; the pupal instar was very constant — nine days.

LARVAL AND PUPAL INSTARS.

Since the literature gives the larval period of other Dermestids as lasting from five to forty or more months, it is interesting to note the rapid development of this species under sub-tropical conditions.

The larvae of this species were never observed to eat their own skins and they do not destroy one another. Both larvae and beetles have the habit of feigning death when first disturbed.

Sharp (Cambridge Natural History, Vol. VI, p. 241, 1909), states that Dermestids pupate in the larval skin, but the species here studied invariably shed the last larval skin and showed the typical pupal characters of beetles.

LARVAL AND PUPAL INSTARS

Larvae	Hatched	2nd Instar	3rd Instar	4th Instar	5th Instar	6th Instar	7th Instar	Pupal Instar	Adult
No. 1.....	Sept. 7	Sept. 10	Sept. 13	Sept. 15	Sept. 17	Sept. 19	Sept. 22	Oct. 8	Oct. 17
No. 2.....	" 7	" 10	" 13	" 15	" 16	" 19	" 22	" 5	" 14
No. 3.....	" 7	" 10	" 13	" 15	" 17	" 19	" 22	" 8	" 17
No. 4.....	" 7	" 10	" 13	" 15	" 17	" 19	" 21	" 18	" 27
No. 5.....	" 10	" 13	" 15	" 17	" 19	" 22	" 27	" 21	" 30
No. 6.....	" 13	" 16	" 19	" 21	" 27	" 30	Oct. 3	" 21	" 30

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PARADISE-PACIFIC PRIN

Vol. III., No. 4. May, 1917.

PROCEEDINGS

OF THE

HAWAIIAN ENTOMOLOGICAL SOCIETY

FOR THE YEAR 1916

HONOLULU, HAWAII
Price 50 Cents

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All correspondence should be addressed to the Secretary, Hawaiian Entomological Society, Experiment Station, H. S. P. A., Honolulu, Hawaii, from whom copies of the Proceedings may be purchased.

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PARADISE-PACIFIC PRINT.

PROCEEDINGS

OF THE

Hawaiian Entomological Society

Vol. III, No. 4. For the Year 1916. May, 1917.

JANUARY 6th, 1916.

The one hundred twenty-fourth meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Bryan, Ehrhorn, Mant, Pemberton, and Swezey.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Mr. Bridwell exhibited specimens and related interesting observations made on a number of rare, strange, beautiful, or otherwise interesting insects from Australia and Africa:

Stigmodera.—A box of specimens exhibited, containing many species of this Buprestid genus. About 300 species of the genus are known in Australia, of great variety as regards size, coloration, etc. About 70 species are found in the vicinity of Sydney, being usually taken on flowers, particularly *Leptospermum* and *Angophora*. The genus is under revision by Mr. H. J. Carter of Sydney and will be split up, several sections deserving separation. Five species of the characteristic African genus *Julodis* and a specimen of *Cyria imperialis* from Sydney where it is commonly found on the foliage of *Banksia*.

Psychopsis newmani.—A bred specimen of this rare moth-like Neuropteron was exhibited. *Psychopsis* has been included in the Hemerobiidae, but Mr. R. J. Tillyard of Sydney, whose remarkable work in Neuroptera and Odonata is clearing up the affinities of many of the groups, considers the genus as forming a distinct archaic family. He has been the first to study its life-history and to trace the development of its venation.

Thynnidae.—He exhibited a box of Australian *Thynnidae* collected in the Moreton Bay district of Queensland and near Sydney.

Rophalomutilla clavicornis.—A Mutillid, so determined by Dr. L. Peringuey of the South African Museum, was taken while visiting glands on the foliage of a malvaceous weed at Oloke Meji, Nigeria. The male carries the female in copula much as do the male *Thynnidae.*

Synagris cornuta.—A pair of this large Eumenid wasp and three of its mud nests were exhibited.

Chitinization.—Mr. Bridwell made some remarks on the chitinization of bees and flies, to the effect that it does not take place fully in many cases until the recently emerged adult has fed. In many other cases chitinization is completed without feeding.

Chinese Thrush.—Prof. Bryan announced the death of the Chinese thrush which he had had in a cage since last May, experimenting on its food habits, it having been captured in a rat trap. It would not eat papaia or figs, nor oranges except when they were cut open. It ate any kind of insect which was offered it, also centipedes and scorpions, but would not eat wood-lice. It was fond of the common garden snail, but did not eat the native snail from the mountains even when broken open for it. As a regulation ration it took a preparation made by mixing raw eggs with puffed rice and drying it. These feeding experiments indicate that the bird is insectivorous and therefore to be considered as beneficial.

Cephalonomia sp.—Mr. Swezey reported finding this Bethylid, Jan. 4th, in a package of seeded Muscatel raisins, where it was breeding on the larvae of *Silvanus surinamensis.* A male and female were found, and 23 cocoons on the surface of the raisins where the host larvae had been feeding. Two larvae were also found on their respective host larvae. The cocoons were retained to obtain a further supply of specimens of the parasite. A related insect, *Neoscleroderma* (*Ateleopterus*) *tarsalis* Ashm., was reported by Ashmead similarly breeding on the same host in raisins.

Notes on Synagris.

BY J. C. BRIDWELL.

The genus *Synagris* is a characteristic Ethiopian genus of wasps of which three species were taken at Oloke Meji, Nigeria (*S. cornuta* Linne, *S. sicheliana* Saussure and *S. amplissima* Kohl).

Of these the most abundant was *S. cornuta*. This species and *S. sicheliana* were commonly found visiting the large pea-like flowers of a species of *Crotalaria*, their long tongues enabling them to secure the nectar concealed within.

The male of *S. cornuta* is remarkable for the peculiar antler-like process developed on the base of the mandibles and projecting forward about four times the length of the mandible. In some individuals this is much more feebly developed and less than twice the length of the mandible and in others still it is represented only by a tubercle. In *S. amplissima* the male typically bears a pair of long projecting horns on the posterior margin of the second sternite, absent however in some individuals. Peculiar male secondary sexual characters abound in the genus and are frequently absent in individual males.

The females of the genus have great powers of stinging and are not at all loath to employ them. The males share with the males of *Monobia quadridens* of North America the unusual power of inflicting a real sting, the male genitalia terminating in sharp slender spines capable of piercing the human skin and producing a distinct painful sting.

The nests are made of mud-cells arranged in a single layer on the underside of green leaves or in sheltered positions on large stones. One nest was made up of five cells. The cells are not closed until the larva is full grown and ready to pupate. Since none of the cells examined contained insect remains the larvae are apparently fed by the mother either on insect juices or possibly on nectar.

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A Note on an Epyris and Its Prey.

BY J. C. BRIDWELL.

Haliday in 1834 reported an unknown *Bethylus* dragging about a lepidopterous larva with the apparent purpose of burying it. This observation has been looked on with a certain amount of suspicion particularly since the general parasitic habit of the Bethylidae has been recognized. He considered it as showing the fossorial relations of the Bethylids. I am happy to be able to add a second case to his and cite analogous cases among the Scoliidae, the closest allies of the Bethylidae and with similar parasitic-predaceous habits.

In April, 1915, while collecting on the golf links of the Mowbray Golf Club on the sand flats east of Capetown, I observed a small black Hymenopteron dragging along between its jaws a small tenebrionid larva which was, however, several times larger than its captor. After watching it for a moment I captured it and its prey and mounted them together. Upon examination the wasp proved to be a species of *Epyris* apparently as yet undescribed.

In most cases I think the Bethylids find their prey in suitable locations, sting them and oviposit in them; and only in exceptional cases attempt to place them more suitably and this seems also to be the case with the Scoliidae. This would explain the rarity of such observations.

In 1859 Philip Henry Gosse published a little book called "Letters from Alabama (U. S.) Chiefly Relating to Natural History," which contains a number of original observations on our insects which have escaped the cataloguers. On pp. 120 and 121 will be found the following passage reproduced here on account of the scarcity of the book from which it is drawn and as showing such an exceptional case among the Scoliids.

"There is a hymenopterous fly (*Scolia quadrimaculata*) which I have seen here occasionally, in the paths of the forest, towards evening. It is shaped like a bee, but is vastly larger, deep black, with four large yellow spots on the abdomen, placed in the form of a square; the wings have in a high degree that brilliant violet reflection which is found in many species of this order; the legs are thickly clothed with coarse black hair. The first time I saw it, it was fluttering along the ground, half flying, half crawling, carrying the larva of a lamellicorn beetle in its mouth, as big and as long as my little finger, indeed much larger and heavier than itself; I was told that it is in the habit of burying these in the ground. Doubtless, like many other similar insects, it stupefies the larva, without killing it, and then lays its egg in the hole with it, so that the young, as soon as hatched, finds its food thus ready prepared for it. The insect is somewhat clumsy in its motions, even when unincumbered; sometimes fluttering along the ground, thus, a few inches at a time, so slowly as to be readily caught, at other times flying fairly enough, but with a heavy, lumbering flight. I do not believe that it is poisonous or if it is, that it readily exerts its powers."

It is probably only exceptionally that the *Scolia* (better known in our lists as an *Elis*) would have occasion to bury its prey or to transfer it from place to place.

Forbes has reported *Tiphia* burying exposed *Lachnosterna* larva (Illinois Expt. Sta. Bull. 118, and 24th Rept. Ill. State Ent., p. 159, 1908).

Notes on the Thynnidae.

BY J. C. BRIDWELL.

The Thynnidae are a family of Scolioid wasps presenting several points of great interest. They combine extreme specialization due to parasitic habits with archaic characters retained in but few Aculeate Hymenoptera. The incomplete fusion of the thorax in both sexes with the pronotum and propodeum movable upon the mesonotum and metanotum, is a character of extreme interest and so far as I can learn found in no other Aculeates. In many of the species the first cubital cell is distinctly divided so as to form four closed cubital cells. Both these characters seem to me extremely archaic. The males have exceptionally strong powers of flight while the

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females are wingless and in many cases have the mouth parts besides the mandibles largely atrophied.

The family is one of those whose distribution is of great interest and is a southern group. If we exclude *Methoca,* whose association with the family must be considered doubtful, the Thynnidae are represented in the northern hemisphere by two or three species from California and a single species is found in the Galapagos Islands. There have been no species as yet described from Africa tho in Capetown Dr. Peringuey showed me an authentic male Thynnid from South Africa. In South America, Chile, Argentine, and Southern Brazil, the family is abundantly represented. About 400 species are known from Australia, Papua and the adjacent island groups, being much more numerously represented in Southern Australia among the characteristic Australian fauna and flora than in the north, where the Malayan element is more abundant.

In Australia it is the dominant family among the Forsorial Hymenoptera, appearing more numerous in species and individuals than any other group.

Most of the species frequent flowers, particularly the Myrtaceous *Angophora* and *Leptospermum.*

Mr. Henry Hacker, the indefatigable entomologist of the Queensland Museum, guided the writer to his favorite collecting grounds around Brisbane and on Stradbroke Island in Moreton Bay, and kindly told him many interesting observations which he had made and enabled him to see for himself their behavior in the field.

The Thynnidae, according to Mr. Hacker's observations, are certainly subterranean in their breeding habits, for the females frequently come up out of the ground covered with mud. Like most Hymenoptera the males emerge first, in most species appearing in September and October, feeding at flowers and racing up and down footpaths in the forests and among bushes searching for the females. These when they emerge crawl up to the top of the grass, weeds or bushes and await the males there. When a male discovers a female he swoops down on her and according to Mr. Hacker's observations the female grasps him with her mandibles by the end of the abdomen or legs and accouplement is effected while in flight. The coupled pair visits flowers and apparently the male, in some cases at least, feeds the female.

No reliable observations appear to have been published in regard to the breeding habits of any of the species, tho one published note credits one species with dragging a cricket about. This, however, appears to be a mistake. Mr. Rowland E. Turner, who has monographed the species and has collected them extensively, suggests that they may be parasitic on other Aculeate Hymenoptera after the manner of the Mutillidae. It would, however, be difficult to find Aculeates enough of the size necessary to provide food for the numerous species of the size of *Thynnus apterus* and abundant enough to account for the great numbers of them which are to be found. The great number of species to be found in a locality greater than the number of abundant species of Aculeates appears also to negative this view. To the writer it seems more likely that the larvae of Scarabaeid and Rhyncophorous beetles furnish them with prey. The larvae of both groups are nearly enough alike to serve as the prey of such a compact group where we would expect community of habits. If the group has community of habits there is no other source for prey for the group than the grubs of these beetles, which are largely subterranean, numerous enough in species and in individuals, and with differences enough in size to provide for all the species of Thynnidae. The affinities of the Thynnidae are also with the Scoliid wasps such as *Plesia* and *Myzine* which attack *Scarabaeidae* rather than with the Mutillidae with their usual habits of parasitism on other Hymenoptera.

We await with great interest a series of life-history studies in this group from some of our capable Australian entomologists.

Regeneration in Cockroaches.

BY J. F. ILLINGWORTH.

While carrying on life history work with our Hawaiian cockroaches I was interested in noting the rapid replacement of lost appendages, etc. Eight of our species have been observed.

Usually, if a leg is broken off beyond the trochanter, soon after molting, the appendage is renewed at the next molt, which occurs in a month or six weeks. If the injury happens shortly before molting the parts are not renewed until the succeeding molt.

In catching roaches they often lose some parts of the legs and it was observed that these appendages never break off above the trochanter. Experiments were tried of cutting off the trochanter and in some cases the entire leg, next to the body. In each case, where the victim survived, the wound soon scarred over and became heavily chitinized, but regeneration Apparently the renewing cells are located in the proximal segments of the leg.

The antennae, also, have the power of renewing, even when cut off close to the head. At the first molt only a few segments appear, but if molting continues they are soon of their normal length.

It is interesting to note that when the tarsi are renewed. they lack the fourth segment, in every case observed. This apparently accounts for many roaches having only four tarsal segments on part of the legs.

FEBRUARY 3RD, 1916.

The one hundred twenty-fifth meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Back, Bridwell, Ehrhorn, Giffard, Kuhns, Pemberton, and Swezey and Mr. P. H. Timberlake, visitor.

Minutes of previous meeting read and approved.

Mr. Swezey proposed the name of Mr. P. H. Timberlake for active membership in the Society.

NOTES AND EXHIBITIONS.

Halobates sp.—Mr. Pemberton reported finding this bug in hundreds at Waikiki beach, January 19th. It was during a "Kona" storm. They were in foot-prints in the sand. None were to be found the following day.

Lucilia dux.—Mr. Kuhns exhibited specimens of this fly reared from maggots found floating in large numbers on the surface of the water of Pearl Harbor, January 16th. He inferred that they must have been washed in from some dead animal on the beach. There had been much rain and high water which would have made this possible.

Chrysopa microphya.—Mr. Ehrhorn exhibited a cocoon of this lace-wing fly made beneath an empty pupa of a lady-beetle on an avocado leaf.

Pseudococcus lounsburyi.—Mr. Ehrhorn exhibited this mealybug on bulbs of *Zepharanthus,* and reported it as occurring also on bulbs of *Crinum,* the spider lily, and other such plants. It was first recorded in Africa on *Agapanthus.*

Araucaria aphid.—Mr. Timberlake exhibited a mounted specimen of an aphid found abundant on tips of young shoots of *Araucaria* in Kapiolani Park, January 30th. It was apparently a species not previously observed here, as it is not in Fullaway's catalogue of the Aphididæ of Hawaii.

Delphacids from Kilauea.—Mr. Giffard reported having collected a considerable number of Delphacids at Kilauea, Hawaii, on trips made in October, 1915, and January, 1916. Enough material was obtained to add largely to our knowledge of this family as regards number of species, food-plants, seasonal occurrence, etc.

Mr. Bridwell made the following exhibits with remarks on the same:

Houseflies.—Several species of *Musca* reared from cow dung in Africa and Australia, some of which resemble the housefly and are distinguished from it with difficulty.

Dolichurus n. sp.—In a nest in a plant stem were found two roach nymphs, on one of which a larva was feeding. It ate both roaches and spun up in May. The adult emerged in September and proved to be this fossorial wasp of the family Ampulicidæ. It was taken near the Rhodes' monument in Cape Town.

Quartinia capensis.—This, and five new species of the same genus, which are the smallest known Vespoid wasps.

Neuroptera.—Specimens of the largest known antlion and the smallest known *Mantispa*, and other interesting Neuroptera.

Paropsis.—A number of species of this Chrysomelid genus, which has 200 to 300 species in Australia.

Lycus.—Several species of this genus of Lampyridae from Nigeria.

Xylocopa.—Several interesting species of these carpenter bees from Africa.

Dryotribus mimeticus.—Professor Illingworth exhibited specimens of this weevil. He had collected three or four dozen under a log on the beach at Koko Head, August, 1915.

MARCH 2ND, 1916.

The one hundred twenty-sixth meeting was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Giffard, Mant, Swezey and Timberlake.

Minutes of previous meeting read and approved.

Mr. P. H. Timberlake elected to active membership.

NOTES AND EXHIBITIONS.

Hemiteles variegatus.—Mr. Ehrhorn reported having reared this parasite from the *Chrysopa microphya* cocoon exhibited by him at the previous meeting.

Mr. Bridwell made the following exhibits with remarks thereon:

Allodape and Exoneura.—Specimens of these African and Australian bees and notes on their habits.

Australian Buprestids.—Specimens illustrating extremes in size. A species of *Stigmodera* was about two inches in length, while *Germaria casuarinae* was only about one-eighth of an inch.

Agriotypus sp.—A single specimen collected by Mr. F. Muir at Okitsu, Japan. It belongs to a family containing but one described species, *Agriotypus armatus* of Europe, which is parasitic on caddis-fly larvae.

A common cricket caught on the barbs of a grass head, *Cenchrus echinatus*, and still alive.

Odonaspis ruthae.—Mr. Ehrhorn called attention to Mr. Kotinsky's description of this scale insect in Proceedings of the Entomological Society of Washington, XVII, p. 101, figs. 1 & 2, 1915.

Pinaspis buxi.—Mr. Ehrhorn stated that this scale is one of those that has been known here as *Fiorina fiorinae* until a recent determination by Mr. Sasscer.

Curculionids.—Mr. Swezey exhibited the following species of weevils collected by Mr. Giffard on Oahu:

Deinocossonus nesiotes var. *oahuensis.*
Pentarthrum obscurum.
Orothreptes callithrix.
Calandra remota.—Originally collected in banana stems, but recently a specimen was taken in beating "ieie" vines.

No one has collected specimens of these species in recent years except Mr. Giffard.

Mr. Giffard mentioned the use of acetic ether in keeping freshly caught insects relaxed for a long time till convenient to mount them. A general discussion of this and other methods of handling specimens followed.

Notes on Two Species of Hawaiian Diptera.

BY J. F. ILLINGWORTH.

The student of diptera has a rich field in Hawaii. Many of the native species are apparently new; and the literature of the Islands, often, hardly mentions some introduced fly which is very abundant. The latter is the case with the two species recorded in this paper.

Brachydeutera argentata Walk.

Hab. Southern United States as far as Kansas; Cuba, Brazil, Bolivia, and Paraguay.

Hawaiian records. First specimen obtained by Dr. Perkins at Olaa, Hawaii, July, 1895. Dr. Howard, Oct. 1900, records three specimens from Hawaii, and a single specimen was taken in the Iao Valley, Maui, Sept. 1901.

Of the specimens in collections, the Hawaiian Sugar Planters' Association has two specimens taken on Molokai, 1907, and four at Waikiki, 1906 and 1907. The College of Hawaii collection has one specimen, 1911, and five specimens, 1914.

The indication would be that these flies are rare, but I found them exceedingly abundant, after the recent heavy rains, both at the College of Hawaii and along the Palolo stream. Those at the College were found under the insectary, in the water basins, which had not been cleaned out for some time. The water was brown in color, and had considerable leaf-trash in the bottom.

These flies, as is characteristic of the family, have a waterproof coat and run about freely upon the surface.

Habits of larvae: The larvae are able to remain submerged for indefinite periods, while feeding, but as soon as they finish they rise and apply their caudal spiracles to the surface of the water, where they hang motionless. The food is apparently the same as that eaten by mosquito larvae. They were observed eating the remains of a sowbug which was decaying in the bottom, and they could constantly be seen browsing upon the microscopic algae that covered the sides of the jar and the submerged leaves. They fed peaceably, side by side, with the mosquitoes, which swarmed in the same water.

Pupae: The outer coat of the full-grown larva hardens into the puparium, with slight change in form, except that a pair of prominent horns terminate the cephalic portion. At this stage they become very buoyant and float in masses or lodge at the edges of the vessel.

Professor J. M. Aldrich gives an interesting account* of the use of the puparia of closely related flies for food by the Indians of the Western United States.

Fannia (Homalomyia) pusio (Wiedemann).†

Hab. South America, ranging north through West Indies into Southern United States.

Hawaiian records. The collection of the Hawaiian Sugar Planters' Association has seven specimens taken in Honolulu from 1904 to 1907, also two specimens from Hawaii, 1905. There are no specimens in the College of Hawaii collected previous to 1914.

Food habits of larvae: The specimens in the collections of Honolulu show that they have been reared from meat, papaia stem, and dead Japanese beetles by Mr. Terry; and from soured bread, dead cockroaches and chicken manure by the writer. The latter substance was swarming with them.

Eggs: The eggs are white, beautifully sculptured, and have a median ridge above and a pair of lateral wings which extend the entire length. They are laid in great numbers upon the surface of the food supply.

Larvae: The larvae, when freed from the substance in which they are feeding, are beautiful objects. They are brown in color and bear two prominent rows of fringed appendages, which extend along the sides and around the caudal border. A

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* Journn. N. Y. Ent. Soc. XX, 90-92.

† The species has been determined by Frederick Knab, of the U. S. National Museum, who states that it was described from South America, and is evidently widely distributed.

pair of slender appendages, also, project from the cephalic border.

Pupa: To pupate the mature larvae crawl out of the food substance, seeking a dry place to hibernate. They do not pass through any material change in form, but simply dry, contracting somewhat. The period of development resembles very closely that of the ordinary housefly.

The adult flies are very commonly taken about the flowers of the algaroba.

APRIL 6TH, 1916.

The one hundred twenty-seventh meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Bryan, Ehrhorn, Giffard, Kuhns, Muir, Pemberton, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Diptera determinations.—Mr. Swezey exhibited specimens of six species of flies which had recently been determined for him by Mr. F. Knab at the U. S. National Museum, from specimens sent to him.

Sciapus pachygyna Macq.—A Dolichopodid that is common in the cane fields on Hawaii. Originally described from Australia.

Ophyra nigra Wied.—A very common black Anthomyid. Described from China and widely distributed in the Orient.

Scholastes bimaculatus Hendel.—The coconut fly (*Paragorgopsis?*) mentioned in Proc. Haw. Ent. Soc. III, p. 70, 1915. Now and then a specimen is taken on windows in Honolulu. Described from Fiji.

Lynchia maura Bigot.—The pigeon fly, which is now very abundant on pigeons in Honolulu. For notes on its occurrence here see Proc. Haw. Ent. Soc., II, p. 188, 1912, and II, p. 206, 1913. Common in the Mediterranean region; also widely distributed through the warmer parts of America.

Chrysomyia dux Esch.

Lucilia sericata Meig.—The two latter are green bottle flies and were determined by Dr. C. H. T. Townsend.

Hippoboscid.—Professor Bryan mentioned having taken a large species from a man-o'-war bird at Moku Manu or Bird Island, off windward Oahu.

Dictyophorodelphax mirabilis.—Mr. Timberlake mentioned having collected a single adult of this remarkable Delphacid, from *Pittosporum*, on the ridge leading up from Alewa Heights to Lanihuli. Mr. Bridwell also secured a specimen from the same tree. This is the first record of the collecting of this insect anywhere except at the original locality on the Kaumuohona ridge near the base of Mt. Konahuanui.

A New Anthribid.—Mr. Timberlake exhibited a small Anthribid with long antennae, of which he had collected several specimens recently in Honolulu. A species not as yet determined or recorded, though Dr. Perkins has stated in the Introduction to *The Fauna Hawaiiensis* that one or two recently introduced species have been observed in Honolulu. In this connection, Mr. Ehrhorn discussed the collecting of rare insects in large numbers, at times, or special occasions, and related how Mr. Fuchs of California was accustomed to return to localities where he had on former occasions taken rare or interesting insects. Other members related incidents of unexpectedly taking a large number of specimens of some hitherto rare species.

Trypoxylon bicolor.—Mr. Bridwell reported having bred this wasp from cells found in rotten wood of *Pisonia*, on Tantalus.

Heteropoda regia.—Mr. Pemberton reported having observed a female spider of this species make her egg-sac, which she carried with her until the eggs hatched. It was 35 days, and she would not eat anything in all this time. When the 530 young spiders hatched, no cannibalism was observed among them. On the day that she dropped the empty egg-sac, the female broke her long fast by eating a cockroach.

Telespiza ultima.—Professor Bryan said that he had for a time entertained suspicions of there being a new bird on Nihoa, a small island about 200 miles beyond Kauai, and was much elated when Captain Brown of the U. S. revenue cutter "Thetis" brought him five specimens which he had secured on his last trip to the island. It is related to the Laysan Island canary, and Professor Bryan has described it as *Telespiza ultima*.

Clerada Apicicornis Sucking Blood. (Hemip.).

BY J. F. ILLINGWORTH.

This predaceous bug is commonly found about buildings; and there has been some question as to its feeding habits. Kirkaldy suspected that it fed on *Lepisma* and small Blattids, and Dr. Perkins saw a specimen feeding on a dead roach.

These insects, in all stages, are often very common in the piles of dry wood in the shops of the College. I have never found them numerous in the house, but from time to time we find individuals. Upon two occasions we have taken them in the beds; and, just recently, I caught an adult, full of blood, upon one of the sleeping children. The place bitten was red and resembled a flea-bite.

Habitat: The Fauna Hawaiiensis gives the distribution of this species: Réunion, Celebes, Bengal, Cuba, St. Thomas, Venezuela, etc.; also, a note that it was taken by beating dead branches of a species of palm in mountain forests, on Oahu.

Webbing Clothes Moth Predaceous.

BY J. F. ILLINGWORTH.

Recently the brushes at the College of Hawaii were found to be badly eaten by the webbing clothes moth (*Tineola bisselliella* Hummel). The brushes had been purchased a year previously in the East.

The naked, full-grown larvae were collected and placed in a test-tube, with bits of tissue paper, so that they might pupate. Several cocoons with almost-mature pupae were put in with them. Having no other food, the larvae dug into these cocoons, during the night, and ate the living pupae, before they spun-up themselves.

MAY 4TH, 1916.

The one hundred twenty-eighth meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Kuhns, Mant, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Eupelmus sp.—Mr. Bridwell exhibited a very large species similar to a species bred by Mr. Swezey previously from *Aristotelia* sp. in galls on stem of *Gouldia*.

Aegosoma reflexum.—A specimen exhibited by Mr. Bridwell, which he had bred from a large pupa found in dead ohia wood on the main ridge back of Palolo Valley. This large Prionid has seldom been taken on Oahu, it being more common on Hawaii.

Nesocrabro stygius.—A nest of this wasp was found by Mr. Bridwell in fallen wood on the ground. It was provisioned with *Discritomyia* flies. Dr. Perkins has given the habit of this wasp as nesting in the ground.

Nesomimesa antennata.—Mr. Bridwell recorded the finding of this wasp nesting in cavities in the dead stem of *Erigeron*. Previously recorded by Dr. Perkins as nesting in the ground.

Psammochares luctuosus.—A cocoon of this Pompilid was found by Mr. Bridwell in rotten wood at about 1,500 feet elevation in the mountains. It has been known as usually nesting in the ground. The opinion was expressed that perhaps unusually wet conditions of the ground had caused the unusual nesting of these wasps.

Heteramphus swezeyi.—A freshly formed adult of this weevil was exhibited by Mr. Bridwell. It had emerged from a pupa found in the mine formed by its larva in the frond of *Elaphoglossum* on Waialae-Nui ridge, April 30, 1916.

Omiodes blackburni.—Professor Illingworth reported finding large numbers of the palm leaf-roller killed by wilt disease.

Pteromalus puparum.—Mr. Ehrhorn inquired whether anyone had taken this insect. None had. Attempts at its introduction here had been made by both him and Mr. Koebele.

Attagenus plebius.—Professor Illingworth reported this Dermestid abundant in clothing in trunks. He is working on its life history.

Smilax insects.—In dead stems of *Smilax* on Waialae-Nui ridge, April 30, Mr. Swezey found the following insects, which were exhibited:

Semnoprepia sp.—Larvae and empty pupae.

Oodemas sp.—Adult, larvae and pupae.

Anobiid.—Two adults, one freshly emerged.

Dromaeolus sp.—Larva.

Scleroderma sp.—Two females, one larva.

Eupelmus sp.—One larva feeding on *Oodemas* larva, one pupa from which an adult emerged May 11.

Notes on a Peregrine Bethylid.

BY J. C. BRIDWELL.

Additional species of immigrant Bethylidae are constantly appearing in the Hawaiian Islands. The present paper describes and gives a summary of our knowledge of the distribution of a recently discovered species of *Epyris,* the first authentic species of the genus taken here. Ashmead (Fauna Hawaiiensis I, p. 286, 1901) described an *Epyris hawaiiensis,* but in revising the genera of the family the Abbé Kieffer has referred the species to his newly established genus *Holepyris* (Ann. Soc. Scient. de Bruxelles 29:111, 1905).

The first adult of this new species was taken by Mr. Swezey on a sugar cane leaf in the Experiment Station grounds of the H. S. P. A. in Honolulu on October 27, 1915, and another on the window of his laboratory there on Nov. 12,

Proc. Haw. Ent. Soc. III, No. 4, May, 1917.

as reported in the present volume of these proceedings, pp. 222 and 223. Subsequently on Feb. 6, 1916, he took it upon the elevated coral reef east of Diamond Head. Early in April the writer found it abundant among the flowers and on the foliage of *klu* (*Acacia farnesiana*) and algeroba (*Prosopis juliflora*) along the road on the ocean side of Diamond Head. Mr. Swezey took it near Pearl City on Sept. 11; the writer found it among the grass on the Ewa coral plain below Sisal on Nov. 28; and Mr. Swezey on Jan. 17, 1917, in the cane-fields above Waipio. I found it in November, 1916, at the base of Koko Head crater under stones with Tenebrionid beetles. Mr. Fullaway informs me that Mr. Giffard and he have taken it in 1917 at the Nuuanu Pali.

In its behavior it is much like the smaller species of *Tiphia**. I have frequently seen it running about on the ground and in one case it entered the ground in an exploratory way thru a crevice. I believe it to be parasitic upon the larvae of some or all of our species of Tenebrionid beetles (*Alphitobius, Gonocephalum*, and *Blapstinus*) which are abundant in the areas where the wasp has been taken. So far as I can learn none of the species of *Epyris* have been bred but I have taken a smaller *Epyris* at Capetown carrying in its jaws a Tenbrionid larva larger than itself, and Mr. H. T. Osborn observed near Pearl City on Sept. 4, 1915, while searching for traces of *Tiphia* larvae on *Anomala* grubs, a Tenebrionid larva parasitized by an external Hymenopterous larva resembling that of *Tiphia*. This perished without transforming, but as we know no other wasp here to which the larva could well be assigned, I am convinced that he had the larva of our *Epyris* before its adult had been discovered.

The species corresponds to none of the North American species of *Epyris* described by Ashmead under *Mesitius* nor with the European forms so admirably described by the Abbé Kieffer. It is here described as new:

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* I am convinced that the association of this family with the Scolioid wasps and the Chrysididae is eminently natural and that any resemblance with the Serphoid (Proctotrypoid) forms is purely superficial.

Epyris extraneus sp. nov.

♀ Lenth, about 6mm. Black; mandibles yellowish; antennae largely, tegulae, femora more or less, tibiae and tarsi largely piceus.

Head square, sparsely punctate, shining; mandibles half the length of the head, swollen toward the apex, hirsute outwardly, a broad longitudinal margined groove beneath; emarginate within toward the middle, beyond this with one large denticle and three smaller ones, apex acute and bent down and inward, beneath and within the apex another denticle and a series of flat spinules; malar space almost absent; eyes glabrous, a third longer than their distance from the occipital margin of the head; hind ocelli a little less distant from the hind margin of the head than from each other or the anterior ocellus and about four or five times farther from the eye than from each other. Antennae tapering towards the apex and very finely pubescent, scape large, curved, hirsute, not quite as long as the four succeeding joints; joints two and three narrower and somewhat shorter than those succeeding which are sub-equal and a little longer than broad.

Pronotum a little longer than wide, broadening posteriorly where it attains the width of the head, with coarse sparse punctures. Mesonotum not half the length of the pronotum, impunctate except for a few small punctures on either side of the expanded portion of the parapsidal furrows, these expanded and slightly converging posteriorly, exterior furrows not percurrent, the three lobes subequal. Scutellum about as long as the mesonotum, subtriangular, impunctate, the basal pits broadly elliptical, arranged obliquely a little outside the ends of the parapsidal furrows, distant from each other about four times their length. Propodeum as long as the mesonotum and scutellum together, square, margined, with five longitudinal carinae, the outer carinae slightly converging behind, distant from the lateral margins, area outside the carinae finely transversely striate; declivous portion slightly concave, margined, finely transversely striate and divided by a shallow longitudinal furrow; sides of propodeum finely longitudinally striate.

Wings yellowish with the venation and stigma yellow; stigma oval; median cell broader than the submedian; the basal vein oblique, inserted at the base of the stigma; submedian cell longer than the median; transverse vein as long as the basal, arched, with a very slight trace of a vein arising from before its middle; radius twice as long as the basal, not attaining the apex of the wing by more than its own length.

Anterior femora greatly expanded and thickened, broader and longer than the other femora; anterior tibiae not particularly larger than the middles ones; middle tibiae spinose; anterior tarsi longer than their tibiae, the first four segments bearing long stout flattened obtuse spines on the outer margin and similar shorter spines beneath, the metatarsus as long as the next three joints together, these as broad as long.

♂ 4 to 5 mm. long. Slenderer than the female. Antennae black, longer than the head and thorax together; scape not longer nor much thicker than the third segment, which is about two and one-half times as long as wide; second antennal segment about one-half as long as wide, and narrower than the third; third and succeeding joints subequal, gradually tapering to the apex. Sculpture of head and thorax somewhat coarser and less sparse than in the female. Mouth parts and tarsi more yellowish than in the female. Mandibles obliquely truncate at the apex, with a strong and acute apical tooth, the truncation quadridenticulate, with the inner denticle somewhat produced. Anterior tarsi not appendiculate; middle tibiae not spinose.

Described from eleven females and eight males taken on Oahu at Diamond Head April, 1916, and four females from Koko Head November, 1916, (J. C. Bridwell).

Type, female and male, and paratypes in the entomological collection of the B. P. Bishop Museum of Polynesian Ethnology and Natural History, and paratypes in the author's collection.

Closely related to *Epyris armatitarsis* Kieffer from Tunis, the excellent description of which (Ann. Mus. Civ. Storia Nat. Genova (3) 1:399, 1904) has been followed in detail here. The principal difference appears to lie in the structure of the mandibles. It is probable, however, that there is less difference than appears in the descriptions on account of the difficulty in making out the peculiar structure of these distorted organs.

Notes on Dictyophorodelphax mirabilis.

BY J. C. BRIDWELL.

Among the Hawaiian insects *Dictyophorodelphax mirabilis* Swezey has been of particular interest on account of its peculiar form and limited distribution. Its enormously prolonged head is a peculiar development very rare among the Delphacids, and the genus appears to be an endemic development from the ordinary types of Delphacidae in the Islands.

Mr. Swezey has already described the nymphal forms as well as the adults. Until recently it had appeared to be confined to a single ridge of the Koolau mountains, but Mr. Timberlake has extended its known range to the ridge opposite its first discovered habitat, across the broad Nuuanu Valley, the most important dividing valley of the range.

Hitherto its food-plant has remained undetermined. It had been originally taken only in small numbers sweeping over the staghorn fern (*Gleichenia*) and other vegetation along the old native trail on the crest of Kaumuohona ridge. Mr. Timberlake and I had each taken a single male on *Pittosporum* on the Lanihuli ridge at about the same elevation as its original habitat.

On April 23, while collecting with Mr. Timberlake along the Castle trail, in returning we separated and I proceeded along the old ridge trail back to the Cooke trail descending into Nuuanu Valley, hoping to secure further material of this species of which even as yet only a few specimens had been taken, and perhaps to solve the problem of its food-plant. After a few strokes of the sweep-net over ferns and other low vegetation, four adults were seen in the net. For some time this process was continued, keeping in mind the plants swept over, and it soon became evident that aside from the common ferns and *Metrosideros*, the only possible food-plant among those swept would be *Euphorbia clusiaefolia*. The first plant examined disclosed one adult, and repeated examinations others both adults and nymphs. In one case a single leaf bore on its under side about a dozen individuals, including two or three nymphs. This leaf was placed in a glass tube and carried home. During the succeeding week one of the nymphs completed its transformations and the greater part of the individuals remained in a living condition until the leaf withered. In all about 50 individuals of the species were taken, being all found in the region where the host-plant was present.

Euphorbia clusiaefolia thus appears to be the proper host-plant for the species. This plant appears to be generally distributed along the lateral ridges back of Honolulu, though in no other place have I happened to find it so abundant as on this particular ridge. We may perhaps hope to extend our knowledge of the distribution of the species by a careful examination of the plant in other parts of its range.

JUNE 1st, 1916.

The one hundred twenty-ninth meeting was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Kuhns, Mant, Pemberton, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Psyllid parasite.—Mr. Timberlake exhibited specimens of a parasite bred from galls of a Psyllid (*Trioza iolani*) on ohia leaves brought in by Mr. Swezey, from a ridge back of Hauula; also from Waialae-Nui. The galls were numerous on the few leaves brought in, and about 50 of the parasites had bred out. It is a Eulophine thought to be near the genus *Sympiesis.*

Adelencyrtus kaalae Ashm.—Mr. Timberlake exhibited specimens collected in various places in the Islands, hosts unknown, and expressed the opinion that the species should be placed in some other genus.

Beetles in alfalfa meal.—Prof. Illingworth reported finding Clerid beetles breeding very abundantly in alfalfa meal. The larva were reddish.

Catorama mexicana.—Prof. Illingworth reported this beetle feeding in slippers.

Cerapachys silvestrii Wh.—Mr. Swezey exhibited specimens of this ant which he had found nesting in a compost heap at the Experiment Station grounds. This is the first time that it has been collected since its discovery at Hilo by Dr. Silvestri in 1908.

Aegosoma reflexum.—Mr. Bridwell reported that the beetle from his previously exhibited pupa finally became fully matured and hardened up.

Pseudococcus nipae.—Mr. Ehrhorn remarked on the usual scarcity of this mealybug, in several instances that had come under his observation it had entirely disappeared. Others mentioned similar observations.

Aramigus fulleri.—Mr. Kuhns reported that George Lucas had told him that this beetle was injuring the ferns in his fern-house.

Antonina indica.—Mr. Ehrhorn reported that Mr. Green in a recent letter had informed him that what has been known here as *Antonina boutelouae* is *A. indica.* This is the species on Bermuda grass.

JULY 6TH, 1916.

The one hundred thirtieth meeting was held in the usual place. In the absence of the President and Vice-President, the Secretary called the meeting to order and Mr. Fullaway was elected chairman for the meeting. Members present: Messrs. Bridwell, Ehrhorn, Fullaway, Kuhns, Pemberton, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Dictyophorodelphax mirabilis.—Mr. Timberlake exhibited a female of this Delphacid captured on *Euphorbia hillebrandi*, on Mt. Kaala, July 4th. Messrs. Swezey and Bridwell secured nymphs also from the same place. The range of this remarkable insect is thus widely extended, it having been collected previously only on ridges each side of Nuuanu Valley.

Callithmysus cristatus.—Mr. Timberlake exhibited three specimens of this Cerambycid taken at various places on Oahu. He also exhibited two other species, one of which was from Kaala and seemed to be different from any described species. Mr. Swezey exhibited a very large specimen of another *Callithmysus* or *Plagithmysus* taken also on Kaala and apparently being another new species.

Pachycrepoideus dubius.—Mr. Fullaway exhibited this Philippine Pteromalid which was introduced about two years ago and is now found to be established. Mr. Pemberton reported having bred it from *Ceratitis capitata* on seven occasions, and from at least three different localities.

Platymischoides sp.—Mr. Bridwell exhibited two species of wingless Diaprids of this genus, one collected on Mt. Olympus and the other on Mt. Kaala. He also exhibited two Dryinids collected in the mountains.

Proterhinus maurus.—Mr. Bridwell exhibited specimens of this very large *Proterhinus*, collected on *Suttonia lessertiana* on the main ridge at the head of Palolo valley on June 18 and July 2.

Rhyncogonus koebelei.—Mr. Bridwell exhibited three specimens of this weevil, collected by him on the tips of the branches of *Broussaisia*, on the Olympus trail, Palolo, June 18th. Mr. Kuhns remarked that he had always found this species on *Scaevola*.

Wingless Hemerobiid.—Mr. Bridwell reported having collected a few specimens on Mt. Kaala, July 4th.

Delphacids from Kaala.—Mr. Swezey reported having collected quite a number of species of these leafhoppers on Mt. Kaala, July 4th, two of which may be new species, being collected respectively on *Astelia* and *Gunnera*.

AUGUST 3RD, 1916.

The one hundred thirty-first meeting of the Society was held in the usual place. The President and Vice-President being absent, the Secretary called the meeting to order, after which Professor Bryan was elected chairman for the meeting. Members present: Messrs. Bridwell, Bryan, Fullaway, Ehrhorn, Mant, Osborn, Pemberton, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Nesosydne leahi.—Mr. Timberlake exhibited specimens of this Delphacid collected on *Lipochaeta* at Kuliouou, June 25th. A branch of the plant was brought in and several egg-parasites emerged from the leafhopper eggs therein—*Anagrus frequens* and *Polynema* (probably a new species). Very few leafhoppers hatched out. This leafhopper had not been collected on Oahu since the time that Kirkaldy collected it in Diamond Head crater at the time it was described. Mr. Swezey collected it at Waimea, Kauai, in February, 1915, where it was also found on *Lipochaeta*.

Oxacis collaris.—Mr. Bridwell called attention to the abundance of this Oedemerid beetle lately. He had collected them by the dozen at the lights at the Pawaa Junction waiting station. He said that Mr. Timberlake had also mentioned noticing them at lights at the Hotel Macdonald.

Distribution of insects per elevation.—Professor Bryan asked how the different members had found the distribution of insects to be influenced by the elevation. Mr. Swezey discussed this with regard to the Lepidoptera, showing that their distribution is chiefly influenced by the food-plant, whose distribution is in turn influenced by elevation, and depending on climatic conditions. Mr. Bridwell discussed the question as to Hymenoptera, especially wasps. The latter being limited by their habits of nesting, whether in the ground, in holes in rocks, in hollow stems or excavations in rotten wood. The selection of caterpillars by the species of *Odynerus* was discussed at some length. In the main they took whatever was available, although some species had favorites. Mr. Bridwell mentioned having observed a *Crabro* in California which had supplied its nest with Chalcids instead of flies as the species of that genus usually do. The nests were in galls on willow.

Chrysidid.—Mr. Ehrhorn reported this insect now quite abundant in Manoa Valley. He had observed one enter the open cell of a *Sceliphron* nest. Others reported having captured it lately. Mr. Swezey reported seeing one at Waipio the previous day. This is the farthest from Honolulu that it has been observed.

Cerapachys silvestrii.—Mr. Ehrhorn, experimenting on this ant, found that they clustered among aphids on *Purslane* in his breeding jar. They have a peculiar habit of carrying their larvae longitudinally underneath, between the legs.

Solenopsis geminata.—Mr. Fullaway reported finding the fire ant eating out the eggs of the melon fly in Manila. Mr. Osborn reported this ant as also eating out the eggs of the corn leafhopper in Manila.

SEPTEMBER 7TH, 1916.

The one hundred thirty-second meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Kuhns, Pemberton, Swezey, Timberlake, and W. H. Meinecke, visitor.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Neoexaireta spiniger.—Mr. Pemberton exhibited a specimen of this fly captured in Kona, Hawaii, where they were hovering about heaps of coffee pomace in which it was thought that the larvae were feeding. Other members mentioned rotten sugar cane, banana stems and other rotting vegetation as breeding-places of this fly.

Insects from the crater of Mauna Loa.—Mr. Meinecke exhibited insects collected by him, August 1st, in Mokuaweoweo, the crater of Mauna Loa, Hawaii. Some of them were on the rocks and some on snow. This was at an elevation of about 14,000 feet. They must have been carried to the place by air currents, it being a long distance and much higher than any possible breeding-places for any of them. Following is a list as determined by Mr. Swezey:

Hymenoptera

1 *Psammochares luctuosus* (Cr.)
6 *Bassus laetatorius* (Fab.)
3 *Limnerium blackburni* Cam.

Diptera

4 *Xanthogramma grandicorne* Macq.
1 *Sarcophaga pallinervis* Thoms.
2 *Frontina archippivora* Will.
4 of an undetermined species.

Lepidoptera

1 *Pontia rapae* (Linn.)
1 *Scotorythra rara* Butl.
2 *Eccoptocera foeterivorans* (Butl.)

Hemiptera

7 *Nysius delectus* White.

5 *Nysius coenosulus* White.

Myrmeleo wilsoni McL.—Mr. Meinecke exhibited several specimens of this ant-lion captured by him at a sandy place on the road at Pohakuloa, Hawaii, which was about five miles from the Humuula sheep station towards Waimea. He reported seeing them also on the road towards Waikee. Mr. Ehrhorn mentioned having seen them at Puuwaawaa, Hawaii, several years ago. Mr. Bridwell reported having seen in West Africa a swarm of ant-lions moving along. He also reported having found in Africa a Leptid fly of the genus *Vermileo* making pits similar to those of ant-lions.

Hawaiian Ophionidae.—Mr. Fullaway exhibited specimens of Mr. Giffard's collection of Ophionidae, illustrating the different genera: *Enicospilus, Pleuroneurophion, Athyreodon, Eremotyloides, Banchogastra,* and *Pycnophion.*

Enicospilus dispilus.—Mr. Bridwell mentioned having secured 17 specimens of this species on Lanihuli, Sept. 3rd. They were swarming together.

Egg-parasites of the corn leafhopper.—Mr. Fullaway reported having bred from corn leafhopper eggs, the parasites of the sugar cane leafhopper, *Paranagrus optabilis, Ootetrastichus beatus,* and a dark *Anagrus* besides. From cages of corn leafhopper parasite material brought by Mr. Osborn from the Philippines, he had bred a species of *Paranagrus,* a dark Mymarid and a dark species of *Ootetrastichus.*

Chrysidid.—Mr. Bridwell stated that he had found a cocoon of this insect in a *Sceliphron* nest under circumstances that demonstrated it to be a parasite of that wasp.

Notes on Life History of Attagenus Plebius Sharp.

BY J. F. ILLINGWORTH.

The very destructive habits of this Hawaiian household beetle first came to my attention several months ago, when I opened up two trunks, which had been stored for some time. Everything of animal origin was riddled. Since I am unable to find any notes on the habits or life history of this species, I have made a rather careful study of them.

DISTRIBUTION.

So far as I can learn, these beetles have not been found outside of the Hawaiian Islands. Sharp* named the species from specimens secured here, and remarks that they are found in houses in Honolulu. They are probably found on all of our islands, for we have specimens from Maui, and Mr. D. B. Kuhns tells me that they are a pest on the Island of Hawaii.

LIFE HISTORY.

After securing newly emerged beetles they were confined in a covered glass dish for thirty-six days before the first eggs and newly-hatched larvae were discovered upon the woolen cloth which had been supplied them together with dried insects for food. It was found that the larval period consists of seven instars, and varies slightly, probably due to the kind of food, etc. The pupal stage lasts from twelve to fourteen days. The periods of two of the individuals are given as typical of those under observation:

Larva Hatched	2nd Instar	3rd Instar	4th Instar	5th Instar	6th Instar	7th Instar	Pupal Instar	Adult Emerged	Total
Feb. 15, 1916	Feb. 26	Mar. 16	Mar. 30	May 4	May 19	June 5	July 8	July 20	156 Dys.
April 14, 1916	Apr. 24	May 12	May 24	June 8	June 20	July 15	Aug. 30	Sept. 11	150 Dys.

It is interesting to note the rapidity with which these insects develop under our tropical climate. Chittenden found that two years were required for the development of the closely-

* Trans. Royal Dublin Soc. Vol. III. Ser. II. 1885, p. 147.

Proc. Haw. Ent. Soc. III, No. 4, May, 1917.

related, black, carpet beetle (*Attagnus piceus*), in the United States.

CONTROL MEASURES.

Carbon bisulphide was used successfully in destroying the insects in the trunks, but the treatment had to be repeated after about two weeks, when some young larvae were again discovered. Possibly the eggs are not destroyed by the treatment, and this may account for the second appearance of the pest, unless the young larvae crawled in from the outside.

OCTOBER 5TH, 1916.

The one hundred thirty-third meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Giffard, Kuhns, Pemberton, Swezey and Timberlake.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Diachus auratus.—Mr. Fullaway exhibited a specimen of this American Chrysomelid beetle from the Board of Agriculture collection, collected by Mr. J. Kotinsky, at Waianae in 1909. The earliest previous record of its occurrence was 1913,* collected by Mr. Swezey in Honolulu and also in Honolulu Plantation above Pearl City, at which time specimens were sent to Dr. Van Dyke for determination.

Lithurgus albofimbriatus.—Mr. Bridwell reported his first capture of this bee in September on morning glory blossoms at Black Point, east of Diamond Head.

Mezium sp.—Mr. Bridwell reported finding this peculiar Ptinid beetle numerous in sparrow nests in a cave-like excavation at the side of the Diamond Head road. There were also some of them in crevices of the rocks. Hen fleas were also found in the sparrow nests.

Chrysidid.—Mr. Bridwell reported finding cocoons and adults of this insect in *Sceliphron* nests in a road culvert at Diamond Head.

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* Proc. Haw. Ent. Soc., III, p. 11, 1914, and III, p. 62, 1915.

Epyris sp.—Reported by Mr. Bridwell as being very abundant in the locality where previously observed in waste land at the east of Diamond Head. One was observed to sweep down to the ground and burrow in.

Crabro distinctus.—Mr. Bridwell reported the present absence of this wasp where he had found it abundant in April on Crotons near Diamond Head.

Throscus sp.—Mr. Bridwell exhibited a specimen of this small beetle of the family Throscidae, near to the Elateridae, recently caught by him at light. No representative of this family had yet been recorded here.

Argentine ant.—Mr. Ehrhorn reported that in his inspection work recently he had found a colony of this ant in a case of plants from Alameda County, California. It was the first finding of this pest, and they were of course promptly destroyed. Mr. Giffard stated that he noticed the houses overrun with this pest at Birmingham this summer.

Methoca sp.—Mr. Swezey exhibited a specimen of the family Thynnidae which Mr. Bridwell had recognized as a *Methoca.* It had recently issued from a cocoon amongst others found in the ground by Mr. Osborn at Los Banos, P. I. Mr. Bridwell gave a resume of the known habits of this genus of Thynnidae. They are most abundant in South Africa. None have previously been reported in the Philippines.

Mutillid.—Mr. Swezey exhibited a female Mutillid that was found in a cage in which adult *Scolia* were sent from the Philippines. No doubt it had issued from a cocoon accidentally occurring in the soil of the cage.

Rhipiphorid beetle.—A specimen of a species of Rhipiphoridae was exhibited by Mr. Swezey. In examining some apparently dead *Scolia* cocoons from the Philippines, Mr. Timberlake had found this beetle alive in one of them. The *Scolia* cocoon was of a batch that had been reared in the insectary at Los Banos, and it is somewhat of a mystery how the *Scolia* became parasitized by this insect. Possibly it was by a triungulin larva being present in the soil used in the breeding cage. Mr. Timberlake suggested that the triungulin might have been present on the adult *Scolia* used in the cage, she having been caught in the field.

Scolia and Tiphia eggs.—Mr. Swezey exhibited photographs recently made by Mr. Potter, showing the eggs of *Scolia manilae* and two species of Philippine *Tiphia* on their respective host grubs. The egg of *Scolia manilae* stands up vertically on the ventral surface behind the legs on *Anomala* grub; that of *Tiphia compressa* lies on the side behind the hind leg on *Adoretus* grub; that of the other *Tiphia* lies on the side of next to the last segment of the abdoment just below the lateral fold on *Anomala* grub.

*Pineapple weevil.**—Mr. Swezey exhibited photos of the work of a large weevil in pineapples, that he had recently received from Mr. A. R. Ritchie, the government entomologist in Jamaica, where in the infested district 75% of the pineapples were said to be injured by it.

NOVEMBER 2ND, 1916.

The one hundred thirty-fourth meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Giffard, Kuhns, Osborn, Pemberton, Potter, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

Mr. Swezey was appointed a committee to interview the Director of the Bishop Museum regarding co-operation in the printing of The Proceedings.

Mr. Giffard was appointed a committee to confer with the trustees of the Hawaiian Sugar Planters' Association relative to financial assistance, the publication of the last number of The Proceedings having left the Treasury with a large deficit.

Messrs. Bridwell and Swezey were appointed a committee to draft resolutions embodying the sense of the Society regarding the disposal of "types" of Hawaiian insects.

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* *Metamasius ritchiei* Marshall. Bulletin of Entomological Research, VII, p. 197, 1916. Ritchie, Journal of the Jamaica Agricultural Society, XX, pp. 316-318, 1916.

Mr. Bridwell exhibited a dividing instrument and a small metal scale which he had found very useful in making measurements of insects.

Iolania perkinsi.—Mr. Giffard exhibited a collection of 35 specimens of this Cixiid taken at light at his place at 4,000 feet elevation, Kilauea, Hawaii, during two weeks. Other insects were also taken. Psocids were abundant on one night.

Throscus sp.—Messrs. Giffard and Timberlake reported taking this beetle at the Pali. Mr. Swezey reported haying taken it at light.

Description of a New Species of Spalangia.

BY D. T. FULLAWAY.

In connection with the work on the control of the horn fly (*Lyperosia irritans*), the writer introduced from the Philippines in 1914 a Spalangia bred from house fly and other muscid puparia. This species, which was multiplied and distributed throughout the islands, proves to be new to science, and is described herewith.

Spalangia philippinensis n. sp.

♀ Length 3mm. Black, the polished surfaces brilliant, tarsi brown with black tips.

Head vertical, fairly long and thin, about twice as long as the eyes, which are oval, flatly convex and hairy; surface smooth and shining but marked with broad shallow punctures and almost as hairy as the eyes. Face between the eyes broad, narrowing but little toward the mouth; clypeal margin truncate; cheeks flat and as long as the eyes; ocelli fairly large and arranged in an obtuse triangle, the lateral members a little further apart than from the eye margin, to anterior member about the same as to eye; a broad deep triangular groove on the lower part of the face smoothly surfaced, the clypeal margin forming the base and the apex on a level with the lower margin of the eye; a shallow punctate furrow from the apex to the occipital margin passing through the anterior ocellus. Antennae attached at the clypeus, at the basal angles of the groove; fairly long, consisting of 10 segments; scape slender but somewhat clavate, not reaching anterior ocellus, pedicel obconic about 4 in the scape, 1st funicle joint about equal to the pedicel, the next two joints about as broad as long, the four following ones a trifle wider than long, club undivided, not quite as long as the three preceding joints, bluntly pointed and bearing short silvery hairs.

Prothorax fairly wide but narrower than the head and mesothorax and rather long, narrowing into a fairly slender neck where the prosternum advances in front of it, the two separated by a costate line; the pronotum rugose and hairy, the neck less so. Mesothorax wider still than the head, wider than long, the mesonotal surface polished in front and behind more or less rugose and hairy with three large shallow pits near the posterior margin, the lateral ones on a line with the parapsidal furrows, which diverge anteriorly, becoming very deep and broad; axillae smooth and shining like the scutellum and separated from this by costate lines, the scutellum having a transverse costate line in front of the hind margin and the suture between it and the postscutellum costate. Propodeum nearly flat, median anterior portion somewhat elevated; a longitudinal carina divides

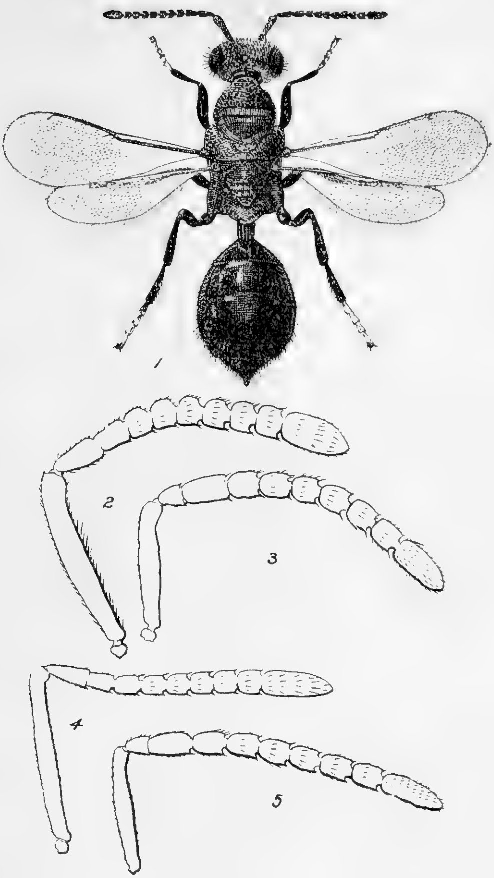

Figure 1, *Spalangia philippinensis*, female; Fig. 2, female antenna; Fig. 3, male antenna. Fig. 4, *Spalangia cameroni*, female antenna; Fig. 5, male antenna.

it, in front passing between two rather large shallow pits and behind flanked on either side by a punctate line or furrow; laterally the pleura are separated by broad shallow grooves; the flat surfaces are partly smooth and shining, but the margins, especially posteriorly, are shallowly rugose; hind angles of the pleura rather sharp.

Abdominal pedicel about twice as long as wide, attached beneath; on the upper surface are half a dozen raised longitudinal lines, between which the surface is finely punctate.

Abdomen broadly oval and convex, smooth and polished; 4th segment the longest, twice as long as the 3rd or 2nd and more than twice the 5th; following segments still narrower; the 5th, 6th and 7th bearing long silvery hairs on posterior margin which extend anteriorly on the sides even to the first; anterior margin of this segment very deeply indented above the pedicel.

Wings long and narrow; width less than one-third length; the submarginal vein joins the marginal at about the middle; marginal long, more than half the submarginal; stigmal and postmarginal very short, the former with an uncus; disc ciliate outwardly from the juncture of submarginal with marginal but basally bare; veins brown.

♂ Head shorter, almost triangular in outline. The pedicel of antennae is shorter than in the female, the 1st funicle joint long, about twice the length of the pedicel, and the other funicle joints all longer than wide, and pedicilate. There is not the large polished area anteriorly on the mesothorax, only a narrow band so polished, although the extent of this area seems to vary. The metathorax is more rugose; the pedicel apparently longer, the 3rd segment narrower in comparison with 2nd as also the 5th and 6th in comparison with 4th.

Differs from *cameroni* in having the antennae stouter, the 1st funicle joint more or less obconic, and shorter club.

DECEMBER 14TH, 1916.

The one hundred thirty-fifth regular and twelfth annual meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Bryan, Ehrhorn, Fullaway, Giffard, Mant, Muir, Osborn, Pemberton, Potter, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

Mr. Giffard reported that the Trustees of the Hawaiian Sugar Planters' Association had contributed $250.00 to the financial assistance of the Society.

The committee on "types" reported progress. It was augmented by the appointment of Messrs. Fullaway, Illingworth, and Timberlake.

Report of the Secretary-Treasurer read and accepted.

ELECTION OF OFFICERS FOR 1917.

President.................................W. R. R. POTTER
Vice-President........................C. E. PEMBERTON
Secretary-Treasurer......................H. T. OSBORN

Corn leafhopper parasites.—Mr. Fullaway reported having reared a Dryinid from the corn leafhopper. He had previously reported having reared all of the sugar cane leafhopper egg-parasites from corn leafhoper eggs, so now he has reared all of the sugar cane leafhopper parasites from the cornhopper. They do not breed nearly so extensively in the latter as they do in the former, however.

Mauna Loa insects.—Professor Bryan exhibited a few insects collected from ice-water pools at the summit of Mauna Loa in August. These were determined by Mr. Swezey as follows:

Hymenoptera

3 *Psammochares luctuosus* (Cr.)
1 *Limnerium blackburi* Cam.
1 Pteromalid.

Odonata

1 *Anax junius* Drury.

Coleoptera

1 *Scymnus notescens*

Diptera

1 *Sarcophaga pallinervis* Thoms.
1 *Frontina archippivora* Will.
2 *Lyperosia irritans* L.
3 *Borborus* sp.
6 Small Diptera, 3 species.

Hemiptera.

3 *Nysius delectus* White.
2 *Nysius* sp.
3 Wingless bug (nymph) ?
1 Mirid.

Arachnida

1 Small spider.

Exhibition of 'Types' of Some Recent Hawaiian Lepidoptera.

BY OTTO H. SWEZEY.

The "types" exhibited are of 41 species of moths described by the writer in recent years. At the times of description no mention was made of the location of the "types". They are now segregated for the purpose of depositing them in the Bishop Museum. None of these species have been hitherto represented in the Museum collections.

Herewith is a list of the species together with references to their descriptions. Those marked with an asterisk (*) have "paratypes" in the author's collection; those marked with a double asterisk (**) have "paratypes" in the cabinets at the Hawaiian Sugar Planters' Association Experiment Station:

Nesamiptis newelli	Proceedings of the Hawaiian Entomological Society, II, 5, Pg. 270, 1913.
Nesamiptis laysanensis	Op. cit., III, 1, Pg. 18, 1914.
*Plusia giffardi***	Op. cit., II, 5, Pg. 270, 1913.
Hydriomena giffardi	Op. cit., II, 5, Pg. 271, 1913.
*Hydriomena roseata***	Op. cit., II, 5, Pg. 271, 1913.
*Genophantis leahi**	Op. cit., II, 3, Pg. 103, 1910.
*Cryptoblabes aliena***	Bull. Ent. Experiment Sta., H. S. P. A., 6, Pg. 24, 1909.
*Omiodes meyricki**	Op. cit., 5, Pg. 24, 1907.
*Omiodes musicola**	Proc. Haw. Ent. Soc. II, 2, Pg. 40, 1909.
*Omiodes maia**	Op. cit., II, 2, Pg. 74, 1909.
*Omiodes anastreptoides**	Op. cit., II, 5, Pg. 272, 1913.
Omiodes fullawayi	Op. cit., II, 5, Pg. 272, 1913.
Omiodes laysanensis	Op. cit., III, 1, Pg. 19, 1914.
*Pyrausta thermantoidis***	Op. cit., II, 5, Pg. 273, 1913.
*Scoparia lycopodiae**	Op. cit., II, 3, Pg. 104, 1910.
*Scoparia nectarioides***	Op. cit., II, 5, Pg. 273, 1913.
Aristotelia gigantea	Op. cit., II, 5, Pg. 274, 1913.
*Thyrocopa sapindiella**	Op. cit., II, 5, Pg. 274, 1913.

Proc. Haw. Ent. Soc. III, No. 4, May, 1917.

Archips fuscocinereus	Op. cit., II, 5, Pg. 275, 1913.
*Archips sublichenoides***	Op. cit., II, 5, Pg. 276, 1913.
Tortrix semicinerana	Op. cit., II, 5, Pg. 276, 1913.
*Epagoge urerana**	Op. cit., III, 2, Pg. 93, 1915.
*Capua cassia**	Op. cit., II, 4, Pg. 183, 1912.
*Capua santalata**	Op. cit., II, 5, Pg. 276, 1913.
*Euhyposmocoma ekaha**	Op. cit., II, 3, Pg. 105, 1910.
Euhyposmocoma trivitella	Op. cit., II, 5, Pg. 278, 1913.
Semnoprepia fuscopurpurea	Op. cit., III, 2, Pg. 94, 1915.
*Semnoprepia ferruginea**	Op. cit., III, 2, Pg. 94, 1915.
Petrochroa trifasciata	Op. cit., III, 2, Pg. 97, 1915.
*Opogona purpuriella**	Op. cit., II, 5, Pg. 280, 1915.
*Opogona apicalis**	Bull. Ent. Exp. Sta., H. S. P. A., 6, Pg. 17, 1909.
*Ereunetis penicillata***	Opp. cit., 6, Pg. 13, 1909.
*Gracilaria mabaella**	Proc. Haw. Ent. Soc., II, 3, Pg. 89, 1910.
*Gracilaria hauicola**	Op. cit., II, 3, Pg. 106, 1910.
*Gracilaria dubautiella**	Op. cit., II, 5, Pg. 278, 1913.
*Gracilaria hibiscella**	Op. cit., II, 5, Pg. 279, 1913.
*Gracilaria ureraella**	Op. cit., III, 2, Pg. 94, 1915.
*Gracilaria urerana**	Op. cit., III, 2, Pg. 95, 1915.
*Philodoria pipturicola**	Op. cit., III, 2, Pg. 96, 1915.
*Bedellia oplismeniella**	Op. cit., II, 4, Pg. 184, 1912.
*Bedellia boehmeriella**	Op. cit., II, 4, Pg. 185, 1912.

New Hawaiian Delphacidae.

BY F. MUIR.

(Read December 14, 1916.*)

During the last twelve months considerable additions have been made to our Delphacid collections, several new species have been captured and our knowledge of the food-plants of many species has been corrected or extended. This has been chiefly due to the energy of Messrs. P. H. Timberlake, O. H. Swezey and W. M. Giffard. Mr. Giffard has also procured a small but interesting collection from the Island of Lanai. This collection was made by Mr. G. C. Munro with the assistance of H. Gibson and it brings the number of species known from that island up to fifteen, and places it third on the list. This indicates that the number of species still unknown from the three larger islands of Kauai, Molokai and Maui is very great.

The new species show the same degree of phallic differentiation as do species previously described, in some cases they are closely related to known forms but in others they appear to be quite isolated. The Hawaiian species of *Kelisia* have been considered as foreign; the four species belong to three distinct types which, without intermediate forms, cannot be conceived as having any relationship. Two species, *K. sporobolicola* and *K. swezeyi*, are closely related, and it is probable that one is of local origin.†. Elsewhere‡ I have put forward the suggestion that this phallic differentiation represents a differentiation of the germ-plasm and, although I have given the subject considerable thought, I can offer no better reason. I believe that one of the first steps in species formation among Hawaiian Delphacidae is a change of food-plant. In many cases this will lead to isolation and may eventually lead to differentiation of the germ-plasm. Mr. W. M. Giffard brought to my notice the fact that certain species feeding upon more than one food-

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* The captures, etc., have been brought up to date (February, 1917).

† Since this was written, *K. paludum* Kirk. has been found to have a wide range in the Pacific.

‡ Pro. Haw. Ent. Soc. III, 1916, p. 210.

plant have two or more forms. At Kilauea, Hawaii, *Nesosydne ipomoeicola* is very common on *Lythrum maritimum* H. B. K. and *Sadleria* sp.; specimens from the former plant are on the average much darker than specimens from the latter. In the same locality *N. blackburni* from *Clermontia parviflora* and *Stenogyne* has a distinct green tint when alive which is absent from specimens off of *Pipturus*.

During a recent trip to Kilauea, Hawaii, along with Mr. W. M. Giffard, we hatched out several hundred nymphs of *Nesosydne koae* Kirk. without getting a single egg parasite. We also found evidence that indicated that *N. koae* only oviposits in the young shoots bearing leaves and *N. rubescens* only in the edges of the leaves and phyllodia. Mr. Swezey took the eggs of *N. koae-phyllodii* in the edges of phyllodia. The ovipositor of *N. koae* and *N. rubescens* are quite distinct, the former being smaller, very slightly curved, with about 25-30 fine teeth along the dorso-apical half, the latter is larger, stouter, slightly curved and recurved, with about the same number of larger, square teeth along the dorso-apical half. The ovipositor of *N. rubescens* var. *pulla* is similar to that of the species.

The types of the new species described in this paper, as well as those described in a previous paper,* have been deposited in the collection of the Hawaiian Sugar Planters' Association in Honolulu, T. H.

Genus Leialoha Kirk.

L. lehuae lanaiensis subsp. nov. Pl. V, fig. 1.

♂ Dark brown, antennae, legs and base of abdomen lighter. Tegmina dark fuscous, more intensely so down the middle; apical two-thirds of costal cell (except a dark spot about one-fourth from apex), subcostal cell and a mark in first two apical cells nearly colorless; the clavus, a spot at fork of cubital veins and over the fifth and sixth apical cells lightly fuscous; veins concolorous with membrane, beset with very minute dark granules; wings light fuscous, veins darker.

The genitalia are near to those of the subspecies *kauaiensis*, the crook at apex of aedeagus large, with its apex curved outward.

Length 2.5 mm.; tegmen 3.6 mm.

Hab. Lanai, Kaiholena (G. C. Munro, November, 1916.) This sub-species is closely related to *L. lehuae kauaiensis*.

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* Pro. Haw. Ent. Soc. III, pp. 168-221, 1916.

L. lehuae oahuensis Muir.

A long series from various localities from Lanai (Munro, December, 1916). These show the same amount of variation as specimens from Oahu, including the immaculate red female which possibly may be a female form of *L. lehuae lanaiensis.* There is also a form in which the marking in the middle of the tegmen is much more extensive and considerably tinged with reddish brown. Some of these specimens may belong to *L. ohiae* Kirk. as I believe that the division between *L. ohiae* and *L. lehuae* is arbitrary.

L. lehuae hawaiiensis Muir.

Many specimens off *Metrosideros collina polymorpha,* also some nymphs bred to maturity on *Straussia* sp. Kilauea, Hawaii (Giffard and Muir, January, 1917).

Genus Nesodryas Kirk.

N. antidesmae sp. nov. Pl. V, Fig. 2, 2a.

♂ Slender, as in the typical subgenus. Head and legs white or pale yellow; face and genae between eyes, first segment of antennae and a longitudinal line on second segment black or dark brown, a spot on front coxae and a band at the apex of femora and base of tibiae of middle and hind legs black or dark brown; thorax and abdomen yellow, pronotum lighter than mesonotum, dorsum of abdomen and the pygophor fuscous. Tegmina hyaline, yellowish or light brown at base of clavus and from base of costal cell across to hind margin near apex of clavus, where the otherwise white dorsum is dark brown, veins light except the apical halves of median and cubital veins which are broadly fuscous; margins of apical half of tegmina also fuscous; wings hyaline with light veins.

Pygophor similar in shape to *N. eleocarpae*; anal segment with a pair of stout spines slightly curved and compressed laterally; genital styles similar to *N. eugeniae*; aedeagus straight, cylindrical, slightly larger at base than at apex, apex with a large curved crook on right side and a smaller one on left, a nearly straight spine on ventral side a little before the apex.

Length 2.2 mm.; tegmen 3 mm.

♀ Similar to male; ovipositor dark brown and the pygophor on each side fuscous.

Hab. Nuuanu Pali, Oahu (Giffard and Fullaway, November, 1916), six specimens off *Antidesma platyphyllum.*

This species comes next to *N. eugeniae* but is quite distinct, especially in coloration.

N. eugeniae Kirk. Pl. V, fig. 5, 5a.

Four specimens from Kaiholena and Kapano, Lanai (Munro, December). In coloration these conform to *N. eugeniae* of Oahu but the genitalia approaches to those of *N. giffardi*; certain specimens of the latter species from Waiahole, Oahu, have the genitalia approaching to *N. eugeniae* and they both approach to *N. eleaocarpi*. The three species are nearly related and best separated on color.

N. (*Nesothoe*) *dryope* (Kirk.)

A series of males and females off *Antidesma platyphyllum* beside the government road Kau, Hawaii, near the Kona boundary. (Giffard and Muir, January, 1917).

N. (*Nesothoe*) *gulicki* Muir.

A series of males and females, but no young, off of *Metrosideros polymorpha* Gaud. on the edge of the lava flow near Waiamau, Hawaii, and one nymph bred to maturity off of *Osmanthus sandwicensis.* (Giffard and Muir, January, 1917.)

N. (*Nesothoe*) *terryi* (Kirk.). Pl. V, fig. 3.

Two females, one male and a nymph which I consider to be this species, from Waialae Nui, Oahu, (Swezey, April, 1916,) off *Osmanthus sandwicensis* (Gray). The type locality is Waialua, Oahu.

Anal segment with short flattened spines with wide base; genital styles with basal half straight and apical half curved; aedeagus long, thin, tubular, apex pointed, a curved spine from right side, about one-third from apex.

This species comes next to *N. bobeae* (Kirk.).

N. (*Nesothoe*) *piilani* (Kirk.). Pl. V, fig. 4.

♂ Vertex, face and genae between eyes and clypeus brown, vertex and genae speckled with light brown, face and genae below eyes sordid creamy white with dirty spots; antennae light brown; pronotum light mottled brown, darker brown on lateral areas and on pleura; mesonotum dark brown between carinae, light brown on sides; legs yellowish or light brown, fuscous at apex of femora and base of tibiae; abdominal tergites and phygophor brown, sternites dirty white. Tegmina slightly opaque, milky, veins light with distinct dark brown granules somewhat irregular on apical portion, a fuscous band from costal margin near base to junction of claval veins and then to beyond middle of claval margin where there is a darker mark, the basal border of the band fairly well defined but the apical border fading out irregularly; a dark mark at contact between radius and media, and from median cross-vein to apex, more or less indefinite; wings whitish with light veins. The opaque, milky appearance of tegmina and wings due to a waxy secretion and can be removed with chloroform.

Length 3 mm.; tegmen 3.4 mm.

♀ Lighter in color than the male. The band across tegmen is sometimes nearly obsolete, even in males, and the mesonotum between the carinae hardly darker than the sides.

Hab. Kaiholena, Lanai (G. C. Munro, December, 1916), off *Osmanthus sandwicensis* (Gray).

This species was originally described from one female in bad condition from Molokai. The present specimens appear to me to be more distinctly marked and may prove to be distinct, but until male specimens from Molokai can be procured and the genitalia examined I consider it better to place them under the same name. This species comes near to *N. terryi* and *N. bobeae.*

N. (*Nesothoe*) *maculata* Muir.

One female specimen from Kaiholena, Lanai (Munro, December, 1916). Hitherto only known from Hawaii. Common on lama (*Maba sandwicensis* D. C.) along the government road between Kahuku ranch and Kona boundary. Nymphs also bred to maturity on leaves of *Osmanthus sandwicensis.* (Giffard and Muir, January, 1917.)

N. (*Nesothoe*) *fletus* (Kirk.).

A series of both sexes from Kaiholena, Lanai, off of *Suttonia* (Munro, December, 1916). Hitherto only known from Maui. In coloration darker and more fuscous than from the type locality. The aedeagus is more acute at apex and the spine at side has a few minute teeth.

N. (*Nesothoe*) *munroi* sp. nov. Pl. V, fig. 6.

♂ Face banded black and creamy white; the face and genae between eyes, a band across face and genae one-fourth from apex and a fine line at extreme apex black or dark, shiny brown, the intervening areas creamy white; clypeus fuscous; vertex, pronotum and mesonotum mottled brown, darkest laterad of carinae; antennae black; legs light brown with darker longitudinal markings; abdomen fuscous, lighter on base and on pleura. Tegmina slightly opaque and milky, a sinuous black or dark brown longitudinal mark from base to apex, covering base of clavus, curving to near middle of costa and then toward apex of clavus, irregularly fuscous over base of radius, media and cubitus; veins in base of clavus light with light granules, otherwise veins dark with dark granules irregularly scattered; wings hyaline, slightly fuscous, with brown veins. Anal spines short, flat, broad at base; aedeagus figured.

Length 2.5 mm.; tegmen 3 mm.

♀ Similar to male in coloration; ovipositor dark.

Length 3.7 mm.; tegmen 3.9 mm.

Hab. Lanai 2,000 feet (Munro, December, 1916) on *Dodonaea viscosa* L. (aalii). The nymphs are characterized by the black and white banded face. The aedeagus is a modification of that of *N. dryope.*

Genus Aloha Kirkaldy.

A. campylothecae Muir.

A. kaalensis Muir. Pro. Haw. Ent. Soc. 1916, p. 183. A long series taken by Mr. Timberlake (July, 1916,) shows that there is no good distinction between these two species and so the latter must be sunk.

A. myoporicola Kirk.

Taken on *Pelea volcanica*, Kilauea, Hawaii, adults and nymphs. (Giffard and Muir, January, 1916.)

A. swezeyi Muir.

One male and several females, one of the latter being macropterous, taken on Mount Tantalus off *Campylotheca macrocarpa* (Timberlake, February, 1917). They are of a more uniform brown than the type. One male specimen from Kuliouou, Oahu, off *Lythrum* (Swezey, June, 1916).

Genus Nothorestias nov.

This genus differs from *Nesorestias* Kirk. by having a single median frontal carina, either simple or furcate. It stands in the same relation to *Nesorestias* Kirk. as *Nesodryas* Kirk. and *Nesosydne* Kirk. do to *Leialoha* Kirk. and *Aloha* Kirk.

N. badia sp. nov. Pl. V, fig. 9.

♂ Antennae reaching to middle of clypeus, first segment more than half the length of second; frontal carina furcate from middle, the two carinae on basal half being near together. Tegmina not reaching to middle of abdomen, reticulate and coriaceous.

Body and tegmina dark brown, darkest over frons and first and second coxae.

Anal segment without spines; genital styles similar to *Aloha ipomoeae* Kirk. but with the "toe" and "heel" more rounded; aedeagus near to that of *Nesorestias filicicola* Kirk., but with the dorso-basal knob reduced to a blunt point, the cock's comb reduced to minute teeth, the spine on right side near apex large, with its apex bent at right angle, the spine on left side stout.

Length 2.5 mm.; tegmen 1 mm.

Hab. Kuliouou, Oahu. (Timberlake, June, 1916.) One specimen swept from ferns.

A female specimen (Swezey, September, 1908,) from Nahiku, Maui, has a simple median frontal carina and forms a second species in this genus.

Genus Nesosydne Kirk.

N. pele Kirk.

Nymphs on *Straussia* sp. bred to maturity.

N. timberlakei sp. nov. Pl. V, fig. 14.

♂ Brachypterous, tegmina not reaching to base of pygophor; antennae reaching beyond middle of clypeus, second segment slightly longer than first; frontal carina furcating about one-third from base.

Light brown, darker on head and thorax between carinae and over lateral and posterior portions of abdominal tergites. Tegmina hyaline, light brown, a dark mark at end of costal cell and another at end of cubitus, veins slightly darker with small granules bearing hairs. Anal segment without spines; gential styles curved, slightly flattened, broad at base and narrowing to rounded apex; aedeagus curved dorsad, apex rounded, a row of teeth over apex and along dorso-apical half, four teeth on right side, from the medio-ventral fourth there arises a thin, curved plate with serrated edge.

Length 3.4 mm.; tegmen 2.3mm.

Hab. Oahu, Waiahole. (Timberlake, August, 1916), one male off *Cyrtandra garnotiana*. This species is very distinct but appears to be a development of *N. cyrtandrae* Muir.

N. gunnerae sp. nov. Pl. V, fig. 15.

♂ Brachypterous, tegmina reaching nearly to apex of abdomen; antennae reaching to about middle of clypeus, first segment more than half the length of second; furcation of frontal carina indefinite, about the middle of face.

Light brown or yellowish brown, darker between carinae of head and thorax; front legs with dark tarsi; abdomen dark except the base, an indefinite mark down middle of dorsum and the lateral edges of abdomen lighter. Tegmina hyaline, light brown, veins with minute granules bearing small black hairs, veins dark over the middle third, a small dark mark at apex of costal cell and another at the apex of cubitus, the membrane over middle third slightly infuscate. There is considerable variation in coloration, some specimens having the dark areas on tegmina and body more intense and more extensive.

Width of pygophor about equal to depth, ventro-lateral edges produced into rounded process, medio-ventral edge with a minute spine; anal segment short, without spines, medio-apical edge labiate; styles small, narrowing to apex, slightly curved and converging at apex; aedeagus short, slightly flattened laterally, base deep with the stem very strongly curved, apex rounded, orifice on dorsal side near apex, some minute teeth along dorsal surface.

Length 3 mm.; tegmen 2.3 mm.

♀ Similar to male but generally lighter in color.

Length 3 mm.; tegmen 2.3 mm.

Hab. Oahu, Mount Kaala, about 4,000 feet elevation. (Timberlake, July, 1916). A long series of both sexes and one nymph off *Gunnera petaloidea* Gaud., mostly along the midrib on the under side of old leaves. A male and female on *Pelea* sp., one female on *Coprosma longifolia* Gray, and one female on *Suttonia*.

This species comes next to *N. perkinsi* Muir from Maui.

N. nesogunnerae sp. nov. Pl. V, figs. 16, 16a.

♂ Brachypterous; antennae reaching to middle of clypeus or beyond, second joint double as long as the first; medio-frontal carina furcating about middle; vertex longer than broad; first joint of hind tarsus slightly longer than other two together; spur with sixteen teeth on hind edge.

Blackish brown, carinae of head slightly lighter; pleura, legs, base and a medio-dorsal line of abdomen lighter. Tegmina hyaline, ochraceous-tawny, blackish at end of clavus especially so on margin and vein, veins thick, concolorous with membrane, no distinct granules but sparsely beset with black hairs.

Pygophor about as wide as deep; anal spines large, cultrate, slightly diverging; genital styles small, broadest at base and apex, apex truncate with the inner corner slightly produced; aedeagus short, deep, compressed laterally, with a deep emargination about middle of ventral edge, some five or six spines on left side near apex and a longer row on right.

Length 2.9 mm.; tegmen 2 mm.

♀ The female I associate with this species is tawny brown instead of blackish brown, it has sixteen teeth on the tibial spur.

Length 3.9 mm.; tegmen 2.5 mm.

Hab. Lanai, Lanaihale, 3,000 feet elevation (Munro, December, 1916). This species comes between *N. perkinsi* and *N. gunnerae*.

N. disjuncta sp. nov. Pl. V, figs. 12, 12a.

♂ Brachypterous; antennae reaching to middle of clypeus, proportional length of first and second joints as 1 to 1.7; medio-frontal carina furcate at extreme base; vertex longer than broad; first joint of hind tarsi longer than other two together, spur about 3/4 the length of first tarsal joint.

Head and thorax between carinae dark brown or black, carinae, antennae, lateral margins of pronotum light brown or yellow; legs light brown with longitudinal brown mark on femora; abdomen dark brown with lighter markings on base and in medio-dorsal line near apex. Tegmina hyaline slightly tinged with yellow, lightly fuscous from near base of costal cell to apex of clavus, where there is a dark-brown mark, also a dark mark at apex of costal cell, veins concolorous with membrane with a few minute granules bearing black hairs.

Genitalia as figured. The aedeagus slightly curved with a flange along each side with the edges deeply serrated.

Length 3.7 mm.; tegmen 2.2 mm.

♀ The female I associate with this is slightly lighter in color over the lateral portions of notum and the infuscation from base of costal cell to apex of clavus is very faint. Proportional length of first and second antennal joint as 1 to 2.3.

Length 3 mm.; tegmen 2.3.

Hab. Lanai, male from north end of highest ridge, 3,000 feet, female from Lanaihale, 2,000 feet. This is an isolated species; for the present I shall place it next to *N. perkinsi*.

N. lobeliae Muir.

Aedeagus and genital style figured, Pl. V, figs. 7, 7a.

N. asteliae sp. nov. Pl. V, fig. 13.

♂ Brachypterous, tegmen not reaching to the base of the pygophor; antennae reaching to the middle of clypeus, first segment more than half the length of second; furcation of frontal carina about one-third from base.

Pale yellow, fuscous between carinae of face and clypeus, over lateral portion of abdominal tergites and on hind femora. Tegmina hyaline, fuscous over the middle half. There is considerable variation of color in this species, the abdomen in some specimens being nearly all fuscous and the thorax between carinae, especially of the mesothorax, being fuscous; the tegmina also are nearly black in some and in others the dark marking is confined to a mark at apex of clavus and another at apex of costal cell.

Pygophor about as broad as deep, ventro-lateral edges produced in rounded processes, medio-ventral area bearing a small, blunt spine; anal segment bearing two large, flattened spines slightly sinuous and diverging; genital styles small, slightly curved and slightly narrowed at truncate apex. Aedeagus figured.

Length 3.2 mm.; tegmen 1.8 mm.

♀ Lighter in color, some specimens being almost immaculate; but there is a similar degree of variation as in the male.

Length 3.2 mm.; tegmen 2 mm.

Hab. Oahu, Mt. Kaala (Timberlake, July, 1916), 4,000 feet elevation; a series of males, females and nymphs off *Astelia veratroides* Gaud. This species is very distinct. I consider that it comes next to *N. sharpi* Muir.

N. sola sp. nov. Pl. V, figs. 11, 11a.

♂ Brachypterous, tegmina not quite reaching base of pygophor; antennae reaching to middle of clypeus, first segment more than half the length of second; furcation of frontal carina about middle, the two carinae on basal half being near together and appearing as a single thick carina.

Castaneous, fuscous over lateral portions of abdominal tergites. Tegmina light castaneous, a small fuscous mark at apex of costal cell and another at apex of clavus.

Pygophor deeper than wide, medio-ventral edge produced into a point, medio-lateral edges roundly excavate; anal segment prolonged on ventral edge where it is sublabiate, no anal spines; styles very small, slightly curved, apices subacute; aedeagus large, long, tubular, slightly curved, ventral edge of apex produced into two spines, the left larger than the right, dorsal part of apex flattened vertically, a few small spines near apex on ventral side and a couple on right side.

Length 3.2 mm.; tegmen 2.2 mm.

♀ Unknown.

Hab. Oahu, Punaluu (Swezey, June, 1911). This species is very distinct, the aedeagus not being closely related to any of the described species. Along with *N. palustris* it shares the distinction of having the ventral edge of the pygophor produced into a large spine.

N. koebelei sp. nov. Pl. V, figs. 10, 10a.

♂ Brachypterous, tegmina reaching to base of pygophor; antennae reaching beyond middle of clypeus, first segment nearly equal to second in length; frontal carina simple.

Stramineous, fuscous between carinae of head and thorax, and over the sides of abdominal tergites. Tegmina stramineous, veins slightly fuscous, a dark mark at apex of clavus and another at apex of costal cell.

Pygophor wider than deep; anal segment with two short, broad spines, their bases approximate and apices diverging; genital styles broad at base, curved, narrow on apical third, the apices curved and truncate; aedeagus short, flattened laterally, apex subcrassate and bent to the left.

Length 3.6 mm.; tegmen 2 mm.

Hab. Oahu, Punaluu (Swezey, June, 1911). This species is very distinct, but I place it in the vicinity of *N. sharpi*. I name it after Mr. A. Koebele, whose associations with entomological work of our island is well known to local entomologists.

N. blackburni Muir.

One male taken at Punaluu, Oahu, by Swezey (June, 1911). Previously known only from Hawaii.

N. nephelias Kirk. Pl. V, fig. 8.

One male specimen from Lanai, Halelepaakai (Perkins, No. 134, July, 1894), which differs from the description by having the carinae of the same color as the rest of the head and thorax, the femora not striped and the two fuscous marks on tegmina more extensive. The genitalia come near to those of *N. anceps* and *N. swezeyi*.

N. nigriceps sp. nov. Pl. VI, figs. 33, 33a.

♂ Brachypterous; vertex longer than wide, slightly rounded at apex; antennae reaching beyond middle of clypeus, first joint to second as 1 to 1.7; lateral pronotal carinae straight, diverging posteriorly, reaching hind margin; frontal carina forking near base.

Head, pro- and mesothorax and front and middle coxae black, antennae, carinae of clypeus, metathorax and legs ochraceous, a round black spot on metapleura; abdomen black, base, on pleura and a median mark on the hind margin of each tergite yellow. Tegmina ochraceous, a black mark over apex of costal cell and a larger one over middle of tegmen reaching to hind margin at apex of clavus, veins concolorous with membrane, without granules. Genitalia figured.

Length 2.6 mm.; tegmen 2 mm.

♀ There is one specimen which may be the female of this species but the thorax and carinae of head are ochraceous and the black in middle of tegmen not so extensive.

Length 3.1 mm.; tegmen 2.3 mm.

Hab. Lanai, 2,300 feet elevation (Munro, February, 1917). This species comes next to *N. anceps* Muir, but it also shows affinities with *Aloha ipomoeae* Kirk. and *A. myoporicola* Kirk.

N. fullawayi lanaiensis subsp. nov.

The genitalia of this sub-species are similar to those of *N. cyathodis* and *N. fullawayi*. In coloration it is nearer to the latter, but uniformly darker. The tegmina are slightly opaque and milky white with brown veins and granules.

Length 1.7 mm.; tegmen 1 mm.

Hab. Waiopaa, Kaiholena, Lanai (Munro, December, 1916), off *Cyathodes*.

N. raillardiae Kirk.

Numerous on *Raillardia* along government road some three miles from Volcano House, Kilauea. One macropterous female among them. (Giffard and Muir, January, 1917.)

N. hamata sp. nov. Pl. V, figs. 17, 17a.

♂ Brachypterous; vertex longer than wide, medio-frontal carina simple but thick at base; antennae reaching to about middle of clypeus, first joint half the length of second; tibial spur with ten, teeth.

Light ochraceous-buff; between carinae of head and thorax fuscous black; a spot on pleura and a longitudinal mark on femora dark; abdominal segments with darker markings over the lateral areas. Tegmina light ochraceous-buff, a fuscous mark at end of costal cell and another at end of clavus; veins concolorous with membrane; a few minute granules bearing hairs.

Pygophor a little deeper than broad, medio-ventral and lateral edges without projections; anal spines large, bases near together, slightly diverging towards apex; aedeagus small, with a large barb at the apex; genital styles small, slightly narrowed in middle, apex obliquely truncate, inner corner slightly produced.

Length 2.3 mm.; tegmen 1.5 mm.

♀ The female I associate with this male is similar in color. Length 3 mm.; tegmen 2.3 mm.

Hab. Lanai, north end of highest ridge, 3,000 feet elevation. This species is isolated; it may come near to *N. palustris* Kirk. of which I have only seen a female.

Genus Kelisia Fieber.

The four species of this genus recorded from the archipelago have the face slightly broader and the sides more arcuate than in the type species. The endemism of these insects is doubtful.

K. sporobolicola Kirk. Pl. V, figs. 21, 21a.

Anal segment sunk into dorsal edge of pygophor, spines on ventro-lateral edges large, thick, with blunt apices; genital styles "leg-of-mutton" shape with blunt apex (viewed in situ they appear much more slender; the figure is from specimen mounted in balsam); aedeagus long, thin, tubular, apex acute, orifice on ventral side one-third from apex; from a dorso-median position arises a small serrated crest.

K. swezeyi Kirk. Pl. V, figs. 20, 20a.

Genitalia similar to *K. sporobolicola* Kirk. but the aedeagus more slender, orifice nearer to apex, the dorsal crest replaced by a few teeth, and the genital styles more slender.

Female similar to male, with two distinct black marks on the abdomen, one on each side of the ovipositor near the apex, ovipositor brown.

The type locality is Kalihi, Oahu (Swezey, March, 1906), but recently it has been taken at Nuuanu Pali (Timberlake and Swezey, October, 1916) (Giffard, November, 1916), off *Eragrostis variabilis* Gaud.

K. paludum Kirk. Pl. V, figs. 18, 18a.

Pygophor deeply emarginate on dorsal edge where anal segment is sunk into pygophor; anal spines acute; genital styles short, widest at apex and base, apex truncate; aedeagus small, tubular, basal half larger than apical half, dorsal surface of basal half corrugated. This is very distinct from the former species. Taken by Mr. Fullaway in Laysan Island.*

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* Now known from several places in south and southeastern Pacific.

K. emoloa sp. nov. Pl. V, figs. 19, 19a.

Spur tectiform, hind margin with numerous small teeth. Tegmina not reaching to middle of abdomen.

♂ Light brown or stramineous; antennae dark with a longitudinal light mark, legs with longitudinal darker marks; fuscous over the lateral portions of abdominal tergites and sternites; genitalia dark brown. Tegmina stramineous, veins concolorous with membrane, a small dark spot at apex of clavus.

Pygophor subquadrate, lateral edges considerably produced; anal segment sunk into pygophor, each ventro-posterior corner produced into a strong spine with blunt apex; genital styles strongly diverging, strongly bent about middle; aedeagus straight, tubular, with apical portion strongly incrassate and beset with teeth.

Length 2.3 mm.; tegmen 1 mm.,

♀ Lighter in color, slightly infuscate between carinae of head and thorax; antennae light with two dark, longitudinal marks, longitudinal marks on legs more distinct; neuration of tegmina lighter than membrane; five more or less distinct light marks down dorsum of abdomen.

Length 3.3 mm.; tegmen 1 mm.

Hab. Oahu, Palolo Valley (Timberlake, July, 1916), Kuliouou (Swezey, June, 1916), off *Eragrostis variabilis* Gaud., which is called by the Hawaiians "emoloa".

Homopterous Notes.

BY F. MUIR.

The material pertaining to these notes forms part of the material collected by members of the staff of the Hawaiian Sugar Planters' Experiment Station during the course of economic work in the Malay and Oriental regions, also material belonging to Prof. C. F. Baker of Los Banos, Luzon, P. I. The types of new species have been placed in the collection of the H. S. P. A. Experiment Station.

The interesting feature of this work has been the finding of several species so widely distributed. *Kelisia paludum* Kirk. hitherto only known from the Hawaiian archipelago is now known from several localities in the south, southwest and west Pacific. *Delphacodes anderida* (Kirk.), which is most likely the same as *Delphax sordescens* Motsch. from Ceylon, is now

* Pro. Haw. Ent. Soc. III, pp. 168-221, 1916.

PLATE V.

Figure 1. *Leialoha lehuae lanaiensis,* aedeagus.
2. *Nesodryas antidesmae,* aedeagus; *a,* genital style.
3. " *terryi,* aedeagus.
4. " *piilani,* aedeagus.
5. " *eugeniae,* aedeagus; *a,* genital style.
6. " *munroi,* aedeagus.
7. *Nesosydne lobeliae,* aedeagus; *a,* genital style.
8. " *nephelias,* aedeagus.
9. *Nothorestias badia,* aedeagus.
10. *Nesosydne koebelei,* ¾ view of pygophor; *a,* aedeagus.
11. " *sola,* ½ view of pygophor; *a,* aedeagus.
12. " *disjuncta,* full view of pygophor; *a,* aedeagus.
13. " *asteliae,* aedeagus.
14. " *timberlakei,* aedeagus.
15. " *gunnerae,* aedeagus.
16. " *nesogunnerae,* aedeagus side view; *a,* end view.
17. " *hamata,* aedeagus side view; *a,* ventral view.
18. *Kelisia paludum,* aedeagus; *a,* genital style.
19. " *emoloa,* aedeagus; *a,* genital style.
20. " *swezeyi,* aedeagus; *a,* genital style.
21. " *sporobolicola,* aedeagus; *a,* genital style.
22. *Anectopia atrata,* pygophor, side view; *a,* genital style; *b,* aedeagus.
23. *Delphacodes terryi,* pygophor, full view.
24. " *meridianalis,* pygophor, full view; *a,* aedeagus.
25. *Phyllodinus sauteri,* aedeagus; *a,* genital style.
26. *Dicranotropis fuscifrons,* pygophor, full view.
27. *Perkinsiella pseudosinensis,* pygophor, ¾ view.
28. " *thompsoni,* pygophor, right half, full view.
29. *Phyllodinus punctata,* genital style.
30. *Perkinsiella fuscipennis,* aedeagus.
31. " *graminicida,* aedeagus.
32. " *manilae,* pygophor, ¾ view.

Proc. Hawaiian Ent. Soc. III. Plate V.

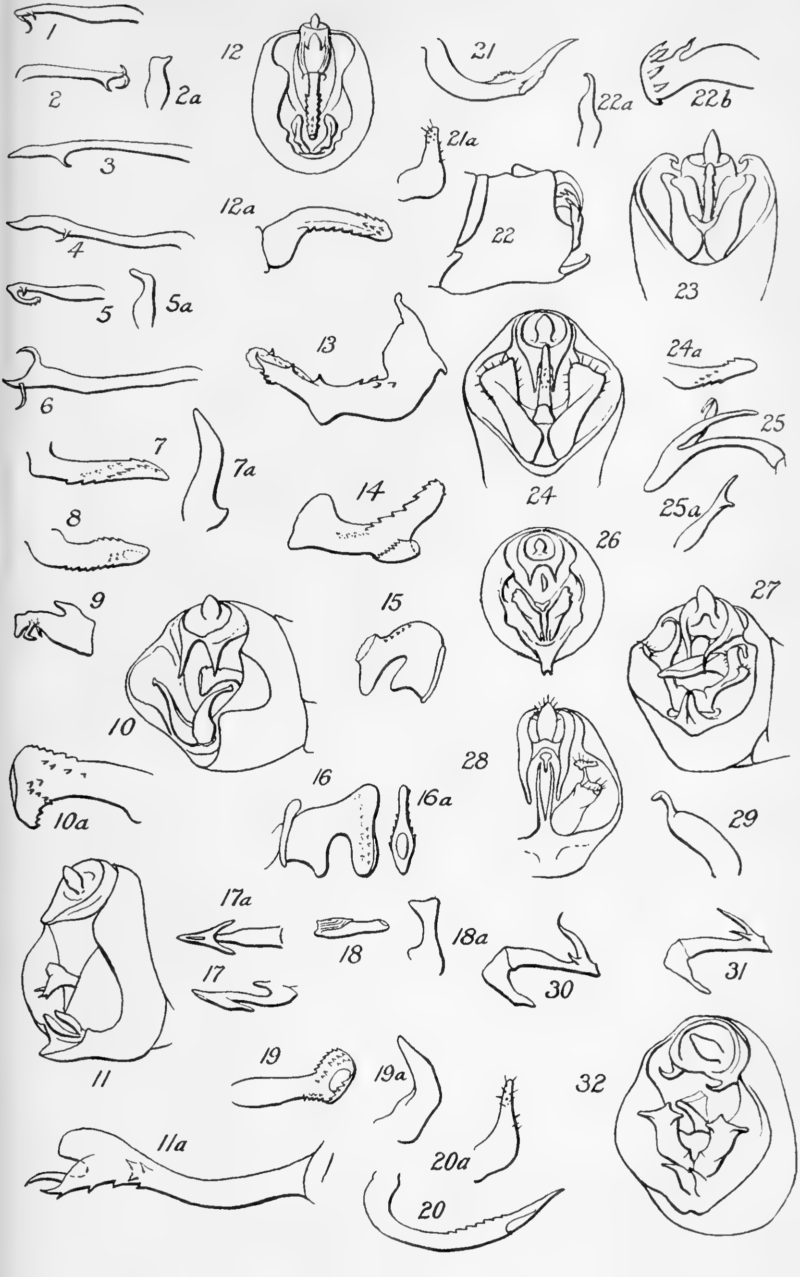
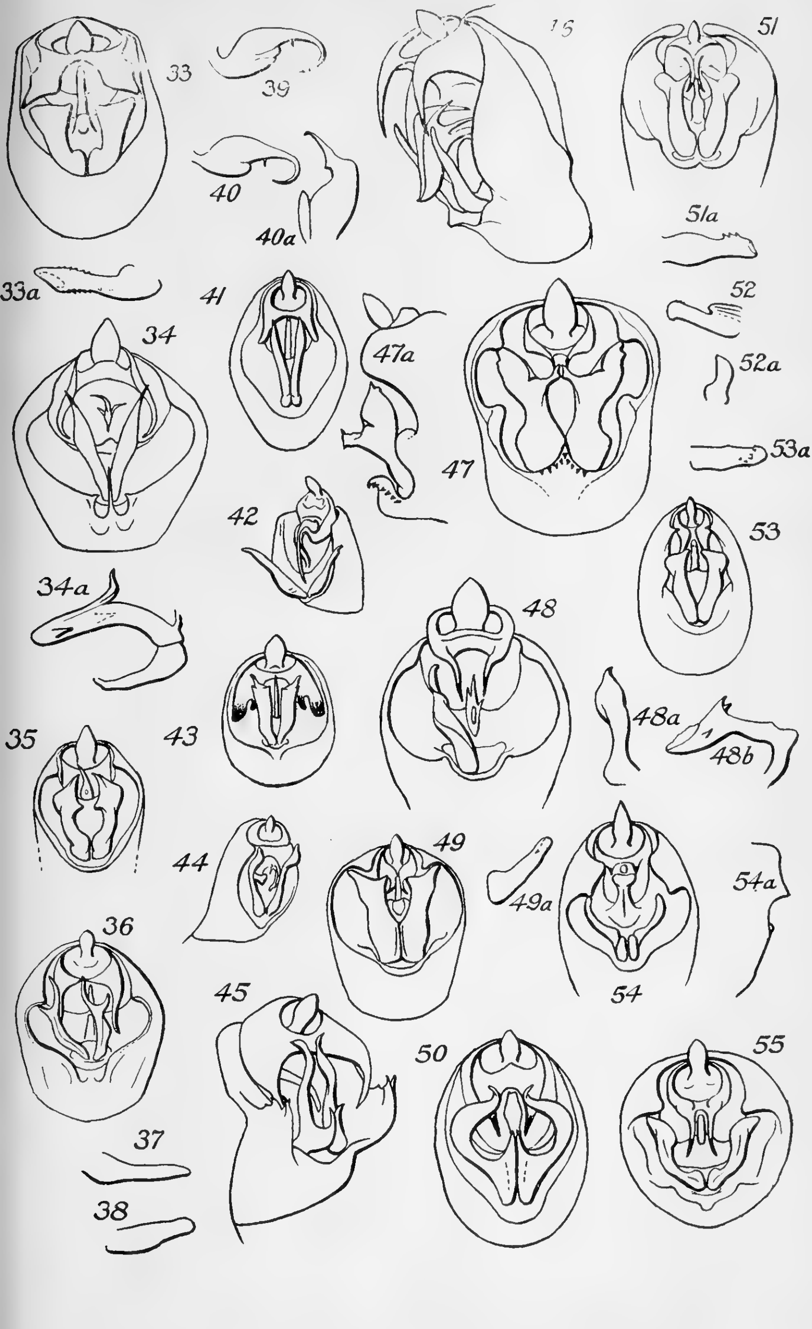


Plate VI.

Figure 33. *Nesosydne nigroceps,* pygophor, full view;
a, aedeagus.
34. *Dicranotropis cognata,* pygophor, full view;
a, aedeagus.
35. *Delphacodes anderida,* pygophor, full view.
36. " *cervina,* pygophor, full view.
37. " *propinqua,* aedeagus.
38. " *neopropinqua,* aedeagus.
39. *Stenocranus agamopsyche,* aedeagus.
40. " *philippinensis,* aedeagus;
a, genital style.
41. " *neopacificus,* pygophor, full view.
42. " *nigrifrons,* pygophor, ¾ view.
43. " *bakeri,* pygophor, full view.
44. " *taiwanensis,* pygophor, ¾ view.
45. " *pseudopacificus,* pygophor, ¾ view.
46. *Phyllodinus nigromaculosus,* pygophor, ¾ view.
47. *Delphacodes bakeri,* pygophor, full view;
a, side view.
48. *Dicranotropis fuscicaudata,* pygophor, full view;
a, genital style; *b,* aedeagus.
49. *Kelisia fieberi,* pygophor, full view; *a,* aedeagus.
50. *Stenocranus luteus,* pygophor, full view.
51. *Sardia brunnia,* pygophor, full view; *a,* aedeagus.
52. *Kelisia kirkaldyi,* aedeagus; *a,* genital style.
53. *Delphacodes lactepennis,* pygophor, full view;
a, aedeagus.
54. *Megamelus albicollis,* pygophor, full view;
a, side view.
55. *Delphacodes nigripennis,* pygophor, full view.

Proc. Hawaiian Ent. Soc. III, Plate. VI.



known from several spots between Fiji and China. Other species have an equally wide range.

In working over a collection of Delphacidae from different zoological regions one soon notices that there are numerous cases of parallel development, both in structure and coloration, which has no phylogenetic significance. The expansion of the legs in *Asiraca* and *Phyllodinus,* and of the antennae in *Asiraca copicerus, Delphax* and *Purohita,* the reduction of both wings and tegmina, are a few such cases in structure. In coloration it would be possible to draw up a long list, of which the following are a few: Light carinae of head and thorax with darker intercarinal spaces; light spots on the face; light pronotum with dark mesonotum; a dark spot on metapleurum; rings and longitudinal marks on legs; a median mark down frons, vertex and thorax; a dark mark at end of clavus and at end of costal cell; these marks are often joined by an ill-defined band; and the "crescent" pattern on apical half of tegmen. This last consists of a mark from costa over cross-veins, along hind apical margin to apex or beyond; this pattern with an increase or decrease of infuscation, with hyaline spots at the end of the apical cells and with the other apical veins also fuscous, forms the markings of a great number of species of which the following list is but a few: *Stobaera concinna, Sogatopsis pratti, Bambusibatus albolineatus, Delphax crassicornis, Perkinsiella variegata, P. pallidula, Phyllodinus macaoensis, Anectopia mandane, Kelisia fieberi, Bakerella maculata, Dicranotropis koebelei, D. pseudomaidis, Peregrinus maidis, Delphacodes limbata.*

I cannot account for these cases of parallel development on any utilitarian principal and if I must classify the process it must be under some form of orthogenesis, which may give us a name but not an explanation.

Before the species of the genus *Delphacodes* and its allies can be straightened out it will be necessary to make more use of the genitalia than has been up to the present; not only the pygophor, anal segment and genital styles but also the aedeagus must be used. The last-named organ, I believe, will give us a better idea of relationship than any other single character.

Measurements are made from apex of head to vent, and from the base to the apex of one tegmen; in measuring the tarsal joints I have taken from the base of the first joint to the base of the second joint and then to the apex of the third joint, thus the spines at the apex of the first joint are not included in the length of that joint.

DELPHACIDAE.

Genus Dicranotropis Fieb.

D. fuscifrons (Muir). Pl. V, fig. 26.

Perkinsiella fuscifrons Muir, H. S. P. A. Ent. Bull. 9. (1910), p. 11.

This was originally described from a single female. I now have males and females from the same locality. The second segment of the antenna is cylindrical. It comes next to *D. pseudomaidis** (Kirk.).

D. koebelei (Kirk.).

Formerly known from Fiji, Queensland, Philippines and Java, now known from Borneo, New Guinea and Ceram Island.

D. muiri Kirk.

One male specimen from Formosa (Muir, January, 1916); Luzon, Los Banos (Baker coll.). Formerly known from China, Java and Borneo.

D. cognata sp. nov. Pl. VI, figs. 34, 34a.

♂ Brachypterous; tegmen reaching to base of seventh abdominal segment, neuration normal. Length of vertex equal to the width at base; medio-frontal carina forking level with lower margin of eyes; antennae reaching near to the middle of clypeus, cylindrical; lateral carinae of pronotum divergingly curved, not reaching hind margin; front and middle tibiae and femora not flattened; length of first joint of hind tibia equal to the other two together, spur slightly longer than first tibial joint, broad, laminate, many minute teeth on hind margin.

Ochraceous-tawny, a few very faint spots on face, the apex of first and base of second antennal joint dark, carinae of thorax slightly

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*In H. S. P. A. Ent. Bull. III, on page 136 fourth line from end read Plate XIII for Plate XII.

lighter, a round, brown mark on metapleura, abdomen dark on lateral portions, pygophor and styles dark brown. Tegmina hyaline, light ochraceous, a black mark covering the apical cells, veins concolorous with membrane, without granules. The genitalia figured.

Length 2 mm.; tegmen 1.3 mm.

♀ One female from Baguio which I associate with this species is of a uniform liver brown.

Length 2.5 mm.; tegmen 1.4 mm.

Hab. Queensland, Cairns and Brisbane (Perkins and Koebele, 1904); Fiji, Rewa (March, 1906, Muir); Luzon, P. I., Benguet, Baguio (Baker), Mount Benahao (Muir).

With the exception of the normal legs and neuration of tegmina this species shows close affinity with *Phyllodinus nigromaculosus* Muir and its allies. It is probable that the species of the genus *Phyllodinus* are polyphyletic.

D. fuscicaudata sp. nov. Pl. VI, figs. 48, a, b.

♂ Light buff, pygophor and styles fuscous brown. Tegmina light buff, opaque with a thin waxy secretion, veins concolorous with membrane, granules minute and concolorous with veins; wings hyaline, veins yellowish. Genitalia figured.

Length 2 mm.; tegmen 2.6 mm.

♀ The female I place with this species is brachypterous and also uniformly light buff.

Length 2.6 mm.; tegmen 1.3 mm.

Hab. Luzon, Los Banos (Muir, September, 1915). This uniformly colored species is easily recognized by the male genitalia.

D. cervina sp. nov. Pl. VI, fig. 36.

♂ Length of vertex equal to width at base, apex slightly narrower than base, carination of the usual *Dicranotropis* type but the median carina nearly obsolete; length of face nearly twice the width, sides subparallel sided except at base between the eyes, where it is slightly narrowed, median carina forking slightly before lower margin of eyes; antennae reaching to the middle of clypeus, second segment nearly twice (1.9) the length of first; hind tarsus a little shorter than tibia, first tarsal joint 1.5 times the length of the other two together, spur about two-thirds the length of first joint, moderately wide, with about 25 small teeth on hind margin; lateral pronotal carinae divergingly curved, not reaching hind margin of pronotum.

Burnt sienna or light chestnut, four pair of lighter spots on frons, carinae and some spots on the lateral portion of pronotum lighter; abdomen chestnut brown, lighter on pleura, the hind margin of some segments and a narrow mark down middle, genital styles dark brown.

Tegmina hyaline slightly tinged with ochraceous, veins to crossveins light ochraceous, apical portion fuscous, granules small, concolorous with veins, a fuscous mark on hind margin at apex of clavus.

Length 2.7 mm.; tegmen 3.4 mm.

♀ The two specimens of females that I place with this species are similar in build but slightly darker in color, the neuration of tegmen being fuscous from base to apex. The pygophor is dark but the lateral plates light.

Length 2.8 mm.; tegmen 3 mm.

Hab. Luzon, Los Banos (Muir, September), one male and two females.

Genus Phyllodinus V. D.

P. nigromaculosus sp. nov. Pl. VI, fig. 46.

♂ Head as wide as thorax; vertex wider than long; medio-frontal carina forking near middle; antennae reaching to middle of clypeus or beyond, second segment slightly clavate; first and second femora and tibiae distinctly flattened but not so wide as in *P. nervatus* V. D.; tegmina reaching to pygophor.

Dark brown; lateral areas of pronotum, carinae of head and thorax, second joint of antennae, spots on frons, base and apex of femora and tibiae, hind tarsi and along hind tibiae, base of abdomen and anal tube lighter brown or yellowish. Tegmina hyaline, very light brown, fuscous over apical area, veins white with distinct black granules each bearing a white hair.

Pygophor short dorsally, long ventrally, aperture longer than broad, medio-ventral edge forming a small quadrate lip; anal segment large, with a long, curved spine at each apical corner; styles long, thin, diminishing to apex, slightly sinuate; aedeagus complex, thin at the base, the apex forming a large barb with the corners projecting basad, that on the left forming a curved spine, that on the right a longer and thinner spine with a shorter one near base.

Length 2 mm.; tegmen 1.4 mm.

♀ Similar to male in coloration.

Length 2.7 mm.; tegmen 1.7 mm.

Hab. Luzon, Los Banos (type, Muir, September, 1915), Mt. Maquiling (Baker) very light in color; Papua, Laloki River (Muir, 1909) slightly lighter in color than the type, otherwise typical.

P. sauteri sp. nov. Pl. V, figs. 25, a.

♂ This species is similar to *P. nigromaculosus* Muir except in the genitalia. Medio-ventral edge of pygophor with very small lip, lateral edges produced below anal segment and partly embracing it, spines on anal segment small; genital styles small with a small prong on outer edge near apex; aedeagus also differing from *P. nigromaculosus*.

Length 2 mm.; tegmen 1.4 mm.

Hab. Formosa, Daimokko (Muir, Sauter, January, 1916), swept from grass.

P. punctata sp. nov. Pl. V, fig. 29.

♂ Except in genitalia this species is structurally the same as *P. nigromaculosus* Muir. Color also similar except that the vertex. thorax between carinae and lateral margins light brown, thorax laterad of carinae dark brown; frons, clypeus and antennae fuscous, frons with light spots.

Medio-ventral edge of pygophor produced into a small quadrate plate wider than long with the apical margin roundly emarginate, lateral margins of pygophor slightly sinuous; apical corners of anal segment each with a long, thin, curved spine; genital styles broad on basal two-thirds, apical third thinner and twisted; aedeagus with spine on right side small, acute, left side longer, curved.

Length 2 mm.; tegmen 1 mm.

Hab. Formosa, Daimokko (Muir, January, 1916). Swept from grass.

P. luzonensis Muir has the first and second pair of femora and tibiae much wider and more foliaceous than in *P. nervatus* V. D. and I think it represents *Platybrachys* Bierman. The latter name is preoccupied in *Heteroptera* (Stål, 1860) but as it is likely to be a synonym I refrain from creating a new name.

Genus Smicrotatodelphax Kirk.

S. kirkaldyi sp. nov.

♂ Testaceous; abdomen, with the exception of the base and pleura, fuscous. Tegmina light testaceous, veins concolorous with membrane with a few minute granules; margins of tegmina slightly incrassate and lighter in color.

Pygophor about as wide as deep, dorsal edge deeply emarginate where the anal segment is sunk into it, the corners of the emargination simple, not produced or turned down; anal segment small, ventral edge of apex produced into a small point turned ventrad; genital styles very similar to *S. perkinsi*.

Length 1.3 mm.; tegmen .6 mm.

Hab. Java, Roban (Muir, 1907), one male swept from grass.

This is very close to the type species but the shape of the pygophor makes it easily recognizable. Kirkaldy's measurements of *S. perkinsi* is given as 1½ mill. but the true measurement is the same as this species. They are the smallest Delphacids I am acquainted with.

Genus Stenocranus Fieb.

Some of the species under this genus appear to belong to *Sogata* Distant, but until I can examine the type species (*S. doughertyi* Dist.) I cannot place them correctly, as some of the critical characters of this and other genera are omitted in Distant's descriptions and figures.

S. bakeri sp. nov. Pl. VI, fig. 43.

S. pacificus Muir not Kirk., Phil. Jour. Sci. 1916, Sec. D, vol. xi, No. 6, p. 382.

♂ Width of head including eyes to length of head and thorax 1 to 1.90; width of face to length 1 to 2.90; first segment of antenna to second as 1 to 2. Spur with many (25-30) small teeth on hind margin. Vertex longer than wide, base wider than apex; sides of face nearly straight, base slightly narrower than apex.

Buckthorn brown (Ridgway standard), a white median line down head and thorax, blackish on face between carinae, a small black spot on mesopleurum, claws and spines on legs black; abdominal tergites ochraceous orange, anal spines fuscous. Tegmina hyaline, slightly tinged with buckthorn brown, darker over clavus, claval margin whitish, veins darker, granules very minute; wings hyaline, veins brown.

Apical corners of anal segment produced into wide, apically rounded plates with a small, slightly curved, blunt spine at their inner base; genital styles truncate at apex with an acute process arising from the hind margin of apex; aedeagus simple, slender, slightly curved.

Length 2.5 mm.; tegmen 3.6 mm.

♀ Unknown.

Hab. Luzon, Los Banos, on grass (Baker, Muir), Baguio, Benguet (Baker coll.).

S. neopacificus sp. nov. Pl. VI, fig. 41.

♂ In structure similar to *S. bakeri*, the first joint of antenna a little longer in comparison with second (1 to 1.70). In color similar to *S. bakeri* but the white line down thorax and vertex continued down frons. Anal spines broad, obtusely pointed; genital styles simple, apex acute, narrow, a small knob at base; aedeagus tubular, thin, with three small curved spines about middle of dorsal surface.

Length 2.8 mm.; tegmen 4 mm.

♀ The groove down pygophor narrow, posterior edge of pygophor slightly emarginate; lateral plates narrow, subequal in width, except at base where it is narrower, apical margin deeply emarginate, leaving the corner projecting; ovipositor sheaths narrow. Similar in color to male.

Length 3.6 mm.; tegmen 5 mm.

Hab. Amboina (type); Papua, Laloki River (Muir). This is the simplest form of the Malay species that I have studied.

S. nigrifrons sp. nov. Pl. VI, fig. 42.

♂ Width of head including eyes to length of head and thorax 1 to 1.6; width of face to length 1 to 2.5; first joint of antenna to second 1 to 2.4; otherwise structurally as in *S. neopacificus*. Thorax buckthorn brown, carinae of face and a median mark down thorax and vertex lighter; face between carinae, genae below eyes and clypeus between carinae black; a minute black spot on pleurum; spines on legs and teeth on spur black; abdomen ochraceous orange, genital styles brown. Tegmina hyaline, light buckthorn brown, darker over clavus, veins darker with minute granules, claval margin whitish; apical veins blackish spreading into fifth and sixth apical veins.

The apical corners of anal segment are brought together making segment diamond shape, the spines long, thin, ensate and curved; aedeagus curved, ensate, slightly flattened laterally, resting between the anal spines.

Length 2.6 mm.; tegmen 3.5 mm.

♀ Much darker than male, the abdomen nearly all black, tegmina darker with most of the veins blackish. Ovipositor sheaths narrow, laterally flattened on apical half; groove narrow; lateral plates small, inner margin arcuate, entire.

Length 3.6 mm.; tegmen 4 mm.

Hab. Formosa, Kanshirai (Muir, 1916), swept from reeds.

S. pacificus Kirk.

♀ Lateral plates about one-fourth length of pygophor, narrow, edge emarginate at middle, the plate elevated at that point.

S. agamopsyche Kirk. Pl. VI, fig. 39.

♀ Lateral plates of female nearly half the length of pygophor, narrow, margins entire.

S. pseudopacificus Muir. Pl. VI, fig. 45.

Male genitalia figured, female with apical edge of pygophor medianly emarginate, latero-apical portions forming small, blunt, conical projections; ovipositor sheaths narrow; lateral plates reaching about one-third along pygophor, basally wide, apically graduating to a point, a deep emargination near base.

S. philippinensis sp. nov. Pl. VI, fig. 40.

♂ Antennae reaching slightly beyond base of clypeus, second joint 3.2 times the length of first; first joint of hind tarsus as long as the other two together, spur as long as first joint, wide, laminate, with minute teeth along hind margin.

Ochraceous-buff, fuscous or black between the carinae of head and slightly so on the pronotum, a round black spot on lateral margin of pronotum, slightly fuscous between the carinae of mesonotum, legs darker ochraceous with a longitudinal mark on femora, more distinctly so on hind femora; abdomen dorsally dark, lighter at base and along middle, pygophor and styles dark brown. Tegmina hyaline, veins colorless on basal half, brown on apical half.

Length 3 mm.; tegmen 3.6 mm.

♀ Unknown.

Hab. Luzon, P. I., Mount Maquiling. This is a Philippine form of *S. agamopsyche* Kirk. of Queensland. The form of the pygophor is similar but the genital styles are distinct and it has a distinct black spot on the side of the pronotum.

S.? taiwanensis sp. nov. Pl. VI, fig. 44.

♂ Length of vertex equal to width, projecting slightly in front of eyes, apex slightly arcuate, base slightly wider than apex, carination similar to that of *Delphacodes*; lateral pronotal carinae straight, slightly diverging, reaching hind margin; width of head including eyes to length of head and thorax 1 to 2.1; width of face to length 1 to 1.7, very slightly narrower at base than at apex, median carina unforked; antennae reaching to apex of face, length of first joint to second 1 to 4, first joint as broad as long. Spur cultrate, concave on inner side, an apical tooth but no teeth on hind margin.

Ochraceous-orange dorsally, yellow-ocher ventrally, chocolate or black slightly over vertex and middle of pronotum, darker over most of the mesonotum, tegulae, the five median abdominal tergites and the genital styles. The dark markings very variable, in some specimens almost absent. Tegmina hyaline, ochreous, veins darker with exceedingly minute granules, clavus and cubital cells light brown, a dark mark on claval border near base and another near apex.

Opening of pygophor ventrally oblique; no spines on anal segment; aedeagus short, strongly curved, basal half deep, apical half thin, tubular, a strong curved spine from near the middle of left side along side of aedeagus to near apex, at its base a small spine standing at right angle to aedeagus.

Length 2.3 mm.; tegmen 3.5 mm.

♀ Similar to male. Pregenital plate distinct, quadrate, deeply emarginate to near base; lateral plates small, reaching about one-third from base of pygophor, inner edge arcuate, entire. Pygophor large, wide, median depression large, posterior margin roundly emarginate; ovipositor sheath narrow, compressed laterally on upper half.

Length 3.8 mm.; tegmen 4.1 mm.

Hab. Formosa, on reeds (Muir, January, 1916). By the tibial spur this should come into the Tropidocephalini. It may belong to one of Mr. Distant's Indian genera but I leave it in its present position until I have fuller knowledge.

S.? luteus sp. nov. Pl. VI, fig. 50.

♂ Length of vertex, pro- and mesonotum one and one-half the width of head including eyes; length of vertex one and one-half the width of base, base broader than apex; length of face two and one-half the width of apex, base narrower than apex, lateral edges straight; antennae reaching nearly to middle of clypeus, second joint 1.75 times the length of first; lateral pronotal carinae straight, diverging, not quite reaching to the hind margin of pronotum; basal joint of hind tarsus slightly longer than the other two together; spur as long as basal tibial joint, wide, laminate, with many fine teeth on hind margin.

Capucine orange, vertex, frons and antennae slightly fuscous, an indefinite whitish mark down the middle of mesonotum. Tegmina and wings hyaline, very slightly yellowish, veins concolorous with membrane, a few minute concolorous granules on tegminal veins. Genitalia figured.

Length 2.2 mm.; tegmen 3 mm.

♀ The female I place with this species has the antennae a little shorter. The pygophor is long and narrow, ovipositor laterally compressed on apical 3/5; lateral plates two-fifths along ovipositor, edges entire, at base slightly produced and touching in the middle line.

Hab. Amboina, two males and one female (Muir). This species may belong to *Sogata,* it is not typical of *Stenocranus.*

Genus Perkinsiella Kirk.

Perkinsiella manilae sp. nov. Pl. V. fig. 32.

♂ Light brown or yellow; face between eyes, antennae, clypeus with the exception of the apex, a fine line across apex of face, lateral portions of pro- and mesonotum, first and second coxae, a spot on metapleurum, longitudinal lines on femora, two bands on first and second tibiae, first and second tarsi, and the abdomen with the exception of basal tergite, dark brown; face between eyes with small, light spots. Tegmina hyaline, brown, darkest over apical third, lighter brown or clear hyaline over costal, subcostal, and a triangular mark in radial apical cells; veins concolorous with membrane, granules very minute with dark hairs, hind margin of clavus white;

wings hyaline with brown veins; spur on hind tibia slightly darker than leg.

Medio-ventral edge of pygophor with two small, laterally flattened spines; anal spines small, bent backward from near base; genital styles short, broad, flattened, sides subparallel, apex subtruncate, each apical corner produced into a small, subquadrate process with their corners produced into small points.

Length 3.5 mm.; tegmen 4.7 mm.

Female unknown.

Hab. Luzon, Manila (C. R. Jones), Bureau of Science, No. 14525.

In the table of the Philippine species of this genus* this species comes next to *P. saccharivora* Muir, but the genitalia are near to *P. saccharicida* Kirk. This is the nineteenth species of this genus, and the seventh recorded from the Philippines.

P. graminicida Kirk. Pl. V, fig. 31 Aedeagus figured.
P. fuscipennis Muir. Pl. V, fig. 30. Aedeagus figured.
P. thompsoni Muir. Pl. V, fig. 28. Genitalia figured.
P. pseudosinensis Muir. Pl. V, fig. 27. Genitalia figured.

Genus Pissonotus Van Duzee.

P. pylaon (Kirk.).

"Delphax" pylaon Kirkaldy, 1907, H. S. P. A. Ent. Bull. III, p. 160, Pl. XV, figs. 12-14.

Originally described from Queensland. I have a long series of males, all macropterous, and a short series of females, both macropterous, and brachypterous, from Formosa, also two specimens from Luzon, P. I., and one from Java. The lateral pronotal carinae are straight or but very slightly divergingly curved, and reach near to the hind margin. The first joint of the hind tibia equal to the two other together; spur slightly shorter than first tibial joint, laminate, moderately wide, with numerous small teeth on hind margin; width of head, including eyes, double the length; antennae reaching to about middle of clypeus, first joint slightly more than half the length of second (1 to 1.9). I place it in this genus provisionally, the spur is not of the *Pissonotus* type.

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* Philippine Journal Science, xi, Sec. D. No. 6, p. 378, 1916.

Genus Anectopia Kirk.

A. mandane Kirk.

Mestus morio Melichar not Motsch.?

Thanks to the kindness of Dr. Melichar, I have a male specimen of the species described and figured by him* under this name. I have not seen Motschoulsky's original description and figure, only Distant's translation. It is with great diffidence that I question the correctness of our leading Homopterist's identification of this insect; it does not agree with Motschoulsky's generic characters of *Mestus* but it is the same as *A. mandane* Kirk. Only an examination of *Motschoulsky's* type can decide this identification; should Dr. Melichar be correct then *Anectopia* Kirk. must fall to *Mestus* Motsch. In Kirkaldy's figures† the carinae of vertex and thorax are too distinct and the lateral pronotal carinae should not distinctly reach the hind margin. The habitat of this species will now be Queensland and Ceylon. That it will be found in other parts of the Austro-Malayan region I feel quite sure.

A. atrata sp. nov. Pl. V, figs. 22, 22a, 22b.

♂ Bachypterous. Vertex as long as broad, not quite so wide as the thorax; antennae reaching to near the middle of clypeus, second joint nearly twice the length of first; carinae not distinct; mediofrontal carina simple; lateral carinae of pronotum divergingly curved, not reaching to hind margin; tegmina reaching to base of pygophor; hind tarsi short, first joint not quite so long as the other two together, spur as long as first joint, laminate, hind margin without teeth.

Black or blackish brown, legs lighter brown; tegmina shiny black or blackish brown, veins with minute granules bearing black hairs.

Length 2 mm.; tegmen 1.5 mm.

Macropterous; one male similar in color to the above but having the tegmina colorless hyaline, with the veins light brown with minute granules.

Length 2 mm.; tegmen 2.7 mm.

♀ Similar to the male.

Length 2.6 mm.; tegmen 1.8 mm.

Hab. Luzon, P. I., Baguio (Baker coll.). The genitalia have an affinity with *A. mandane,* but the sides of the face

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* Hom. Faun. Ceylon, Melichar 1903, p. 105, Pl. II, fig. 15.

† H. S. P. A. Ent. Bull. III, Pl. XI, figs. 11, 17 (1907).

are less arcuate. This species may be the same as *A. igerna* Kirk. described from a female.

Genus Megamelus Fieber.

M. proserpina Kirk.

Originally described from Fiji but I now have specimens from Queensland, Amboina, Java, and Luzon, P. I.

M. proserpinoides sp. nov.

♂ Macropterous. In build and coloration this species is similar to *M. proserpina* Kirk. but the genitalia are distinct. Instead of the three flat flanges on the ventral edge of the pygophor there are three conical processes, the median one the largest; the apical portion of the genital styles is not so curved and the apex is truncate; the anal spines are closely appressed at their bases.

Length 2.6 mm.; tegmen 2.8 mm.

♀ The females I cannot distinguish from *M. proserpina.*

Length 2.9 mm.; tegmen 3 mm.

Hab. Davao, Mindanao, P. I. One male and one female (Baker coll.).

M. albicollis sp. nov. Pl. VI, figs. 54, 54a.

♂ Length of vertex one and one-half the width; length of face 2.2 times the width, widest in middle, sides slightly arcuate, median carina not forked; antennae reaching to the middle of clypeus, second segment 1.6 times the length of first; lateral pronotal carinae straight, slightly diverging, reaching hind margin of pronotum; first joint of hind tarsus equal in length to other two together, spur not quite so long as first tarsal joint, moderately wide, laminate, hind edge with minute teeth; brachypterous.

Intercarinal spaces of face, genae and clypeus black or fuscous brown, vertex, antennae, sides of clypeus, legs and carinae of face and clypeus ochraceous, the median frontal carina wider and whiter than the others; brown over coxae; pronotum white or creamy white, mesonotum brown, darkest between carinae; abdomen ochraceous, brown over median portion of tergites and on some sternites, also the genital styles and ventral half of pygophor brown. Tegmina brown with a darker spot at the end of clavus; hind margin to spot at end of clavus, a small mark beyond that spot and the costal margin white; granules exceedingly minute and sparse.

Genitalia figured. A noticeable point is the great development of the process on the diaphragm below the aedeagus.

Length 1.9 mm.; tegmen .9 mm.

Hab. Luzon, Mount Benahao (Muir), described from a single male.

M.(?) furcifera (Horv.).

Delphax furcifera Horvath, 1899, Terms. Fuzetek, XXII p. 372.

Delphax kolophon Kirkaldy 1907 H. S. P. A. Ent. Bull. III, p. 159, Pl. XV, figs. 9, 10, 11.

The vertex of this species is longer than broad with the apex slightly narrower than the base. It is not congeneric with *Delphacodes mulsanti* Fieb., neither is it strictly congeneric with *Megamelus notulus* (Germar), but I think it is better placed with the latter than with the former.

I have specimens of this species from Fiji, Amboina, Ceram, India, Philippines, South China (Lo-fu-shan, 3,000 feet), Formosa and Japan. They may eventually be divided into two subspecies as the Philippines and Indian species differ somewhat from the type.

M. geranor (Kirk.).

"*Delphax*" *geranor* Kirkaldy, 1907, t. c. 158.

M. kaha (Kirk.).

"*Delphax*" *kaha Kirkaldy*, 1907, l. c.

M. leimonias (Kirk.).

"*Delphax*" *leimonias* Kirkaldy, 1907, t. c. 159.

Genus Sardia Melichar.

S. pluto (Kirk.).

One male specimen from Formosa (Muir, December, 1916), previously known from Fiji, Queensland and the Philippines.

S. brunnia sp. nov. Pl. VI, figs. 51, 51a.

♂ Vertex longer than width of base, apex about half the width of base; medio-lateral carinae meeting before the apex; lateral pronotal carinae diverging, slightly curved, not reaching hind margin; in profile the head not projecting so far, or the medio-frontal carina so prominent, as in the type spcies; antennae reaching to about middle of clypeus, first joint half the length of second; first hind tarsal joint as long as the other two together, spur longer than first tarsal joint, broad, laminate, with minute teeth on hind margin.

Shiny warm blackish brown; antennae, apical portion of clypeus, rostrum and legs ochraceous, genital styles light brown; tegmina and wings warm blackish brown with darker veins, veins of tegmina with small brown granules. Genitalia figured.

Length 1.9 mm.; tegmen 2.5 mm.

Hab. Amboina (type, Muir); Luzon, Pagsanhan, P. I. (Baker coll.). In the Philippine specimen the carinae of frons considerably lighter.

S. rostrata Dist.

Four females from Los Banos, Luzon (Muir, September, 1915), which are like the specimens from Borneo which I referred to this species.

Genus Kelisia Fieber.

K. kirkaldyi sp. nov. Pl. VI, figs. 52-a.

"*Delphax*" *puella* Kirkaldy not Van Duzee* (1907), H. S. P. A. Ent. Bull. III, p. 160. Pl. XV, figs. 1-3; Muir, Philippine Journ. Sci. XI, Sec. D, No. 6, p. 385, 1916.

♂ Macropterous. Vertex a little longer than the width of base, apex slightly narrower than base; frons narrowest at base between eyes, sides slightly arcuate, median carina simple; antennae reaching to base of clypeus, first joint slightly more than half the length of second; lateral pronotal carinae not divergingly curved, straight, diverging, not quite reaching hind margin, or if they do they are slightly convergingly curved near hind margin; first joint of hind tarsus not quite so long as the other two together, spur longer than first tarsal joint, wide, laminate, with numerous minute black teeth on hind margin.

Head, anterior third of pronotum, mesonotum, coxae and most of thoracic pleura shiny black or blackish brown, lateral carinae of face, the triangular space between carinae at apex of vertex, carinae of clypeus, all the pronotum except a narrow anterior margin and the posterior angle of mesonotum white or light creamy white, apex of first antennal joint and most of second joint light brown; legs light brown, femora darker than tibiae; abdomen dark brown, light over base and on pleura. Tegmina hyaline, slightly opaquely white, veins light with very minute granules, margins darker, especially the apical margin, a dark brown spot on margin at apex of clavus; wings hyaline with light veins. Opening of pygophor deeper than wide, a deep anal emargination on dorsal edge, rest of margin entire, simple; anal spines contiguous at base, divergingly curved to apex; styles small, their bases generally concealed within the pygopher so that they appear curved and acute, but dissected out and viewed flat they appear as in Pl. VI, fig. 52a; aedeagus slightly crassate at apex with three minute spines in a dorso-apical position, base with a dorsal

* See remarks under Delphacodes puella, p. 337.

enlargement which has one or two longitudinal corrugations along it.

Length 1.6 mm.; tegmen 2 mm.

Brachypterous form similar to above but the tegmina only reaching to the eighth abdominal segment, white or creamy white over base and along apical margin, fuscous over median portion. Length of tegmen 1 mm.

♀ Similar to male. Macropterous forms 1.9 mm. long, tegmen 2 mm.; brachypterous forms 1.9 mm. long, tegmen 1 mm.

Hab. Fiji (type, Muir, Koebele); Queensland (Koebele, Perkins); Luzon, Los Banos (Baker, Muir); Formosa (Muir). This species is a near ally of *K. paludum* Kirk.

K. paludum Kirk. Pl. V, figs. 18-a.

This species was described by Kirkaldy from specimens taken on Oahu, Hawaiian Islands, and afterward taken by D. T. Fullaway in Laysan Island to the northwest. I now find specimens among our material from Fiji, Queensland, Java, Ceylon and the Philippines. The genitalia of specimens from these widely separated localities are similar but the coloration varies. The prevailing color of the Hawaiian specimens is brownish yellow with a variable amount of infuscation on the face between the carinae and over the abdomen; there is a tendency for the mesonotum to darken and for a tinge of fuscous to appear over the claval and cubital cells. Among the nine specimens from Rewa, Ba and Navua, Fiji, the color is darker (except the pronotum and carinae of head) especially the mesonotum which is dark and shiny in some specimens; in the two Queensland specimens, the one from Pekalongan, Java, the one from Ceylon and the five specimens from Mt. Maquiling, Luzon, this tendency is carried still further. In some of the Philippine specimens the pronotum and the carinae of the frons stand out very light against the dark intercarinal spaces and the shiny dark mesonotum; the abdomen is also dark brown in these specimens.

In spite of this difference in coloration I do not feel justified in giving a specific, or even a subspecific, name to any of these geographical varieties. While the Queensland, Java and Philippine specimens could be grouped together it would be difficult to place the Fiji specimens in either groups, as they tend towards both. The genitalia are very near to those of *K. kirkaldyi* Muir.

K. fieberi sp. nov. Pl. VI, figs. 49-a.

♂ Length of vertex 1.5 the width; sides of face subparallel except near base where the face is slightly constricted; antennae reaching beyond the apex of the face, first joint slightly longer than half of second; pronotal lateral carinae diverging, straight or slightly convergingly curved at apex where they reach, or nearly reach, the posterior margin of the pronotum; first hind tarsal joint slightly shorter than the other two together, spur as long as first joint, laminate, moderately wide with many fine teeth on hind margin.

Clypeus, genae behind carina, carinae of face, vertex, a broad median band down pro- and mesonotum, lateral portions of pro- and mesonotum, antennae and legs capucine buff or pale yellow-orange; face and genae between carinae, a broad medio-lateral band down pro- and mesonotum, coxae, most of pleura black fuscous or fuscous brown; abdomen brown with the base, a few marks on pleura and hind margins of some of the segments yellow-orange. Tegmina hyaline tinged with capucine buff, veins darker with minute granules bearing black hairs, a fuscous mark near base and another at apex of clavus, a crescent shape fuscous mark over the posterior apical portion of tegmen including the fork of media and 4-7 apcial veins, the apical half of the fourth and the fifth and sixth apical cells except on the margin where there is a subtriangular clear mark in each cell, the apical portion of the second and third apical veins also fuscous. Genitalia figured.

Length 1.9 mm.; tegmen 2.9 mm.

♀ Similar to the male but slightly lighter over face and abdomen. Pygophor long and narrow.

Length 2.3 mm.; tegmen 2.9 mm.

Hab. Luzon, P. I., a long series, mostly males, from Los Banos (Muir) and one from Mindanao, Davao (Baker coll.). I also have a specimen from Galle, Ceylon (Bainbrigge Fletcher). There is a slight amount of color variation as to the intensity of the black on face and the extent of infuscation on tegmina. I have honored this little insect with the name of Dr. F. H. Fieber to whom we are indebted for the foundations of the classification of the *Delphacidae*.

Genus Bakerella Craw.

B. maculata Craw.

Ten specimens from Mexico Valley (Koebele 1907), one male of which is brachypterous. The tegmina reach the middle of the fifth abdominal segment, brown over the basal two-thirds of clavus, fuscous or black over the rest, the margins thick, the apical margin and hind margin of clavus white. Length 1.6 mm.; tegmen .7 mm.

Genus Delphacodes Fieber.

Delphacodes Fieb. subgenus of Delphax, logotype *mulsanti* Fieb., Verh. z. b. Ges. Wien XVI (1866), p. 524, Pl. VIII, fig. 32.

Liburnia Stål 1866, Hem. Afr. IV, pp. 176, 179, in part.

Delphax Fabricius Ent. Syst. Suppl. (1798), p. 511, in part (and other authors).

In listing the genera of Delphacidae I retained the name *Liburnia* Stål with *Delphax pellucida* Fabr. as its type* for the largest group of species in the family, thinking that by so doing it would cause the least amount of change. A reconsideration of the matter has convinced me that this name cannot be maintained.

Fabricius described the genus *Delphax* (1798) in which he placed *crassicornis, clavicornis* and, at a later date, *pellucida* and other species. There is no such genus as *Delphax* Latr. 1807; in that year Latreille vainly tried to fix *pellucida* Fab. as the type of *Delphax* Fab. Stål and other writers described species under *Delphax* Fab. (not *Delphax* Latr.) which were congeneric with *pellucida* but not with *crassicornis*. In 1866 Stål recognized that *crassicornis* was the type of *Delphax* and so he erected the new genus *Liburnia* to contain those species of *Delphax* which were not congeneric with *crassicornis*. As synonyms of *Liburnia* he gave *Delphax* Auctor and *Embolophora* Stål 1853, and mentioned seven species. It has been contended that the sections *a* and *a.a.* used by Stål to divide his species of *Liburnia* are subgeneric. I cannot agree with this contention as Stål nowhere states this to be the case and he gave no subgeneric names to the divisions. In the same work on pages 15 to 41 he deals with the genus *Tibicen* Latr. and divides it into subgenera which he names and describes.

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* Canadian Entomologist, 1915, p. 265.

and in the subgenus *Quintilia* he uses the same method of dividing his species as he does in *Liburnia*, viz., *a*, *a.a*, *b*, *b.b*, etc,. a method he used in many other parts of the same work and elsewhere.

The subsequent history of *Liburnia* appears to be that Distant in 1906 selected *monoceros* as the type, and at a later date *monoceros* was separated from the other species as a distinct genus. Thus *Embolophora* and *Liburnia* have the same type and the former takes precedence. My knowledge of the literature from 1866 to 1906 is far from complete so that it is possible that someone separated *monoceros* from the other six species before 1906, in which case *Liburnia* still stands without a selected type, so I name *Delphax vitticollis* Stål.

Stål considered *monoceros* congeneric with *pallens* or he would not have placed them together; what his intentions were I cannot say but he made *Embolophora* and *Liburnia* synonyms. Unless new data is presented I shall consider them as such and use the name *Delphacodes* Fieber 1866 for the group that contains *mulsanti* and congeneric species.

D. ordovis (Kirk.).

"Delphax" ordovis Kirkaldy, 1907, H. S. P. A. Ent. Bull. III, p. 152.

D. parysatis (Kirk.).

"Delphax" parysatis Kirkaldy, t. c. p. 153.

D. dilpa (Kirk.).

"Delphax" dilpa Kirkaldy, t. c. p. 162.

D. dryope (Kirk.).

"Delphax" dryope Kirkaldy, 1907, t. c. p. 154.

D. lazulis (Kirk.).

"Delphax" lazulis Kirkaldy, 1907, t. c. p. 155.

D. matanitu (Kirk.).

"Delphax" matanitu Kirkaldy, 1907, l. c.

Also from Papua, Laloki River (Muir, 1909), one macropterous male.

D. hyas (Kirk.).

"Delphax" hyas Kirkaldy, 1907, t. c. p. 156.

D. disonymos (Kirk.).

"*Delphax*" *disonymos* Kirkaldy, 1907, l. c.

Delphacodes miridianalis sp. nov. Pl. V, fig. 24, 24a.

♂ Vertex as long as wide; head as wide as thorax; antennae reaching slightly beyond base of clypeus, length of first joint to second as 1 to 2.5; medio-frontal carina simple; lateral pronotal carinae divergingly curved, not reaching hind margin; brachypterous, tegmen reaching to base of fifth tergite (the pygophor being considered as the ninth abdominal segment); hind tarsus short, first joint slightly longer than the other two together, spur about as long as first joint with many minute teeth on hind margin.

Pygophor a little narrower than deep, margin entire; anal spines strong, near together, slightly curved; genital styles large, flat, broadest at truncate apex, slightly narrowed in middle, the inner apical area bent at a slightly different plane to the basal and outer area; aedeagus slightly flattened laterally, apex rounded, a row of spines from a dorso-apical point down each side to a ventro-subbasal point, a few odd spines over the ventral area.

Head, antennae, thorax and legs ochraceous-buff, frons, genae and clypeus slightly fuscous between carinae, front coxae and a round mark on metapleura dark brown; abdomen blackish brown, lighter over base and pleura; tegmina shiny blackish brown with the extreme base and the margins white or yellowish white, veins concolorous with membrane, without granules.

Length 1.8 mm.; tegmen .7 mm.

♀ There are two females among the series which are uniformly ochraceous-buff.

Length 2.2 mm.; tegmen .9 mm.

Hab. Rotorua, New Zealand (O. H. Swezey, May, 1912). This comes near to *D. dilpa* (Kirk.). from Australia but it can easily be separated by its light head and thorax and by its genitalia.

D. striatella (Fall.)

Mindanao, Davao (Baker coll.). This agrees in every way with specimens from Japan and Europe.

D. terryi sp. nov. Pl. V. fig. 23.

Brachypterous. ♂ Vertex as long as broad; antennae reaching to near the middle of clypeus, second joint double as long as first; frons narrowest at base between eyes, medio-frontal carina simple or furcate only at the extreme base; tegmina reaching to end of abdomen; first joint of hind tarsi as long as the other two together, spur laminate, as long as the first tarsal joint, with many (14-20) fine teeth on posterior edge; lateral pronotal carinae divergingly curved, not reaching hind margin.

Face, genae and clypeus between carinae black, carinae of clypeus and face, antennae, vertex, pro- and mesonotum ochraceous, pro- and mesopleura and coxae black or fuscous, metapleura with a round fuscous spot, abdomen fuscous with the basal segments and posterior edges of 3-8 segments ochraceous. Tegmina ochraceous-buff, fuscous around apex, veins concolorous with membrane, with very minute concolorous granules. Genitalia figured.

Length 1.8 mm.; tegmen 1.3 mm.

♀ Lighter in color, especially between carinae of head.

Length 2.5 mm.; tegmen 1.5 mm.

Macropterous. ♂ Similar in coloration to the brachypterous forms. Tegmina hyaline, slightly opaquely white, veins before cross-veins light yellow, beyond cross-veins brown, apical margin brown, veins with very small granules; wings hyaline, slightly opaque, veins brown. Length of tegmen 3 mm.

♀ Similar in coloration to the brachypterous form, or slightly darker; tegmina similar in coloration and size to that of the macropterous male.

Hab. Java, Dieng Plateau, 7,000 feet elevation. Several specimens bore Dryinid sacs, (F. W. Terry, December, 1908); Formosa, 2 males (Muir, December, 1913).

D. neopropinqua sp. nov. Pl. VI, fig. 38.

♂ Brachypterous. Antennae reaching nearly to the middle of clypeus, first joint half the length of second; first joint of hind tarsus not quite so long as the other two together, spur about as long as the first joint, broad, laminate, with many small teeth on hind margin; lateral pronotal carinae divergingly curved, not reaching hind margin.

Ochraceous-tawny, darker between carinae, on face, clypeus and genae fuscous between carinae, coxae and a round spot on metapleura fuscous, abdomen dark, lighter on base, sides, the anal segment and dorsal portion of pygophor. Tegmina ochraceous-tawny, slightly darker over apex, veins concolorous with membrane, without granules.

The genitalia is near to that of *D. propinqua* (Fieb.) but the aedeagus is distinct (Pl. VI, figs. 37, 38); the genital styles have a less angular projection on the inner basal third, and the truncate apices distinctly narrowed.

Length 1.7 mm.; tegmen 1.3 mm.

Hab. Los Banos, Philippine Islands (Baker coll.). This is a Malayan form of *D. propinqua* of Europe.

D. anderida (Kirk.). Pl. VI, fig. 35.

Dicranotropis anderida Kirkaldy, 1907, H. S. P. A. Ent. Bull. III, p. 133.

The frontal carina furcates at the base of frons and I consider that it should be placed in this genus rather than in *Dicranotropis*. It is possibly the same as *Liburnia sordescens* (Motsch.).

Originally described from a series of females from Fiji and Queensland. I have a long series including a few males from Davao, Mindanao, and Mount Maquiling, Luzon (Baker coll.), also a single male from Lappa Island, South China, one from Pekalongan, Java, and one from Peroe, Ceram Island (Muir). I place them all under this species until the male from Fiji and Queensland is known.

♂ Vertex as long as wide; length of face 2.3 times the width, sides nearly straight, slightly narrowed between the eyes, furcation of medio-frontal carina sometimes indistinct; antennae reaching nearly to middle of clypeus, second joint 1.5 times the length of first; lateral carinae of pronotum divergingly curved, not reaching hind margin; hind tibiae short, first joint not quite so long as other two together with 2-4 small spines near its base, spur slightly longer than first joint, broad, laminate, with numerous small teeth on hind margin. Genitalia figured; the aedeagus is thin, cylindrical, swollen about the middle where the opening is situated, beyond this it is drawn out to a fine, curved point; anal spines larger, slightly diverging.

Blackish brown, lighter over carinae and on pronotum and legs; abdomen darker with light marks on base and pleura; tegmina hyaline, veins brown, darker on apical half, a dark mark on margin at apex of clavus; some specimens are lighter in color and more of a Sanford's brown.

Length 2 mm.; tegmen 2.8 mm.

The females are ochraceous-tawny, some slightly darker than others.

D. bakeri sp. nov. Pl. VI, fig. 47.

♂ Vertex square; frontal carina furcating at base, sides of face subparallel; antennae reaching to near middle of clypeus, second joint 1.8 times the length of first, slightly thickened especially in middle; lateral pronotal carinae divergingly curved, not reaching hind margin; first joint of hind tarsus equal to the two others together, with 2-4 small spines on basal half; spur slightly longer than first tarsal joint, wide, laminate, with numerous small teeth on hind margin.

Head, thorax and legs cinnamon brown, darker over front and middle coxae and a spot on metapleurum; abdomen black or brownish black, lighter over base, pleura and dorsal portion of pygophor and 8th and 7th tergites. Tegmina hyaline, slightly ochraceous, slightly fuscous over cubito-apical cells, veins before cross-veins concolorous with membrane, beyond cross-veins brown, a few very small, concolorous granules. Genitalia figured; anal spines strongly curved. Length 2.5 mm.; tegmen 3 mm.

Hab. Los Banos, Luzon, P. I. (Muir, July, 1916), two male specimens. In build this is very much like *D. anderida* and possesses small spines on the first hind tarsal joint.

D. puella (V. D.)

I have one specimen from Columbus (det. Van Duzee) and others from Dayton and Springfield, Ohio, that agree with the original description and with Crawford's figure of the genitalia. Kirkaldy reported this species from Fiji and Queensland and figured the genitalia of a Queensland specimen*. These figures do not agree with the Ohio specimens and I can find no specimen among the Fiji and Australian material that does. I have placed *D. puella* Kirkaldy not V. D. in *Kelisia* as *K. kirkaldyi*.

D. lacteipennis sp. nov. Pl. VI, figs. 53, 53a.

♂ Head about as broad as pronotum, short; vertex a little broader than long; lateral margins of face arcuate, length of face twice the width, median carina forking at base; antennae reaching a little beyond base of clypeus, second joint 1.8 times the length of first; lateral pronotal carinae divergingly curved; first joint of hind tarsus shorter than other two together, spur as long as first tarsal joint, moderately broad, laminate, with minute teeth on hind margin.

Head and anterior portion of pronotum dark Hessian brown, vertex and carinae at base of face lighter, antennae nearly black, legs brown posterior pair lighter than anterior; posterior portion of pronotum white, creamy white or dirty yellow; meso- and metanotum light brown; abdomen Hessian brown, light on posterior edge of segments and on pleura. On the face, genae and clypeus there are scattered, fine short hairs. Tegmina and wings hyaline, opaquely white, veins yellowish with fine granules on the tegminal veins.

Genitalia figured. Anal spines long, slightly curved, approximate at base, diverging towards apex.

Length 1.4 mm.; tegmen 2 mm.

♀ Brachypterous, tegmina reaching to fourth abdominal segment, orange buff; antennae dark brown, clypeus, face and vertex lighter brown, anterior half of pronotum darker than posterior half. Tegmina hyaline, orange buff; veins concolorous with membrane with concolorous minute granules.

Length 1.6 mm.; tegmen .6 mm.

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* H. S. P. A. Ent. Bull. III (1907), Pl. XV, figs. 1-3.

Hab. Described from eight males from Fiji, four males and one female from Java and one male from Formosa (Muir).

D. nigripennis sp. nov. Pl. VI, fig. 55.

♂ Vertex square; face twice as long as broad, slightly narrowed between eyes, sides subparallel; antennae reaching to the middle of clypeus or a little beyond, second joint 1.7 times the length of first; frontal carina forking at extreme base; lateral pronotal carinae slightly divergingly curved, not reaching hind margin of pronotum; first tarsal joint about equal to the two others together, spur not quite as long as first joint, moderately wide, with small teeth on hind margin.

Light buckthorn brown or ochraceous buff, fuscous over thoracic pleura, on abdominal sternites and ventral half of pygophor. Tegmina shiny black or dark chocolate, veins concolorous, without granules. Genitalia figured.

Length 2 mm.; tegmen 1 mm.

Hab. Formosa, Daimokko (Muir, January, 1916).

TROPIDUCHINAE.

Ommatissus Fieb.

Dr. Melichar* has questioned the status of *Ommatissus lofouensis* Muir and *O. chinsanensis* Muir from China, partly on account of the geographical distribution; the only other species of the genus being found in Andalusia, Spain. I have not seen specimens of *O. binotatus* Fieb., but the two Chinese species agree with Fieber's figures and descriptions so closely that I cannot change my opinion. In the Chinese species the median vein forks at the cross-veins instead of near the apex; the face is slightly broader; in *O. chinsanensis* Muir the clypeus in profile is slightly more arcuate and in *O. lofouensis* Muir still more so, but these slight differences are not sufficient to create a new genus on. The male genitalia separate the three species.

Neommatissus Muir.

I can find no good characters upon which to separate *Stacotoides* Distant from this genus. I placed this, along with *Ommatissus* Fieb. among the Cixiids as the latter holds that position in Oshanin's Catalogue. They both possess the hair-line dividing off the posterior angle of the mesonotum.

* Mon. Tropiduchinae, Verb. Ver. Brün, 1914.

Reference Tables of the Hawaiian Delphacids and of Their Food-Plants.

COMPILED BY WALTER M. GIFFARD.

The compilation of the following ready reference lists of the known species of Hawaiian Delphacids and of their food-plants was undertaken in the hope that it might in a measure be of some assistance to local collectors of this interesting family. Quite a number of food-plants have been added in these lists to those already known and previously recorded, but much has yet to be learned in this particular direction by continued systematic collecting. I have followed Mr. Frederick Muir's recent Review of the Hawaiian Delphacidae* in listing the genera and species together with the compilations of food-plants recorded therein as well as those published in Fauna Hawaiiensis by my friend, the late Mr. George W. Kirkaldy.† To these has been added information supplied me by Messrs. Timberlake, Swezey, and Bridwell and obtained by them on recent collecting trips in the mountainous region of the Island of Oahu. The author has also included his results of systematic collecting of Delphacids for Mr. Muir on two recent visits to the Kilauea region (4,000 feet elevation) on the Island of Hawaii and on Tantalus (1,500 feet elevation), Oahu.‡ Continued systematic collecting of our endemic Delphacids and other Homoptera will undoubtedly furnish present and future workers in this group with a still better knowledge of the trees and plants on which they feed and this in turn will be of material assistance in the future work of identification.

I am much indebted to my friends, Messrs. Muir, Swezey, and Timberlake, for their generous assistance by means of their collections and field notes.

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* Proc. Haw. Ent. Soc., III, No. 3, September, 1916.

† Fauna Hawaiiensis, Vol. II, Part VI (Supplement), pp. 578-598, 1910.

‡ The numbers given in Table I following the author's name as collector are those taken from his field notes which give full details and data as regards environment and the special food plants under observation. The individual specimens in his collections bear corresponding numbers.

The plant names used are according to Hillebrand exce in a few cases where a more recent name or combination used.

Table I.

REFERENCE LIST OF HAWAIIAN DELPHACIDAE WITH THEIR FOO PLANTS.*

LEIALOHA

L. naniicola (Kirk.) *Metrosideros polymorpha* Gaud. (1

L. lehuae (Kirk.) *Metrosideros polymorpha* Gaud. (1).

L. lehuae hawaiiensis Muir *Metrosideros polymorpha* Gau

January, 1915, Muir and Giffard; January, 1916, lon series with young, Giffard No. 7a. Some nymphs bre to maturity on *Straussia* sp., January, 1917, Giffar and Muir.

L. ohiae (Kirk.) *Metrosideros polymorpha* Gaud. (1).

NESODRYAS

N. freycinetiae Kirk. *Freycinetia arnotti* Gaud. (1); Fel ruary, 1916, long series with young along with *Nesosyc ne halia* Kirk., Giffard No. 13a.

N. giffardi Kirk. *Cyrtandra grandiflora* Gaud. (1); *Cyr tandra garnotiana* Gaud. August, 1916, *Rollandi grandifolia* Hbd. March, April, 1916, long series, Tim berlake.

N. elaeocarpi Kirk. *Elaeocarpus bifidus* Hook. and Arn (1); *Cyrtandra paludosa* Gaud. June, 1916, *Scaevoll mollis* Hook. and Arn. June, 1916, long series, Tim berlake.

N. eugeniae Kirk. *Syzygium sandwicense* (Gray) (1) March, April, 1916, long series with young Giffard

N. dodonaeae Muir. *Dodonaea* sp. (2).

N. dryope Kirk. *Antidesma platyphyllum* Mann, Janu ary, 1917, Muir and Giffard.

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* (1) Refers to Kirkaldy, Fauna Hawaiiensis, Vol. II, Part VI pp. 577-598. (2) Refers to Muir, 1916, Pro. Haw. Ent. Soc., III, No. 3, pp. 168-197. Other numbers refer to writer's field notes.

N. antidesmae Muir *Antidesma platyphyllum* Mann, November, 1916, Giffard and Fullaway.

N. fletus (Kirk.) *Suttonia* sp., December, 1916, Munro.

N. gulicki Muir, *Metrosideros polymorpha* Gaud. (2); January, 1917, long series of both sexes, Muir and Giffard; *Osmanthus sandicensis* (Gray), January, 1917; one nymph bred to maturity, Muir and Giffard.

N. bobeae (Kirk.) *Bobea* sp. (1).

N. maculata Muir. *Maba sandwicensis* D. C., long series, *Osmanthus sandwicensis* (Gray), nymphs bred to maturity, January, 1917, Giffard and Muir.

N. perkinsi (Kirk.) *Suttonia* sp. (1).

N. terryi (Kirk.) *Osmanthus sandwicensis* (Gray), April, 1916, Swezey.

N. munroi Muir. *Dodonaea viscosa* L., December, 1916, Munro.

ALOHA

A. ipomoeae Kirk. *Ipomoea pes-caprae, I. batatas, I. bonanox, I. tuberculata, I. insularis* (1) *Scaevola coriacea* Nutt., August, Swezey.

A. myoporicola Kirk. *Myoporum sandwicense* Gray (1); *Pelea volcanica* Gray., adults and nymphs, January, 1917, Muir and Giffard.

A. plectranthi Muir. *Plectranthus parviflorus* Willd., March, 1915, Swezey; April, Osborn, reared from eggs, no adults taken (2).

A. kirkaldyi Muir, *Euphorbia hillebrandi* Forbes, July, 1916, long series, Bridwell, Timberlake.

A. swezeyi Muir. *Campylotheca macrocarpa* Hbd., February, 1917, series of both sexes, Timberlake; *Lythrum* sp., June, 1916, one male, Swezey.

A. wailupensis Muir. *Coprosma longifolia* Gray, June, 1916, one male, Timberlake.

A. flavocollaris Muir. *Dubautia laxa* Hook. and Arn. *D. plantaginea* Gaud., July, 1916, long series, Timberlake, Bridwell.

A. dubautiae (Kirk.) *Dubautia plantaginea* Gaud. (1); *D. laxa* Hook. and Arn., March, Oct., 1916, Timberlake.

A. artemisiae (Kirk.) *Artemisia australis* Less., Kirkaldy, Proc. Haw. Ent. Soc. II, 1910, p. 118.

A. campylothecae Muir, *Campylotheca* sp. (2).

K. kaalensis Muir, *Campylotheca* sp., July, 1916, long series, Timberlake.

NESORESTIAS

N. filicicola Kirk. Ferns (1).

N. nimbata (Kirk.) *Phegopteris* sp., April, 1916, Timberlake.

NOTHORESTIAS

N. badia Muir, Ferns, one male, Timberlake.

DICTYOPHORODELPHAX

D. mirabilis Swezey. *Pittosporum glabrum* Hook. and Arn., March, 1916, two males, Bridwell, Timberlake; *Euphorbia clusiaefolia* Hook. and Arn., June, July, September, 1916, long series, Bridwell, Swezey, Timberlake; *Euphorbia hillebrandi* Forbes, July, 1916, 2 adults and nymphs, Timberlake, Swezey, Bridwell.

NESOSYDNE

N. koae Kirk. *Acacia koa* Gray, on the young leaves, many records of adults and nymphs.

N. rubescens Kirk. and var. *pulla* Muir. *Acacia koa* Gray, on the phyllodia, many records of adults and young. Stray specimens of *N. koae* are found on the phyllodia and *N. rubescens* on leaves.

N. pseudorubescens Muir. *Acacia koa* Gray (2), January, 1917, Giffard and Muir.

N. koae-phyllodii Muir. *Acacia koa* Gray, on the phyllodia (2).

N. pele Kirk. *Straussia* sp., January, 1917, Giffard and Muir.

N. oahuensis Muir. *Charpentiera obovata* Gray, March, April, June, 1916, long series, Timberlake.

N. cyrtandrae Muir. *Cyrtandra* sp., September, Swezey.

N. gouldiae Kirk. *Gouldia** sp. (1); *Cyrtandra grandiflora* Gaud., August, October, 1916, long series, Timberlake.

N. blackburni Muir. *Pipturus alibdus* Gray; January, 1915, Muir and Giffard; October, 1915, and January, 1916, long series with young from isolated trees, Giffard Nos. 5, 10, 11, 14, 17, 5a, 6a, 11a; *Stenogyne calaminthoides* Gray, January, 1916, long series with young, Giffard, Nos. 2a, 4a, 15a; *Clermontia parviflora* var. *pleiantha* Hilleb., January, 1916, small series with young, Giffard No. 14a.

N. pipturi Kirk. *Pipturus albidus* Gray (1), February, 1916, long series with young, Giffard, No. 9a.

N. chambersi Kirk. *Raillardia* sp. January, 1915, Muir and Giffard; January, 1916, long series with young, Giffard No. 3a, 12a.

N. cyathodis Kirk. *Cyathodes tameiameiae* Cham. (1); January, 1915, long series, Muir and Giffard; October, 1915, and January, 1916, very common, Giffard No. 2.

N. leahi (Kirk.) *Lipochaeta* sp. Kirkaldy, 1904, Entomologist p. 176; *Lipochaeta calycosa* Gray, June, 1916, long series, Timberlake; *Lipochaeta integrifolia* Gray, November, 1916, long series, Timberlake.

N. raillardiae Kirk. *Raillardia* sp. (1); *Raillardia* January, 1916, series with young, Giffard No. 10a; January,

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* *Gouldia* of Kirkaldy was no doubt a misidentification. The plant in question was undoubtdly *Cyrtandra* sp. [Ed.]

uary, 1917, long series with young and one macropterous female, Muir and Giffard.

N. ipomoeicola Kirk. *Ipomoea* sp., *Jussiaea villosa, Dolichos lablab* (1); *Ipomoea* sp. February, 1916, long series with young, Giffard Nos. 10a, 18a; *Sadleria* and *Cibotium* ferns; October, 1915, and January, 1916, long series with young, Giffard Nos. 1, 3, 4, 9, 12, 16, 16a; *Lythrum maritimum* H. B. K. January and February, 1916, long series with young, Giffard.

N. halia Kirk. *Freycinetia arnotti* Gaud. February, 1916, long series with young, Giffard Nos. 6a, 13a.

N. giffardi Muir. *Cyrtandra grandiflora* Gaud. October, 1916, long series, Timberlake.

N. montis-tantalus Muir. *Lobelia hypoleuca* Hbd., *Broussaisia arguta* Gaud. March, October, 1916, common on small plants or seedlings close to the ground, Timberlake.

N. argyroxiphii Kirk. *Argyroxiphium sandwicense* D. C. (1).

N. lobeliae Muir. *Lobelia hypoleuca* Hbd., April-October, 1916, long series, Timberlake.

N. timberlakei Muir. *Cyrtandra garnotiana* Gaud. August, 1916, two males and nymphs, Timberlake.

N. gunnerae Muir. *Gunnera petaloidea* Gaud., a long series of both sexes and one nymph, mostly along the midrib on the under side of old leaves, July, 1916, Swezey and Timberlake; a male and female off *Pelea* sp., one female off *Coprosma longifolia* Gray and one female off *Suttonia* sp., July, 1916, Timberlake.

N. asteliae Muir. *Astelia veratroides* Gaud., July, 1916, a series of males, females and nymphs, Timberlake, Swezey and Bridwell.

N. fullawayi lanaiensis Muir. *Cyathodes* sp. December, 1916, Munro.

KELISIA

K. sporobolicola Kirk. *Sporobolus virginicus* Kth. (1).

K. swezeyi Kirk. *Eragrostis variabilis* Gaud. October, 1916, Swezey and Timberlake; November, 1916, Giffard and Fullaway.

K. paludum Kirk. *Herpestis monnieria* and a sedge (*Juncus* is quoted in error) (1).

K. emoloa Muir. *Eragrostis variabilis* Gaud. June, 1916, Swezey; July, 1916, Timberlake and Bridwell.

Perkinsiella saccharicida Kirk. on sugar-cane and *Peregrinus maidis* (Ashm.) on *Zea mays* are of recent introduction.

TABLE II.

ALPHABETICAL LIST OF KNOWN FOOD-PLANTS AND OF THE DELPHACIDAE ATTACHED THERETO.*

ACACIA KOA (native name *koa*) *Nesosydne koae* Kirk.; *N. rubescens* (Kirk.); *N. rubescens* var. *pulla* Muir.; *N. koaephyllodii* Muir; *N. pseudorubescens* Muir.

ANTIDESMA PLATYPHYLLUM (*Hame*) *Nesodryas antidesmae* Muir; *N. dryope* (Kirk.).

ARGYROXIPHIUM SANDWICENSE (*Ahinahina*) *Nesosydne argyroxiphii* Kirk.

ARTEMISIA AUSTRALIS *Aloha artemisiae* (Kirk.).

ASTELIA VERATROIDES (*Painiu*) *Nesosydne asteliae* Muir.

BOBEA *sp.* (*Ahakea*) *Nesodryas bobeae* (Kirk.).

BROUSSAISIA ARGUTA (*Kanawau* and *Puahanui*) *Nesosydne montis-tantalus* Muir.

CAMPYLOTHECA MACROCARPA (*Kokolau*) *Aloha campylothecae* Muir; *A. kaalensis* Muir; *Aloha swezeyi* Muir.

CHARPENTIERA OBOVATA (*Papala*) *Nesosydne oahuensis* Muir.

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* I am indebted to Mr. J. F. Rock for identifications of species of certain of the food-plants given in this list.

CIBOTIUM (*Hapu*) *Nesosydne ipomoeicola* Kirk.; *Nesorestias filicicola* Kirk.?

CLERMONTIA PARVIFLORA var. PLEIANTHA (*Oha wai*) *Nesosydne blackburni* Muir.

COPROSMA LONGIFOLIA (*Pilo, Olena, Koi*) *Aloha wailupensis* Muir.

CYATHODES TAMEIAMEIA (*Pukeawe, Maieli*) *Nesosydne cyathodis* Kirk.; *N. fulawayi lanaiensis* Muir.

CYRTANDRA sp. *Nesosydne cyrtandrae* Muir.

CYRTANDRA GARNOTIANA *Nesodryas giffardi* Kirk.; *Nesosydne timberlakei* Muir.

CYRTANDRA GRANDIFLORA *Nesosydne giffardi* Muir; *N. gouldiae* Kirk.; *Nesodryas giffardi* Kirk.

CYRTANDRA PALUDOSA *Nesodryas elaeocarpi* Kirk.

DODONAEA sp. (*Aalii, Aalii kumakua*) *Nesodryas dodonaeae* Muir.

D. VISCOSA *N. munroi* Muir.

DOLICHOS LABLAB *Nesosydne ipomoeicola* Kirk.

DUBAUTIA LAXA (*Naenae*) *Aloha flavocollaris* Muir; *Aloha dubautiae* (Kirk.).

DUBAUTIA PLANTAGINEA (*Naenae*) *Aloha dubautiae* (Kirk.), *Aloha flavocollaris* Muir.

ELAEOCARPUS BIFIDUS (*Kalia*) *Nesodryas elaeocarpi* Kirk.

ERAGROSTIS VARIABILIS (*Emoloa*) *Kelisia emoloa* Muir; *Kelisia swezeyi* Kirk.

EUGENIA SANDWICENSIS (*Ohia-ha, Paihi*) *Nesodryas eugeniae* Kirk.

EUPHORBA CLUSIAEFOLIA (*Koko, Akoko*) *Dictyophorodelphax mirabilis* Swezey.

EUPHORBIA HILLEBRANDI (*Koko Akoko*) *Aloha kirkaldyi* Muir; *Dictyophorodelphax mirabilis* Swezey.

FREYCINETIA ARNOTTI (*Ie-ie*) *Nesodryas freycinetiae* Kirk.; *Nesosydne halia* Kirk.

GOULDIA sp.* (*Manono*) *Nesosydne gouldiae* Kirk.

GUNNERA PETALOIDEA (*Apé*) *Nesosydne gunnerae* Muir.

HERPESTIS MONNIERIA *Kelisia paludum* Kirk.

IPOMOEA sps. *Nesosydne ipomoeicola* Kirk.; *Aloha ipomoeae* Kirk.

JUSSIAEA VILLOSA (*Kamaole*) *Nesosydne ipomoeicola* Kirk.

LIPOCHAETA CALYCOSA (*Nehe*) *Nesosydne leahi* (Kirk.).

LIPOCHAETA INTEGRIFOLIA (*Nehe*) *Nesosydne leahi* (Kirk.).

LOBELIA HYPOLEUCA *Nesosydne montis-tantalus* Muir; *N. lobeliae* Muir.

LYTHRUM MARITIMUM (*Ninika*) *Nesosydne ipomoeicola* Kirk.

MABA SANDWICENSIS (*Lama*) *Nesodryas maculata* Muir.

METROSIDEROS POLYMORPHA vars. (*Ohia lehua*) *Leialoha naniicola* (Kirk.); *L. lehuae* (Kirk.); *L. lehuae hawaiiensis* Muir; *L. ohiae* (Kirk.); *Nesodryas gulicki* Muir.

MYOPORUM SANDWICENSE (*Naio*) *Aloha myoporicola* Kirk.

OSMANTHUS SANDWICENSIS (*Pua* or *Ulupua*) *Nesodryas gulicki* Muir, *N. terryi* (Kirk.); *N. maculata* Muir.

PELEA VOLCANICA (*Alani*) *Aloha myopoicola* Kirk.

PHEGOPTERIS sp. *Nesorestias nimbata* (Kirk.).

PIPTURUS ALBIDUS (*Mamake*) *Nesosydne blackburni* Muir; *N. pipturi* Kirk.

PITTOSPORUM GLABRUM (*Hoawa*) *Dictyophorodelphax mirabilis* Swezey.

PLECTRANTHUS PARVIFLORUS *Aloha plectranthi* Muir.

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* See footnote, page 343.

RAILLARDIA sp. (*Kupana, Naenae*) *Nesosydne chambersi* Kirk; *N. raillardiae* Kirk.; *N. osborni* Muir.

ROLLANDIA GRANDIFOLIA *Nesodryas giffardi* Kirk.

SADLERIA sp. (*Amamau*) *Nesosydne ipomoeicola* Kirk.; *Nesorestias filicicola* Kirk.

SCAEVOLA CORIACEA (*Naupaka, Naupaka kuahiwi, Ohenaupaka*) *Aloha ipomoeae* Kirk.

SCAEVOLA MOLLIS *Nesodryas elaeocarpi* Kirk.

SPOROBOLUS VIRGINICUS *Kelisia sporobolicola* Kirk.

STENOGYNE CALAMINTHOIDES *Nesosydne blackburni* Muir.

STRAUSSIA sp. (*Kopiko*) *Nesosydne pele* Kirk. *Leialoha lehuae hawaiiensis* Muir.

SUTTONIA sp. (*Kolea*) *Nesodryas fletus* (Kirk.) *Nesodryas perkinsi* (Kirk.).

SYZYGIUM SANDWICENSIS (*Ohia-ha, Paihi*) *Nesodryas eugeniae* Kirk.

TOUCHARDIA LATIFOLIA (*Olona'*) *Nesodryas giffardi* Kirk.

TABLE III.

LIST OF SPECIES OF HAWAIIAN DELPHACIDAE FOR WHICH THE FOOD-PLANTS ARE AT PRESENT UNKNOWN OR IN DOUBT.

Leialoha oceanides (Kirk.); *N. pacifica* (Kirk.)

Nesodryas fletus (Kirk.); *N. frigidula* (Kirk.); *N. hula* (Kirk.); *N. laka* (Kirk.); *N. piilani* (Kirk.); *N. pluvialis* (Kirk.); *N. silvestris* (Kirk.).

Nothorestias badia Muir.

Nesosydne swezeyi Muir; *N. anceps* Muir; *N. nephrolepidis* Kirk.; *N. perkinsi* Muir; *N. wailupensis* Muir; *N. fullawayi* Muir; *N. incommoda* Muir; *N. sharpi* Muir; *N. rocki* Muir; *N. monticola* Kirk.; *N. haleakala* Kirk.; *N. nephelias* Kirk.; *N. procellaris* Kirk.; *N. umbratica* Kirk.; *N. hamadryas* Kirk.; *N. palustris* Kirk.; *N. nubigena* Kirk.; *N. imbricola* Kirk.

ANNUAL ADDRESS.

Economic Aspects of Our Predaceous Ant

(*Pheidole megacephala*)

BY J. F. ILLINGWORTH.

Even the most casual observer is interested in ants. Their extraordinary instincts appeal to the imagination; hence, we find allusions to their industry and perseverance in the earliest literature. 1000 B. C., Solomon pointed to the ants for the emulation of society, and correctly observed that each individual was able, instinctively, to fulfill the demands of social life without "chief, overseer, or ruler".

Their great value in the economy of nature demands our consideration. They not only remove myriads of dead insects, but, also, act as an important factor in the destruction of the living. Forel estimated that a large colony would bring in 100,000 daily during their greatest activity. Moreover, in some countries predaceous ants are regarded as useful allies in the control of insect pests, and we might profitably consider McCook's (1882)* suggestion, that foreign ants be introduced for such purposes.

Though ants often come into conflict with our activities, and there is a popular notion that they are noxious insects, I believe, with Forel and other leading students of the subject, that a consideration of all the facts forces us to the conclusion that as a group they are eminently beneficial.

Ants have become dominant insects through their splendid adaptability and terrestrial habits, as has been pointed out by several authors. Their varied diet, simple home-life, and freedom from enemies being important factors leading to their success. "The worst enemies of ants are other ants, just as the worst enemies of men are other men." Hence, it is a rather common experience, in the tropics, to find that one species becomes dominant in a certain region, at the expense of all the other ant-fauna.

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* Dates in parenthesis refer to bibliography.

A notable case (Wheeler, 1906) is the supplanting of *Pheidole megacephala*, by the Argentine ant (*Iridomyrmex humilis*), in Madeira. This displaced species which has proved itself so dominant in other warm countries of the world, evidently met a superior foe in the pugnacious South American ant. This superiority appears to be evidenced by the way that the Argentine ant is displacing all other ants in our Southern States. (Dr. Wheeler (1910), further, gives interesting accounts of the dominance of *P. megacephala* in tropical countries, citing particularly, Bermuda and the Virgin Islands. He then predicted that this species would rapidly exterminate the ant-fauna of tropical or subtropical regions, wherever it was able to gain a foothold, and propagate abundantly. This prediction is certainly proving true in the case of Hawaii, at least as far as out-of-door nesting species are concerned.

One has but to observe in some particular region of our Islands, for a few years, to note the supplanting of other ants by *P. megacephala*. At my home, in Palolo Valley, this latter species is now the dominant ant, out-of-doors. As recently as 1913, the black ant (*Prenolepis longicornis*) was there in myriads, and the yard contained several nests of the fire ant (*Solenopsis geminata* var. *rufa*); both these species have now entirely disappeared.) The first was particularly troublesome from the fact that whole colonies frequently moved into the house, locating the brood about the water pipes, or inside the tank of the toilet. They gave further trouble by being omnivorous feeders; so we were glad to see them replaced, even though it might be a case of "out of the frying pan into the fire". The *megacephala*, however, have at least kept their family affairs out-of-doors.

Dr. Perkins (1913) has described in a most convincing manner the effects of this dominant introduced ant upon our endemic insect-fauna. For he considered that it had practically exterminated the native insects, particularly the beetles, within its range. But, as he remarked, foreign or imported insects often flourish in spite of it.

Dr. Wheeler has recently written me of his observations on *P. megacephala* in Queensland, Australia, where, he says, one can see very easily the supplanting of the native ants by this species.

ORIGIN.

Considering that the habits of this species were first studied extensively by Professor Heer (1852, 1856) in Madeira, and the name *Œcophthora pusilla*, given to it by him, it is only natural for Brown (1869) to consider this ant peculiar to that island.

Investigations of recent years have demonstrated that *P. megacephala* is cosmopolitan, at least in the tropics and subtropics. Dr. Wheeler informs me that the species seems to have come from Madagascar or Africa originally, for it belongs to a group of *Pheidole* which is best represented in those regions.

There is no record of the time when this ant was introduced into Hawaii, but Dr. Perkins (1913) states that even during the last twenty years it has occupied some considerable areas previously free from it. Blackburn and Kirby (1880) recorded it under the name *Pheidole pusilla* Heer, remarking that it was "one of the commonest ants in Oahu, and probably elsewhere."

DISTRIBUTION.

It is an extremely easy matter for ants to be distributed by shipping, for it is a common experience to find them in packages of merchandise upon the wharves. A good illustration of this fact was recorded by Eckart (1902), who received a barrel of borer-infested seed-cane from Demerara, which upon opening up was found to be swarming with *P. megacephala*.

The range of these ants is largely controlled by climatic conditions. They are not tolerant of cold weather, and apparently, extremes of humidity are very injurious to them.

Girault (1915) has recorded the destruction of vast numbers, due to slight frost in Queensland; but his last statement that the heaps of dead all seemed to be in ruts, might imply that water came in as an additional death-factor. On several occasions, while in Fiji during 1913, I observed similar piles of dead *megacephala,* which had been carried out of the nests by the survivors. These fatalities apparently always took place during cool rainy nights, and the heaps of dead were only found at the entrances of nests located in the furrows between the cane rows. The indication is that the ants were overtaken by a flood of water, while in a chilled condition, otherwise we should expect dead in the nests on the ridges as well as in the furrows. An experiment was tried of flooding a nest for a brief period during the day, but apparently no fatalities resulted, for as soon as the water subsided the workers began carrying the brood to a drier location.

Dr. Perkins (1913) mentions low-lying localities, along the coast, which from excessive dryness and other causes, the *Pheidole* is unable to occupy, at any rate permanently. A good example of such a locality is to be found just beyond Koko Head crater, here on Oahu. Going over into this valley, a marked change in the insect-fauna is to be noted. While *megacephala* is the dominant ant on the Honolulu-side of the crater, there is scarcely a trace of this species on the opposite side, which is an extremely dry and windswept area. Several other ants have, however, adapted themselves to these difficult conditions. Both *Prenolepis longicornis* and the fire ant (*Solenopsis geminata* var. *rufa*) are there in abundance. The first species favoring the region of coral sand, and the second the alluvial soil, further back from the shore, in accordance with its agricultural habits.

It is interesting to recall that these are the same species, recently exterminated by *megacephala* in the vicinity of my home, in Palolo Valley. They are certainly driven to the "ends of the earth" in a region such as we find beyond Koko Head.

HABITS.

In favorable regions, such as we find in any of our humid valleys, *P. megacephala* is exceedingly abundant. These ants make use of every stone for a roof, and the large cracks in the volcanic soil, which form during the dry season, furnish them ready-made chambers to a considerable depth. Naturally, heavy rains are unfavorable to them in this spongy soil, and they probably suffer severe loss. Under such circumstances, we find them bringing great piles of the brood to the surface, and depositing it just beneath the stones or other objects, where it may be easily destroyed by further floods.

When thus set-to to save their brood, the ants make use of any structure above ground; hence, we find them doing considerable damage in unprotected apiaries* during the rainy season. At this time every hive has a thriving colony of ants beneath it, and, as the soil becomes saturated, they try to move inside. They build covered runways, of soil and bits of trash, connecting their nest with the opening to the hive, and thus effect an entrance without apparent remonstrance on the part of the bees. The ants then begin their attack by catching the bees along the edges of the combs, but with each success their numbers increase, until they literally cover every square inch of space within the hive, and the remaining bees are compelled to flee for safety. When the swarm has been thus gotten rid of, the ants devote their attention to the destruction of the larval bees, and often move part of their nest into the hive.

In such an onslaught it is the small workers who rush in from all sides, seizing legs and wings of the prey; but they are soon assisted by the soldiers, who not only help to hold the struggling insect, but also offer most effective service in dismembering it with their powerful jaws, and, in biting it up into pieces of such size that they can be easily carried by the workers. The soldiers apparently disdain any other duties than these, for they have not been observed either carrying food, or assisting in the removal of brood in the suddenly opened nest. In the regular file of workers, struggling under their heavy loads, these big-headed fellows march along empty handed. They have an inquisitive way of rushing up to each worker that they meet and touching antennae for an instant before passing. Furthermore, the workers do all the foraging —a great excess of soldiers being usually found in the nest, as if waiting for a "call to arms". As soon as a new food

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* Methods for the protection of bees discussed under control measures.

supply is located, however, the soldiers advance in a constant stream, along with the workers.

Mr. E. C. Smith, manager of the Garden Island Honey Company, of Honolulu, tells me that with their 5,000 colonies, located on the various islands, they experience by far the greatest difficulty from these ants on the Island of Hawaii; for most of their apiaries are there located in very humid districts. He says that, even here on Oahu, at least twenty-five per cent of the colonies are destroyed during each rainy season, unless protected. It is his experience that no colony, no matter how strong, can withstand these predators, for more than a few days, if once set-upon.

It is fortunate for the apiarist that the ants are omnivorous in their diet, and that they feed upon bees during so short a season; for even though a successful method of keeping them out of the hives has been devised, the expense for the labor item of carrying on the combat throughout the year would be prohibitive.

Since these ants show a decided preference for an insect diet, their activities may lead them to attack other introduced beneficial insects. Fortunately, many of these, for example the hymenopterous parasites, appear to be more or less immune but, as I have recorded (1914) the breeding of dipterous parasites, in Fiji, was greatly hampered by *megacephala*.

Apparently this is a further case of the effects of climate upon the activities of this ant. Fiji, being nearer the equator, is warmer than Hawaii, and *megacephala* is much more abundant, at least, in the cane districts. As far as we were able to observe, none of the thousands of flies that we liberated during the first nine months were able to establish themselves. This was probably due to the fact that the work was started at the beginning of the dry season, at a time when the ants were exceedingly abundant. The breeding cages were moved, however, to a new district, during the following wet season, and in scarcely three months after the liberation (February, 1914) of 320 flies, they were found breeding in the field, and three months later, at cutting time, they were found to be so well established that the fly puparia could be found in almost every borer-infested stalk, and they had spread over several fields. By the end of the dry season, however, the ants, which had become scarce during the wet weather, were again exceedingly abundant, and no flies or their puparia were to be found.

We have had similar experience in each of the districts where the flies have been liberated, even to those that were sent over to Queensland,—at first they would appear to be established and spreading in the fields during the rainy season, but later they would entirely disappear.

The only way that I can account for the way these flies have succeeded in Hawaii is that *megacephala* is not nearly as numerous here.

Though these ants are often regarded as noxious insects because of their relation to Aphids, Coccids and leaf-hoppers, we must give them credit for the fact that they often devour these insects, especially if there is a shortage of the honey-dew. Professor Heer (1852 and 1856) speaks with surprise of their destruction of cochineal insects, and recently Swezey (1913) recorded their eating some of the mealy bugs on sugar cane. Moreover, Dr. Wheeler (1910) points out that ants also render some assistance by removing the sweet excretions produced by these various bugs, for if left to fall upon the leaves, it forms a culture for destructive leaf fungi.

Furthermore, this species can hardly be regarded as a household pest. Though they show a fondness for foods containing fats and proteids, particularly meats, beans, cheese, butter, etc., these foods can easily be protected from them. I have not observed that they show a particular liking for sweets, in the house, as recorded by Professor Heer (1852, 1856). As he noted, however, they do have a decided preference for an insect diet, and we find them not only removing the dead insects that chance about the place, but also going after the living. One remarkable case was that of some dried fish which had become thoroughly infested with Dermestid larvae. When first observed, the ants were all over this fish and vigorously attacking the spiny larvae. Within two days not one of the pests remained and the ants gradually dispersed without any way molesting the fish.

During dry weather the ants often come into the hou after water, and I have found them swarming over th inverted drinking-glass. On one occasion, when taking a drin in the dark, I felt a gritty substance in my mouth from th edge of the glass, and upon investigation in the light I foun that I had devoured a few dozen ants. Fortunately, they hav no taste, so, if we did not know that they were present, w might eat them with impunity.

It is in their relation to our pests out-of-doors that an of this species have demonstrated their great usefulness. A early as 1852, Professor Heer observed that they held a important economic position, for they attacked many of th most destructive pests, and no insect appeared to be too larg for them. Even in their activities against house-flies, whic I have recorded (1913), they render a most valuable servic For the breeding possibilities of this pest, if uncontrolled, i tropical countries, would be inestimable.

As pointed out by Dr. Perkins (1913) there are ver few of the native insects that can long resist this predator and the same might be said for some of our introduced species Even insects as big and powerful as our mole cricket (*Gryllotalpa africana*) are destroyed. I have several times observed these crickets in the clutches of the ants, on sandy soil, and they appeared to be powerless to throw off their little tormentors. In one instance I counted sixteen ants on one leg and there appeared to be as many on each of the other appendages, including the cerci. In their struggle to hold the prey the ants seized upon every bit of rubbish that came in their way, so that the cricket was soon weighted down and tired out carrying this load. He made many attempts to get into the soil but the mass of ants kept their hold upon him until the soldiers succeeded in puncturing the wall of his abdomen, after which the struggle was brief. Cardin (1913) has reported that the ants are the most dreaded enemies of a mole cricket, in Cuba, and he partly attributes the scarcity of this pest, in that country to them.

To form some conclusion as to how such minute insects are able to dominate creatures even hundreds of times their size one has but to observe their persistence and the tenacity of their attack. In Fiji I could hardly collect any insects, at lights, which did not have a number of these ants attached to them. Even the powerful June beetles, (*Rhopoea* sp.) which destroy large areas of sugar-cane by feeding upon the roots, were attacked—often as many as two dozen ants clinging to the legs when captured. Of course, it is impossible to tell how long these ants had maintained their grip upon the insects, but possibly for hours, since they apparently never give up, as long as there is any hope of success.

On one occasion I discovered two soldiers and a few workers holding a large Dermestid larva, and though I watched them for over two hours they hardly changed their positions. The only motions that I could observe were that the ants continually braced themselves, shifting the feet, and there was a periodic jerking of the abdomen, especially by the soldiers.

CONTROL MEASURES.

Let me emphasize in the beginning, that with these ants, our objects should be control and not destruction. If these little creatures, through their zeal, come into conflict with some of our interests, we should not at once try to kill them, but, rather, to devise a means to keep them out of trouble. Therefore, of the numerous remedies that have been recommended for ants, I will not here consider those which aim at their destruction.

The method devised by Mr. E. C. Smith for the protection of bees is, like many important discoveries, both simple and effective. The corners of the hive are supported on the heads of sixty-penny spikes, coated with axle grease (Plate VII). Any kind of a frame-work may serve for the attachment of the spikes, but Mr. Smith has finally standardized it; using two pieces of 2 x 3, which measure just the width of the hive, and a 1 x 3, as long as the hive, for a spreader. In getting out this material at the mill, holes are bored into the 2 x 3s, so that the nails will all enter the same distance, and give no trouble from splitting.

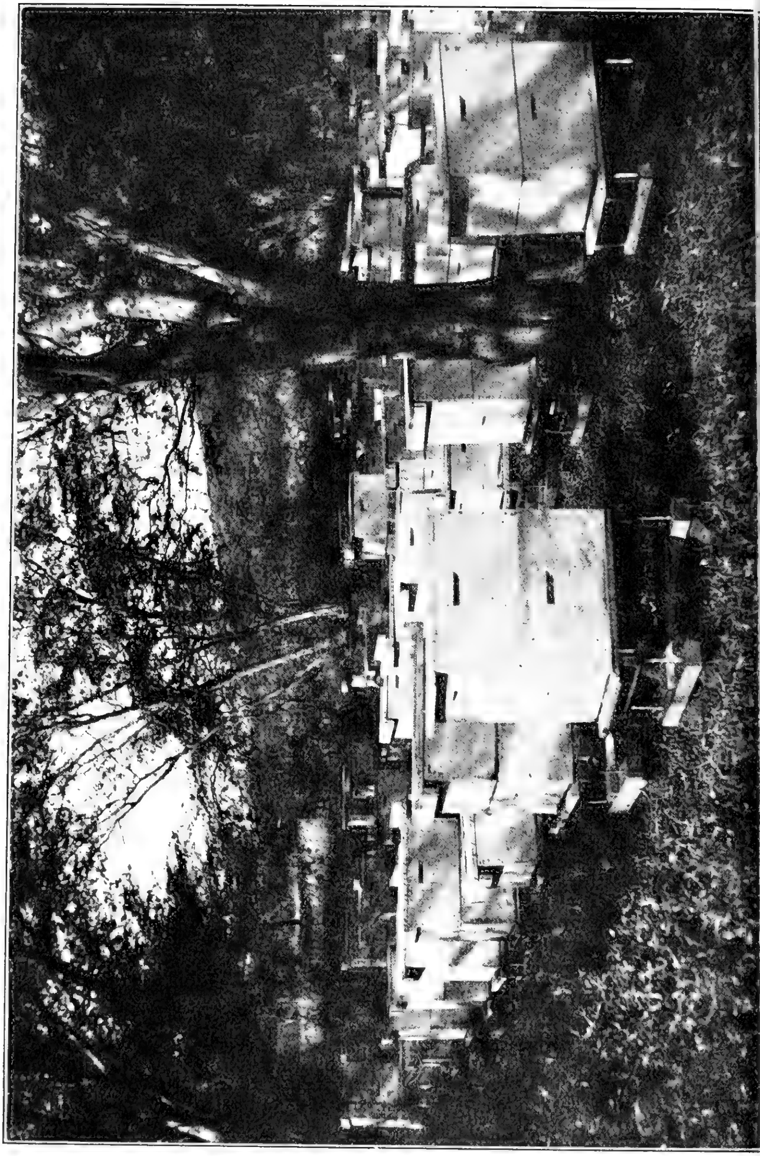

PLATE VII.

Corner of College of Hawaii apiary, showing special stands to keep out ants.

Many difficulties were experienced in trying to keep ants away from the bees, before their aversion for axle grease was discovered. About ten years ago hives in some places were supported upon posts for the easy application of ant-poison, while other apiaries were protected by tins of water, as illustrated by Dr. Phillips.* Both methods had to be discarded, because of the necessity of frequent renewals, which made the cost prohibitive. Tanglefoot, also, proved worthless, from the fact that the ants would bridge over it, in one night, with bits of rubbish. Axle grease, on the other hand, appears to be very distasteful to them, and they stay away from it. This substance also has the advantage of being rather permanent, lasting for two or more months. Hence, a couple of applications are all that are required to carry the bees safely through the wet-season; and the balance of the year they require no protection.

For barriers, indoors, axle grease is hardly suitable, but the well-known bi-chloride-of-mercury band is equally effective, if kept dry. Narrow lamp-wicks serve best for this purpose. They are soaked in a saturated solution of the poison, and hung up to dry, before pinning about the legs of the furniture, etc.

What appears to be a most effective remedy has recently been used** by Mr. Arthur Gibson, of the Department of Agriculture, at Ottawa, Canada, but I have not had time to try it upon our ants. It consists in simply dusting sodium fluoride in the places frequented by the ants, and they soon disappear. This chemical has been recommended† for the destruction of cockroaches, but Mr. Gibson's article would indicate that the ants are simply driven away by it.

ANNOTATED BIBLIOGRAPHY.

‡ 1852. Heer, O.—Ueber die Hausameise Madeiras. An die Zürcherische Jugend auf das Jahr 1852, von der Naturforschenden Gesellschaft, 54 Stück, 1-24.

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* U. S. Dept. Agric. Bur. Ent. Bul. 75, Pls. VII and X.

** Can. Ent. XLVIII, 365-367.

† U. S. Dept. Agric. Farmers' Bul., 658.

‡ I have not seen this paper.

Professor Heer's original account of the habits of our sp-
cies, for which he used the name *Œcophthora pusilla* Hee.
For complete translation, see the next paper.

1856. Heer, O.—On the house ant of Madeira Tran-
lated from the original by Lowe, R. T. Ann. and Mag Na
Hist. 2d ser. XVII, 209-224 and 322-333, 1 Pl.

The author states that these ants were found on the who
south side of the Island of Madeira, up to a height of 1,00
feet, in countless numbers, especially in hot, sunny place
They were under practically every stone, and there was hard
a house that did not harbor millions of them.

They were said to show little preference as to kinds
food attacked in houses; going after sweets (sugar, hone
syrup, preserved fruits); but not less also fresh fleshy frui
of all kinds. They seemed to prefer flesh to vegetable su
stances. Raw and boiled meat was eagerly sought by them
but insects were very decidedly preferred. Great trouble wa
experienced in guarding the collections of insects from them
The author remarks that they did not, however, seek afte
dead insects only, but attacked also the living. He note
their attack upon flies, termites, grasshoppers and eve
the destruction of the cochineal insects, and, members of the
own family. In these attacks upon large living-insects, it wa
noted that the soldiers were never the ones to make the origina
assault, but only entered in after the first seizure by workers
The soldiers, however, rendered efficient aid in cutting of
wings and legs of the larger insects, and in breaking them u
into bits which were easily carried by the workers.

1869. Brown, F. H.—Some observations on the fauna o
Madeira. Proc. Bost. Soc. Nat. Hist. XII, 211.

"A very troublesome little ant, abounds in the houses o
Madeira, and is supposed to be peculiar to the island. It ha
received the name *Œcophthora pusilla* from Prof. Heer, wh
has written an account of this little animal."

1880. Blackburn, T., and Kirby, W. F.—Notes on specie
of aculeate Hymenoptera occurring in the Hawaiian Islands
Ent. Mo. Mag. XVII, 89.

The species is recorded under the name, *Pheidole pusilla* Heer, with the remarks:

"One of the commonest ants in Oahu, and probably elsewhere. (T. B.)"

"The house-ant of Madeira; and occasionally met with in England. (W. F. K.)"

1882. McCook, H. C.—Ants as beneficial insecticides. Proc. Acad. Nat. Sc. Philad. 1882, 263-271.

This article is a discussion of the practicability of the use of ants for the destruction of insect pests, as practiced in the province of Canton, China.

The Chinese are said to protect their orange trees from dreaded pests by importing ants from neighboring hills. The growers themselves supply some ants, which prey upon the enemies of the orange, but not in sufficient numbers; and resort is had to hill-people, who, throughout the summer and winter find the nests suspended from branches of bamboo and various trees. There are two varieties of ants, red and yellow, whose nests resemble cotton-bags. The collectors are supplied with pig or goat bladders, which are baited inside with lard. The orifices of these they apply to the entrance of nests, when the ants enter the bags and become a marketable commodity at the orchards. Orange trees are colonized by depositing the ants on their upper branches, and to enable them to pass from tree to tree all the trees of an orchard are connected by bamboo rods.

The author discusses the subject under several heads, and sums up:

Even if the ant should not be as tractable for domestication as her hymenopterous ally, the bee, and in spite of her occasional forays upon our cupboards and crops, the ant is worthy to stand at the head of insects beneficial to man.

1899. Forel, A.—*Pheidole megacephala* Fab. Fauna Hawaiiensis I, 118.

"Hab. All the Islands from the coast to an elevation of 3,000 feet. Cosmopolitan."

1902. Eckart, C. F.—Report on precautions to be observ with regard to cane importations. Haw. Sugar Plante Assn., p. 8.

A barrel of seed-cane imported from Demerara was four to be badly infested with borers, and the empty channels of tl beetles were alive with our common ant (*Pheidole megac phala*). Upon opening the sticks, traces were found of bot larvae and pupae of the borers, which had been destroyed b the ants, but only a single beetle was found, alive, in the co signment, having escaped because of its perfect cocoon, whic is difficult for the ants to enter.

1903. Perkins, R. C. L.—The leaf-hopper of sugar can Bd. Comm. Agric. and Forestry, Bul. 1, 23.

Pheidole megacephala was noted, as one of the species o ants preying upon the young leaf-hoppers.

1905. Perkins, R. C. L.—Entomological and other note on a trip to Australia. Proc. Haw. Ent. Soc. I, 9.

At Cairns *Pheidole megacephala* swarmed everywhere, an no lady-bird or its larva could get at the scales on many badl affected trees.

1906. Wheeler, W. M.—On certain tropical ants intro duced into the United States. Ent. News, XVII, 24.

Notes, the supplanting of *Pheidole megacephala* by the Ar gentine ant (*Iridomyrmex humilis* Mayr), in Madeira. The author quotes from Prof. Heer's description of the forme species.

1909. Swezey, O. H.—Notes on the budmoth of suga cane, etc. Haw. Planters' Record, I, 133.

The author states that *P. megacephala* is always abundant in cane, often having its nests beneath the leaf sheaths. It destroys not only the young bud worms but also other cane-feeding caterpillars.

1910. Wheeler, W. M.—Ants, p. 154-155.

The author quotes, from Professor Heer's account of *P. megacephala*, and states that this ant is very common in Bermuda and West Indies and will probably be found in Florida. He says that there can be little doubt that wherever it gains a foothold in tropical or subtropical countries it is able to propagate very rapidly and to exterminate the indigenous ant-fauna. Bermuda and the Virgin Islands are cited as cases in point; and the following interesting observations are recorded:

"During March, 1906, I devoted ten days to a careful study of the ant-fauna of the little Island of Culebra, off the eastern coast of Porto Rico, without seeing a single specimen of *Ph. megacephala.* This island is, however, completely overrun with a dark variety of the vicious fire-ant (*Solenopsis geminata*). One day, on visiting the Island of Culebrita, which is separated by a shallow channel hardly a mile in width from the eastern coast of Culebra, I was astonished to find it completely overrun with *Ph. megacephala.* This ant was nesting under every stone and log, from the shifting sand of the sea-beach to the walls of the light-house on the highest point of the island. The most careful search failed to reveal the presence of any other species, though the flora and physical conditions are the same as those of Culebra. It is highly probable that *Ph. megacephala,* perhaps accidentally introduced from St. Thomas, a few miles to the east, had exterminated all the other ants which must previously have inhabited Culebrita. The absence of *megacephala* on Culebra is perhaps to be explained by the presence of the equally prolific and pugnacious fire-ant."

1913. Cardin, Patricio.—A probable parasite of *Scapteriscus didactylus* in Cuba. Journ. Econ. Ent. VI, 330-331.

The author states that the fire ant (*Solenopsis geminata* Fab.), and the common red ant (*Pheidole megacephala* Fab.), were the most dreaded enemies of the mole cricket, or "changa", in high and dry land, and he partly attributes the scarcity of this pest, in Cuba, to the attacks of these pests.

1913. Illingworth, J. F.—Little brown ant doing good work in Hawaii. Haw. Forester and Agric. X, 370-371.

The writer states that *P. megacephala* appears to be the principal factor holding house flies in check under tropical conditions. It is estimated that the ants destroy fully 75% of the flies; carrying off most of the eggs or larvae as soon as they find them. Furthermore, they were observed attacking and dismembering adult flies.

1913. Swezey, O. H.—Sugar cane mealy bugs in the Hawaiian Islands. Haw. Planters' Record. VIII, 208.

The author states that *P. megacephala* is always present and although feeding largely on the sweetish excretions, yet does eat some of the mealy bugs.

1913. Perkins, R. C. L.—Introduction, Fauna Hawaiiensis, I, xli and ci.

From the standpoint of the systematist, the author gives this most interesting survey of *P. megacephala* in Hawaii:

"As with the birds, destruction of forest has, doubtless, caused the disappearance of many local insects, but even of greater importance has been the introduction of foreign carnivorous species, especially of the dominant ant, *Pheidole megacephala*. There is no record of the time when this destructive creature was imported, but even during the last twenty years it has occupied some considerable areas previously free from it. It may be said that no native Hawaiian Coleopterous insect can resist this predator, and it is practically useless to attempt to collect where it is well established. Just on the limits of its range one may occasionally meet with a few active beetles, e. g. species of *Plagithmysus*, often with these ants attached to their legs or bodies, but sooner or later they are quite exterminated from such localities. It is quite certain that native beetles and many other insects are absent from the localities occupied by *Pheidole*, solely on account of its presence. In several instances, as the ant has been observed to occupy a new area, this area having been collected over before it was present and yielding many native beetles, the latter have entirely disappeared. In a few low-lying localities, even close to the coast, there are some places, which from excessive dryness and other causes, the *Pheidole* is unable to occupy, at any rate permanently, and yet unfavorable, as these are, for insects of any kind, here only will native Coleoptera be found. On one occasion I came across an instructive instance of the effect of these ants on the native fauna. A more or less open piece of forest at an elevation of 1,500 feet above sea level, with a large variety of trees scattered in it, appeared at first sight an excellent spot for collecting native insects. A number of native Hymenoptera were seen flying round the foliage, hardy insects which the ants cannot exterminate, though they are often seen attached to them by the mandibles. Every tree trunk was invaded by *Pheidole,* and beating the boughs dislodged them in thousands. Not a single beetle nor any native insect was obtained from these trees. One solitary tree, however, for some reason was quite free from ants. It was a large Bobea, with hanging masses of 'Maile' (*Alyxia*) dependent from the boughs. From the dead stems of this were shaken hundreds, if not thousands, of one species of *Proterhinus,* others also being present, as well as the large weevils, *Rhyncogonus,* and other kinds of beetles. I visited this spot on many occasions for the sake of a rare species of wasp, but never obtained a beetle except from this one tree, and a year later it too was occupied by *Pheidole* and barren of native insects. Fortunaetly *Pheidole* is not universal in its distribution. It can in some localities just attain 4,000 feet in the mountains, under certain climatic conditions. Below twelve or thirteen hundred feet it often occupies most of the islands, excepting some extremely arid localities. Though not so utterly destructive to other insects as to the beetles, yet many of them are destroyed by it, and generally speaking, collecting is very poor, where it abounds. Most of the native species taken in such places are vagrant, like Lepidoptera, and have bred in some adjoining area, either free from this ant, or where it is comparatively sparse. Miles of attractive forest in some parts of the islands are almost devoid of native insects, through its destructiveness. A very few endemic insects seem able to breed in its haunts, even where it is quite abundant, but many of the foreign or imported insects flourish in spite of it. It is not probable that it will spread to any great extent beyond the limits now occupied, for it has long since filled all suitable localities. Here and there the opening up of limited areas of forest may by change of conditions allow it to colonize these, but the great bulk of the forest is now reserved and not likely to be opened up. There is no reason to suppose that the endemic insect fauna will suffer any considerable further diminution, and it may, so far as one can see, remain as it is for ages to come. The chief danger would be in the introduction of some predaceous creature like *Pheidole,* which would be able to occupy the great area of forest land and the country above this, where *Pheidole* does not now exist. As no such insect has been imported in the course of the last century, it is on the whole improbable that it ever will be."

And, further, in discussing the ant fauna of the islands, the author adds:

"*Pheidole megacephala* is the most abundant of all the foreign ants. In many parts it occupies not only the whole open country, but also the forests to a height of about 2,000 feet in the mountains. In open country it sometimes becomes established as high as 4,000 feet, and may be numerous at three thousand. Usually, where forests are dense, it ceases to range above about 1,200 to 1,500 feet of elevation, while in its range, no matter how fine or how dense the forest may be, the endemic fauna, save for a few forms, that can resist, or are tolerated by the ants, is entirely exterminated. This native fauna, especially of beetles, appears as if by magic, the moment the limit of range of *Pheidole* is reached. . . . . . Of the native insects that are attacked by *Pheidole,* the Aculeate Hymenoptera are the least injured. Even in the case of large Crabronids and wasps of the genus *Odynerus* it is common enough to find specimens with one or more workers of *Pheidole,* or with the great head of the soldier-form attached to their legs or antennae, and we have noticed instances where these strong insects have been entirely overcome by their assailants."

1914. Illingworth, J. F.—Further notes on the breeding of the Tachinid fly parasite on the cane beetle borer. Journ. Econ. Ent. VII, 396.

The writer places the small brown ant (*P. megacephala*), at the head of the list of mortal enemies of the flies. These ants were troublesome at every stage of the breeding work; being on the ground about the cages in myriads, they swarmed inside at the least oportunity. Carbon bisulphide was used effectively for the destruction of nests in the cages.

Emerging flies in the field were often observed in the toils—a single ant, at this time, being able to hold a fly, and the cane is always swarming with them.

The larvae of the flies only escape because the parasitized borers plug the channels behind them and build ant-proof cocoons, for the ants quickly destroy both grubs and maggots when exposed.

1915. Ehrhorn, E. M.—Ants. Report of the Division of Entomology for the biennial period ending December 31st, 1914. Hawaii Bd. Agric. and Forestry, p. 139-140.

The author reports *Pheidole megacephala* as giving much trouble to householders, attacking foods, but states that this species is more of a garden pest. He says that they frequently loosen the soil around young plants, causing them to fall over, and that they are more troublesome in dry situations.

Control measures include placing the legs of tables, etc., in dishes of water, or tying bands soaked in ant-poison about the legs, and the destruction of the nests. Since this species nests in the soil, outside of the building, they are easily killed by the use of gasoline or carbon bisulphide.

1915. Girault, A. A.—*Pheidole megacephala* Fab. dying from cold in North Queensland. Ent. News, XXVI, 362.

This interesting note follows:

"Toward the last week of July, 1912, all over the Goondi, Darradgee and Mundoo cane plantations near Innisfail, I saw little heaps of dead ants, each heap containing several hundred specimens of the workers and soldiers. They were rather common and I was considerably puzzled to account for them until chancing to hear from a farmer that young sugar cane had been slightly damaged by recent frosts; the ants doubtless had suffered from the same cause, the more clearly indicated because the species appears to be an equatorial one or one of the uplands or of situations not exposed to cold spells in the tropical sense. Nests adjoining the heaps of dead contained living individuals acting as usual. Later, on August 8, at Nelson, North Queensland, I found the same species, dead in similar heaps; if along a road, these heaps all seemed to be in the wheel ruts; from their appearance, they were several weeks or more old."

1915. a. Illingworth, J. F.—Coconut leaf-roller [*Omioides blackburni* (Butl.)] destroyed by ants. Proc. Haw. Ent. Soc. III, 142.

P. megacephala destroyed both the egg-masses and the caterpillars of the above pest, in Palolo Valley, so successfully that no pupae resulted. The ants first cut away the under-part of the web, that protects the young caterpillars, and then pulled them out.

1915. b. Illingworth, J. F.—Notes on the hen flea (*Echinophaga gallinacea* Westw.). Proc. Haw. Ent. Soc. III, 252.

The ants were observed removing the larvae of the fleas from the dust of the roosting-board.

1915. Muir, F.—Review of the autochthonous genera of Hawaiian Delphacidae. Proc. Haw. Ent. Soc. III, 180 and 203.

The author attributes the absence of Delphacids from a certain food-plant, that contained numerous unparasitized-eggs, but no nymphs or adults, to the numerous ants (*P. megacephala*), which swarmed over the plant.

On page 203, in discussing the death factors of Delphacids, the author says: "At the present time the introduced ant (*Pheidole megacephala*) plays a very important part in the districts in which it can thrive, and it is likely it will lead to the extinction of certain species."

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Vol. III., No. 5. April, 1918.

PROCEEDINGS

OF THE

HAWAIIAN ENTOMOLOGICAL SOCIETY

FOR THE YEAR 1917

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* To fill vacancy in absence of Mr. Osborn.

PROCEEDINGS

OF THE

Hawaiian Entomological Society

Vol. III, No. 5. For the Year 1917. April, 1918.

JANUARY 4th, 1917.

The one hundred thirty-sixth meeting of the Society was held in the usual place. Members present were: Messrs. Bridwell, Ehrhorn, Fullaway, Illingworth, Kuhns, Muir, Osborn, Swezey and Timberlake. In the absence of the president and vice-president, Mr. Muir was chosen to preside.

Minutes of previous meeting read and approved.

On motion of Mr. Swezey, it was voted that a bound copy of the "Proceedings," Vols. I to III and succeeding numbers, be sent to the Trustees of the Hawaiian Sugar Planters' Association.

Mr. Muir suggested closing Vol. III with the next issue, and offered to prepare the index for the same.

ENTOMOLOGICAL PROGRAM.

Sclerogibbinae.—Mr. Bridwell exhibited a specimen which he had captured indoors at Kaimuki, apparently representing a new genus in this subfamily of Bethylidae. He considered that his species had probably been introduced to Hawaii from the Orient.

Bembidula spp.—Mr. Bridwell exhibited specimens and discussed certain species of this genus of wasps.

FEBRUARY 1st, 1917.

The one hundred thirty-seventh meeting of the Society was held in the usual place, Vice-President Pemberton in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Illingworth, Kuhns, Muir, Osborn, Swezey and Timberlake.

Minutes of previous meeting read and approved.

It was suggested by Mr. Muir that all new captures be indexed in the "Proceedings". Mr. Bridwell added that it would be an advantage to have all introductions on record in the "Proceedings".

ENTOMOLOGICAL PROGRAM.

Scolia manilae.—Mr. Swezey reported the collecting of 1125 females of this recently introduced wasp during the past few weeks. They were all collected in one place where they were first liberated about ten months previously in a cane field badly infested by *Anomala orientalis* grubs in the plantation of Oahu Sugar Co. The male wasps appeared much more abundant flying about near the ground, the females being seen only when they came to feed on the blossoms of various weeds in the middle of sunny days. The wasps collected were used to distribute to other places helping in their dispersal.

Pheidole megacephala.—Mr. Pemberton reported having observed this ant pulling small fruitfly larvae out of infested coffee at Kona, Hawaii. Mr. Timberlake mentioned having observed the same ant destroying the eggs of the cabbage butterfly. Mr. Bridwell reported ants caring for *Aleurodes* in South Africa.

Lucillia serricata.—Mr. Illingworth reported finding the larvae of this fly in the vent of a hen. On killing and examining the hen these larvae were found feeding and were reared to maturity on meat.

Musca domestica.—Mr. Bridwell reported having noticed large numbers of housefly maggots breeding in potatoes in the hold of a vessel from South America.

Murgantia histronica.—Mr. Ehrhorn reported capturing the harlequin cabbage bug in packing in furniture.

Sarcophagid flies.—Mr. Timberlake exhibited specimens of five different species caught here, four of which he had determined from Aldrich's recent book on this group of flies, and one species yet unnamed. He presented a table for distinguishing the species.

Key to Separate Hawaiian Sarcophaga.

BY P. H. TIMBERLAKE.

Males

Hind tibiae with a long pubescence (villous).

- Hypopygium black — *S. dux* Thomson
- Hypopygium reddish.
  - Prescutellar bristles present — *S. barbata* Thomson
  - Prescutellar bristles absent — *S. haemorrhoidalis* Fallen

Hind tibiae shortly pubescent (not villous).

- Epaulets pale, apical scutellar bristles absent.
  - Hypopygium reddish — *S. pallinervis* Thomson
- Epaulets black, apical scutellar bristles present and crossing.
  - Hypopygium black — *Sarcophaga* sp.
  - Hypopygium reddish — *S. robusta* Aldrich

Females

Prescutellar bristles absent — *S. haemorrhoidalis* Fallen

Prescutellar bristles present.

- Epaulets pale, cheeks black pubescent *S. pallinervis* Thomson
- Epaulets black.

Hypopygium reddish, at least in part.
Dorsum of abdomen with bristles along the posterior margin of the third segment ... *S. barbata* Thomson
Dorsum of abdomen without bristles the posterior margin of the third segment ... *S. robusta* Aldrich
Hypopygium concolorous with rest of abdomen.
Occiput with not more than two rows of black bristles behind the posterior corners of the eyes, the second row generally incomplete or irregular *S. dux* Thomson
Occiput with three rows of black bristles behind the posterior corners of the eyes ... *Sarcophaga* sp.

MARCH 1st, 1917.

The one hundred thirty-eighth meeting of the Society was held in the usual place, Vice-President Pemberton in the chair. Other members present: Messrs. Bridwell, Giffard, Illingworth, Mant, Muir, Osborn and Timberlake.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Kelisia paludum.—Mr. Muir exhibited specimens of this Delphacid from Fiji, Queensland, Java and the Philippines, and pointed out their variation in color. This is the first of the Hawaiian Kelisias to be recognized outside of the Hawaiian Archipelago.

Kelisia swezeyi.—Mr. Bridwell reported finding this Delphacid on a coarse sedge on the slope leading up to Konahuanui. He stated that the usual habitat of the species was on bunch grass (*Eragrostis variabilis*) in wind-swept localities. Mr. Giffard said that this leafhopper was not unusual in the region of the Nuuanu Pali.

Aloha swezeyi.—Mr. Timberlake reported capturing this leafhopper on *Campylotheca* on Mt. Tantalus.

A new Jassid.—Mr. Giffard exhibited specimens of a pretty little Jassid new to the Islands, which he had captured on bunch grass (*Eragrostis variabilis*) near Diamond Head. He also exhibited a green Jassid from grass.

Spodoptera mauritia.—Mr. Bridwell exhibited two of this moth caught on a sand burr (*Cenchrus echinatus*).

Blapstinus sp.—Mr. Bridwell called attention to the fact that this beetle had not been correctly recorded heretofore, but in collections had been labelled *Alphitobius diaperinus.* The latter, however, is a much rarer beetle, only two or three specimens occurring in collections here. Discussing other Tenebrionids, Mr. Bridwell said that *Gonocephalum* (*Opatrum*) *seriatum* was first known from the Marshall Islands, and that Blackburn had credited it to these Islands without giving authority for his determination. The original description is entirely insufficient for identification of the species and might apply to any *Gonocephalum.* Whether our very common species is really *seriatum* seems doubtful. *Sciophagus pandanicola* reported by Blackburn from *Pandanus* has not since been collected.

Eucoila sp.—Mr. Timberlake exhibited a specimen of *Eucoila* reared from *Pipunculus.* Mr. Muir had reared the *Pipunculus* from a Delphacid. The *Eucoila* must have entered the *Pipunculus* while still in the Delphacid.

Gelechia gossypiella.—Mr. Bridwell reported having bred the pink boll-worm from milo (*Thespesia populnea*) pods brought by Mr. Stokes from one of the small islands on the windward side of Oahu. When Mr. Busck made a study of the pink boll-worm in Hawaii he failed to find it breeding in milo pods, and questioned it as a food-plant of this moth.

APRIL 4TH, 1917.

The one hundred thirty-ninth meeting of the Society was held in the usual place, Vice-President Pemberton in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Illingworth, Kuhns, Osborn, Swezey and Timberlake.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

New Curculionid.—Mr. Ehrhorn exhibited a new weevil captured at light at night. Later, specimens were found in decayed wood.

Cerambycid beetle.—Mr. Swezey exhibited a beetle reared from the *Cryptomeria* wood of an insect cage made in Japan, and used to bring living insects from there.

Carabids.—Mr. Bridwell exhibited specimens of rare native Carabids taken in moss on tree trunks, on Mt. Kaala.

Carabid larva.—Mr. Timberlake exhibited a larva of a native Carabid which he is rearing.

Notes on the Mating of Cockroaches.

BY J. F. ILLINGWORTH.

It was April 20, 1914, that I first observed the mating habits of our common cockroach (*Periplaneta americana*).

Hearing a rapid running about, after I had gone to bed, I turned on the light and saw several of these large roaches, which commonly live in a crevice on the veranda, chasing each other as if playing a game. They were too excited to stop, even in the light, and I soon discovered that several were chasing one individual, which in order to escape would fly across the room, dashing into the wall and running rapidly from place to place, closely followed by the pursuers.

Finally, the fleeing one was pounced upon, and I discovered that they were in the act of mating: tho the male at first stood on the back of the female in the normal position, they remained thus for only a brief moment, when by their rapid movements the male was dislodged, and tho still in copula, end to end, they were able to make rapid progress along the wall, the female preceding and the male running backward. After about a minute I succeeded in getting them into a cyanide bottle, but they broke apart before dying.

Again in March, 1915, at the same place I made similar observations upon our other common species (*Periplaneta australasiae*).

The roaches have a favorite retreat in a crevice under the edge of the roof. When I turned on the light I saw several of them running along the board, at the edge of this crack, and I recognized that they were in the activity of mating. The female ran from place to place, very rapidly, and now and then a male dashed out of the crevice after her,—if not pursued far the female soon returned, apparently in an effort to entice other males. After a rapid scamper a male succeded in landing upon her back and mating took place, tho they remained in this position for only a few seconds, before the female ran off with the male still attached and running backwards. Apparently this is the normal method of mating with roaches, at least if disturbed while this act is taking place, for I made similar observations last year as noted above on *P. americana*. I succeeded in securing the pair in the cyanide bottle and they died *in copula*.

The Leather Beetle (*Dermestes vulpinus* Fab.), a Troublesome Pest of Dried Fish in Hawaii.

BY J. F. ILLINGWORTH.

This cosmopolitan Dermestid is an important pest of dried fish in Honolulu, as was recently brought to my attention by Mr. M. B. Bairos, Territorial Food Inspector, Nov. 15, 1916.

He gave me a sample from some bales of dried cod, which were found in the fishmarket so badly infested that the whole consignment had to be destroyed.

In looking up the food habits of this beetle I find that it has become notorious as a boot and leather pest, particularly in the United States, where it shows a fondness for sole-leather. At one time this species became so destructive in the large skin warehouses in London that a reward of £2,000 was offered for a remedy, without any being discovered. There is also a report that considerable damage was done to hams in Arizona, and that the larvae sometimes destroy entomological specimens. Furthermore, this beetle is said to injure both corks and hard-wood planks; the larvae bore these substances, however, only when searching for a safe retreat to pupate.

LIFE HISTORY.

Newly emerged beetles were confined in glass jars for a period of fourteen days before young, freshly-hatched larvae were discovered. Since it was found that the eggs require an incubation period of three days, the preovipositing period of the beetles is about ten or eleven days.

The several stages in the life history have been well described by Riley (1885), but it is interesting to compare observations taken under tropical conditions.

Egg:—The freshly laid, cylindrical eggs lack the transverse impressed lines that Riley describes, tho we found that just before hatching, the segmentation of the larva, within, gave this appearance.

It was found that the beetles place the eggs in any available crevice, hence they are rather difficult to locate at first. The incubation period we found to be approximately three days, in place of four to seven days as observed by Riley.

Larva:—The newly-hatched larva is at first very light colored, but soon darkens; there is a noticeable lighter area on the median dorsal line, which branches on the head in the form of a Y. At this stage the larva is covered with very long hairs, those extending from the caudal segments equaling its entire length. The last segment terminates in a single proleg or sucker, which is used effectively whenever the grub is forced to travel over a smooth surface, such as glass or tin.

The larvae molt in five to eight days after hatching as compared to Riley's four to nine days for this instar*. The second stage larvae molt in four to ten days—Riley's time four to seven days. The third stage is passed in five to eight days—Riley's three to six. The fourth stage larvae molt in three to thirteen days, against Riley's three to six. The fifth instar required five to eight days—Riley's five to seven days. The sixth was six to nine days—Riley's six days.

Under normal conditions the larvae are fully developed after the sixth molt and at once seek a place to pupate; they leave the food and bore into any substance at hand. It is at this stage that they do damage to cork, etc., even boring into hard planks, if nothing else offers a hiding place in which to pupate. Both their habits and structure make it appear that the pupae are preyed upon in their natural development. The last larval skin bears a transverse row of spines above on each of the posterior segments, as Riley has noted, and these project outward, after the skin is shed and crowded into the opening of the pupation burrow. From our observations there are no indications that the pupae of this species are destroyed by the larvae, even when they are left exposed.

Pupa:—The pupal period here lasts for ten to eleven days, while Riley found that this stage required fourteen days.

There are similar pockets on the dorsum of the abdomen to those that are found in *Attagenus plebius*. In this case, however, there are only five in place of six, as found in that species, and tho they bear chitinized edges they lack the teeth.

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* It was noticeable that where food was abundant, development was rapid, while a scarcity of food not only lengthened the period for each of the several instars, but, in some cases, greatly increased the number of molts.

These mouths have the same habit of closing upon any object inserted into them.

The complete larval period for the seven instars was found to require fifty days, while the life cycle, from egg to adult, was passed in sixty-four days. This is slightly longer than Riley found from his experiments in the eastern United States, under summer conditions.

Adult:—The beetles that emerged Jan. 2, 1917, are still alive and actively reproducing (April 5th, 1917). They have been kept in glass jars with screw tops and abundantly supplied with the dried fish. There is no tendency to leave the food and apparently they are well adapted to subsist and reproduce generation after generation, shut away from the air and absolutely without water.

ANNOTATED BIBLIOGRAPHY.

1839. Westwood, J. O.—Introduction Modern Classification Insects. I, 157-158.
Common throout Europe and America, Java, Brazil and Chili.

1884. Walker, J. J.—Ent. Mo. Mag. IV, 161.
Said to destroy thick oak planks by their pupation burrows.

1885. Riley, C. V.—Rept. Comm. Agric. U. S. 258-264.
Common in old hides and later in shoes and leather goods, preferring the undressed parts, *i.e.* soles, heels, etc. Reports injury to hams in Arizona. Gives life history as completed in about 60 days. Describes and figures stages in life history.

1889. Jones, F. M.—Insect Life II, 63-64.
Notes injury to goat skins from Mexico, Russia, Cape Town, Arabia and South America.

1898. Howard, L. O.—Yearbook U. S. Dept. Agric. 148.
Describes pupation in packages of tobacco.

1896. Holland, W. J.—Ent. News, 68.
Records destruction of cork from Spain.

New Records of Insects on Kauai

BY O. H. SWEZEY.

On a recent trip to Kauai, visiting the sugar plantations, several species of insects were observed which had not hitherto been recorded from that Island, and occasion is now taken for recording them. In most cases these immigrants have not been purposely taken to Kauai, their arrival there having been accomplished accidentally thru commercial means, *Ceromasia* and *Pseudogonatopus* being the only ones purposely introduced there.

Cremastus hymeniae. This Ichneumonid was found very abundant at Waipouli, where it was parasitizing the coconut leaf-roller, *Omiodes blackburni.* Adults were numerous, as were also the empty cocoons on the coconut leaves where the leaf-rollers had spun up after feeding. One specimen was bred from *Cryptophloebia illepida* in a pod of *Acacia farnesiana* at Waimea.

Psammochares luctuosus. One or two specimens of this Pompilid wasp were seen in the canefields at Waimea. It is now very abundant on the other Islands, but had not been seen yet on Kauai.

Pseudogonatopus hospes. This Chinese Dryinid, parasitic on the sugarcane leaf-hopper, introduced in 1907, had not heretofore been recovered on Kauai. It was found in cane fields at Kealia and Waimea.

Helegonatopus pseudophanes. This hyperparasite on Dryinids was found at Waimea and Mana.

Sarcophaga haemorrhoidalis. This Sarcophagid fly was collected at Kealia, Grove Farm and Makaweli. At the latter place they were abundant on the cane in cane cars at the mill, being attracted by the juice on the cane.

Atractomorpha crenaticeps. This grasshopper was found at

Waipouli, Koloa and Makaweli. This is the first record for it on any of the Hawaiian Islands except Oahu.

Gryllotalpa africana. In low land at Waimea a few burrows of the mole cricket were observed in the irrigation ditches. By digging a few minutes a specimen of the cricket was secured. The first record for the Islands outside of Oahu.

Ceromasia sphenophori. In a coconut grove at Waipouli, quite a number of the coconut leaves had the borings of the sugar cane borer (*Rhabdocnemis obscura*) in the bases of the petioles. In some of these the borer grubs themselves were found; in others were borer cocoons with puparia of the imported New Guinea Tachinid; and some borer larvae were found having the maggots of the Tachinid. This is the first record in the Islands of this fly attacking the borer larvae in any other plant than sugar cane.

Note on Occurrence of an Endemic Itonidid on Oahu.

BY P. H. TIMBERLAKE.

On March 4 the writer captured a female Itonidid ovipositing in the terminal bud of *Pelea clusiaefolia* on Mt. Kaala, Oahu, at an elevation of about 2500 feet. Only three species of Itonidids have been recorded from the Hawaiian Islands and all these are introduced forms of the lowlands (Swezey, Proc. Haw. Ent. Soc. vol. 1, p. 79). One or two other species of this class have been observed more recently. No endemic species have been taken hithertofore, or none at least have been placed on record.

Note on Rearing of a Native Carabid Larva.

BY P. H. TIMBERLAKE.

A larva of *Metromenus palmae* (Blackburn) was captured hiding at the bases of terminal leaves of *Freycinetia* on the west side of Kalihi Valley, Oahu, on March 11, at about 1200 feet elevation. This larva was brought home alive and molted a few days later, finally pupating on March 27 and issuing as adult on April 3rd. It was fed on small partially crushed or stunned Diptera, mostly Drosophilids, but probably would have accepted other insect food if it had been offered. The beetle assumed a blackish brown coloration within 24 hours after emergence, but up to the present (April 5) it still presents an immature appearance. The larva was of the usual Carabid type.

At least two other species of *Metromenus* captured on March 4th hiding in moss on trees on Mt. Kaala were exhibited, these having been kept alive by feeding them with small Diptera.

Note on the Non-Identity of a Common Hawaiian Jassid with Nesosteles hebe Kirkaldy of Fiji.

BY P. H. TIMBERLAKE.

Kirkaldy in 1910 (Fauna Hawaiiensis, vol. 2, pt. 6, p. 574) identified one of the common grass-inhabiting Jassids of the Hawaiian Islands as *Nesosteles hebe* which he had described in 1906 (Ent. Bull. 1, H. S. P. A., p. 343) from Fiji. Recently the writer took occasion to examine the male genitalia of specimens from Fiji and found that there were good specific differences between them and the genitalia of Hawaiian specimens. The dorsal plate or valve of the genitalia in both species is produced into a strong hook on each side. In the Hawaiian species the hook is simple but in *hebe* it is armed at the base with three or four small but distinct spurs. The aedeagus also presents some differences. Kirkaldy called attention to a small difference in the coloration, and thought that the Hawaiian specimens might possibly be distinguished as a variety, for which he proposed the name *hospes*. This name must be elevated to specific rank for our local form. Kirkaldy also identified an Australian insect as *hebe*, but this has entirely different genitalia.

MAY 3RD, 1917.

The one hundred fortieth meeting of the Society was held in the usual place, Vice-President Pemberton in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Illingworth, Kuhns, Osborn and Swezey.

Minutes of previous meeting read and approved.

Mr. Bridwell presented the name of Mr. H. F. Willard for active membership in the Society.

ENTOMOLOGICAL PROGRAM.

Carpophilus humeralis.—Mr. Illingworth reported finding this Nitidulid beetle attacking the ears of field corn in the field, while yet in the milk.

Plutella maculipennis.—Mr. Swezey exhibited specimens of this moth reared from leaves of *Capparis sandwichensis* near Diamond Head, April 16, 1917. The larvae were found feeding singly between the new folded-together leaves, the margins being nicely fastened with silk. Eight moths were reared, also two *Limnerium polynesiale,* an Ichneumonid parasite.

The moths were paler than the usual *P. maculipennis* reared from cabbage. It was expected, when the larvae were collected, that they would turn out to be the same as the *P. albovenosa* bred by Mr. Bridwell from larvae in the pods of *Capparis* collected by him Dec. 11, 1916, on the coral plain south of Ewa Mill. Further observations are desirable to determine whether these moths breeding on *Capparis* are distinct species or varieties of *P. maculipennis.*

Omiodes blackburni.—Mr. Illingworth reported finding the larvae of this moth recently abundant on the palm *Pritchardia pacifica* in Honolulu.

Cryptorhynchus sp.—Mr. Fullaway exhibited the larva and pupa of a weevil from rotten wood,—the same weevil exhibited by Mr. Ehrhorn at the previous meeting.

Strumigenys lewisii?—Mr. Bridwell exhibited three specimens of a peculiar new ant taken in rotten wood in Palolo Valley, where he had found a colony. He also exhibited a large number of specimens of the ant, *Tetramorium guinense,* from specimens of the peat found on Washington Island.

Scoparia dactyliopa and *S. bucolica.*—Mr. Bridwell reported having reared two moths of the former and one of the latter species from larvae found in moss on Mt. Kaala.

Mestolobes n. sp.—Mr. Bridwell exhibited this moth, reared by Mr. Timberlake from a larva in moss on Mt. Kaala.

Armadillo albospinosus.—Mr. Bridwell reported this sowbug abundant in moss on trees on Mt. Kaala.

Sarcophaga robusta.—Mr. Illingworth reported this fly breeding in meat. It is a very large species, not previously reported as occurring here. Specimens had recently been determined by Mr. Timberlake by the use of Aldrich's book on Sarcophaga flies.

Crocidosema lantana.—Mr. Swezey exhibited a moth reared by Mr. Illingworth from the young shoots of *Tecoma stans* at the College of Hawaii, which is apparently this species, but more material is needed to definitely confirm it.

JUNE 7TH, 1917.

The one hundred forty-first meeting of the Society was held in the usual place with President Potter in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Osborn, Pemberton, Swezey and Willard.

Minutes of previous meeting read and approved.

Mr. H. F. Willard was elected to active membership.

ENTOMOLOGICAL PROGRAM.

*Ohia Psyllids.**—Mr. Swezey exhibited four different spe-

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* Published in the Hawaiian Planters' Record, Vol. XVII, pp. 174-183, 1917.

cies of Psyllids, and material showing their work on leaves of the ohia tree, and reported briefly on a few days' investigation of these and other insects of the ohia forest in the Kohala Mountains, Hawaii.

Baeus sp.—A specimen exhibited by Mr. Bridwell, taken by him in Palolo Valley.

Glyptogastra ashmeadi.—Mr. Bridwell exhibited four specimens of this Ichneumonid, taken by him in Palolo Crater, Kalihi Ridge and Lanihuli Ridge.

Diachus auratus.—Mr. Bridwell exhibited specimens of this Chrysomelid from Palolo Valley.

Plagithmysus acuminatus.—Mr. Bridwell exhibited a specimen of this beetle collected May 3rd, by Mr. Forbes in Wailupe Valley, on *Sapindus oahuensis.*

Scolytid in palm seeds.—Mr. Bridwell exhibited specimens of a Scolytid beetle which he had found attacking palm seeds on the ground at the Queen's Hospital, in April.

Mites on potatoes.—Mr. Bridwell stated that Mr. Carpenter, the Pathologist at the Federal Experiment Station, had called his attention to a diseased condition of potato vines apparently caused by a peculiar species of mite.

Mango blight.—Mr. Ehrhorn reported that dusting mango trees with powdered sulphur was very successful in checking the blight which causes the blossoms to blight and fall off.

Aegosoma reflexum.—Mr. Swezey exhibited a specimen of this Prionid beetle reared from a pupa found by him in a dead ohia tree in the Kohala Mountains. Mr. Ehrhorn related the digging up of a Prionid larva from a root 25 feet under ground in the Santa Clara Valley, California.

Trimera lacerta.—Mr. Bridwell called attention to the scarcity of this dragonfly, which in Dr. Perkins' time was evidently as abundant as the other two species: *Pantala flavescens* and *Anax junius.* It is possibly retreating before the more successful related species.

Notes on the Entomology of Hawawiian *Euphorbia* with the Description of a New *Dictyophorodelphax* (*Homoptera, Delphacidae*).

BY JOHN COLBURN BRIDWELL.

The endemic Hawaiian species of *Euphorbia* form a natural group of closely related species, either shrubs or small trees, ranging from the arid regions of the coastal belt to some of the rainy ridges more than two thousand feet in elevation, most commonly growing on the dry ends of the lateral ridges at the outer limit of native vegetation. They support a diversified insect fauna which has as yet been very imperfectly studied. Some beginning has been made upon this work on Oahu but on the other islands the *Euphorbia*-fauna is practically unknown. These notes refer to Oahu only.

At least one and probably two or three species of *Proterhinus* feed in the larval condition in the wood of recently dead stems and on reaching maturity emerge and live for a time on the foliage on *E. hillebrandi* on the lateral ridge leading out to the eastward from Mt. Kaala in the Waianae range, on *E. clusiaefolia* on Kaumuohona ridge in the Koolau range, and on *E. multiformis* on the Ewa ridge bounding Kalihi valley in the same range.

Mr. Swezey has found the *Phycitid* moths *Genophantis iodora* and *G. leahi*, attacking the foliage of *Euphorbia*, the former in the mountains, the latter in the lowlands.

A number of Heteroptera of the families *Coreidae*, *Lygaeidae*, and *Miridae* have been taken on *Euphorbia* but have not yet been worked up systematically nor has their biology been studied sufficiently to be sure they are really attached to these plants. One species of the *Cicadellid* (Jassid) genus *Nesophrosyne* has been taken attached to *Euphorbia hillebrandi* on the Kaala ridge and another upon what is considered by Mr. C. N. Forbes as a form of *E. multiformis* growing on the Ewa coral plain near Sisal, a few feet above sea level. The *Del-*

Proc. Haw. Ent. Soc., III, No. 5, April, 1918.

phacid, Aloha kirkaldyi, is attached to *E. hillebrandi* growing on the same ridge of Kaala before referred to. Another *Euphorbia* insect and one of the most interesting of our endemic insects is the bizarre *Delphacid, Dictyophorodelphax mirabilis* Swezey, which the writer had the pleasure of relating to its foodplant *Euphorbia clusiaefolia* in 1916 and later with Mr. Timberlake and Mr. Swezey of finding it attached on Mt. Kaala to *E. hillebrandi* some twenty-five miles in an airline from its original habitat in the other range of mountains. On May 6, 1917, while collecting in Wailupe in the southeastern Koolau Mountains in company with Mr. Swezey after climbing out of the valley at the end of the middle ridge dividing the two main branches of the valley at an elevation of about twelve or fifteen hundred feet we came upon some bushes of a *Euphorbia* determined for me by Mr. Forbes as *E. celastroides* Upon sweeping these bushes I secured four specimens of a *Dictyophorodelphax* and when I informed Mr. Swezey of my find, he secured two adults and a single nymph. Upon comparison of these specimens with *D. mirabilis* it became evident that we had discovered a second species of this peculiar endemic genus of *Delphacidae.* It will be interesting to learn if other species occur attached to other species of *Euphorbia* upon the other islands.

* *Dictyophorodelphax swezeyi* n. sp.

Total length, 6 mm.; length of the prolongation of the head in front of the eyes, 2.5 mm.

Closely resembling *D. mirabilis* Swezey but smaller and darker; the prolongation of the head relatively shorter, more slender and tapering, not bent downward apically but with a slight upward curve; tegmina proportionally a little longer but not reaching the apex of the abdomen.

♂ Genital styles blunt at the apex, only slightly curved, not prolonged into an acute curved tooth, apical slender portion of aedeagus nearly in a straight line with the thicker basal portion.

Nymph. The nymphs may be readily distinguished from those of *D. mirabilis* by the much darker coloration and the less prolonged head in corresponding instars.

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* This description supplied just before the MS. for this number of the Proceedings went to press.—[Ed.]

Described from 3 ♂♂, 3 ♀♀, and 1 nymph, Wailupe, May 6, 1917 (J. C. Bridwell and O. H. Swezey); and 15 ♂♂, 14 ♀♀, and 12 nymphs, collected on *Euphorbia celastroides,* Niu, Feb. 10, 1918 (O. H. Swezey and P. H. Timberlake). These localities are adjacent in the southeastern Koolau Mountains, Oahu, Hawaiian Islands.

Type ♂ and ♀ and paratypes in the Bernice Pauahi Bishop Museum, paratypes in the collection of the Hawaiian Sugar Planters' Experiment Station, and in the private collections of J. C. Bridwell, O. H. Swezey, and P. H. Timberlake.

Named in appreciation of Mr. O. H. Swezey, who first discovered and described the genus, for his extensive and successful work in advancing our knowledge of the biology of Hawaiian insects.

NOTE.—The writer had hoped to have the species described by Mr. Frederick Muir, but his departure to take up war service in England prevented this and in default of some one more familiar with the group has described the species to place on record this interesting addition to our fauna.

JULY 6TH, 1917.

The one hundred forty-second meeting of the Society was held in the usual place, Vice-President Pemberton in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Newell, Osborn and Swezey.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Mr. Ehrhorn discussed the confusion which is apt to occur regarding the injury to plants. For example: he had noticed African daisies attacked by some kind of blight, the cause of which was not determined. The injury had been checked by dusting powdered sulphur on the plants. Subsequent observation had shown the infected areas to be covered with mites, but it was uncertain whether they were the original cause of the injury.

Proterhinus on *Hibiscadelphus.*—Mr. Swezey exhibited 15 specimens of *Proterhinus* beetles collected by him in dead twigs of the lone *Hibiscadelphus Giffardianus* tree in the "Kipuka" known as the Bird Park at Kilauea, Hawaii, June 27, 1917. It is probably a new species, as no *Proterhinus* has previously been collected from that species of tree.

Cis sp.—A large series of *Cis* were also taken from dead twigs of the above tree by Mr. Swezey.

Ephestia elutella.—Mr. Pemberton exhibited specimens of this moth bred from corn meal and peanut candy.

Calandra remota.—Mr. Bridwell exhibited specimens of this weevil found by him in banana plants in Pauoa Valley. The larvae were found feeding in the bases of banana stems where there was a great deal of juice, and might be considered as practically aquatic. This is the first record of the larval habitat.

Cerambycid in papaia.—Mr. Bridwell exhibited a specimen of a Cerambycid beetle of which he had reared three from dead leaf stems of papaia that were still attached to the tree. It had not previously been observed here.

Nesidiorchestes hawaiiensis.—Specimens of this bug were exhibited by Mr. Bridwell, who had collected them from dry leaves and trash. Since the publication of the Fauna Hawaiiensis few specimens have been collected or noted.

Acanthia sp.—Mr. Bridwell exhibited a series of two species of this genus of bugs, collected by him in wet moss along the stream in Palolo Valley. Nymphs were also found there.

Kelisia swezeyi.—Mr. Bridwell reported the finding of both long and short winged forms of this Delphacid. The long winged form is rare, this probably being the first record for it.

Rhyncogonus koebelei.—Mr. Bridwell reported collecting this weevil in Palolo Valley.

Proterhinus maurus.—Mr. Bridwell exhibited specimens of this very large Proterhinid beetle collected by him from a variety of *Suttonia lessertiana* having very large leaves clustered at the ends of rather thick twigs. The adult beetles feed in the axils of the leaves, and the larvae feed in the pith of the newly dead twigs. Other collectors of this beetle had collected it only from this form of *Suttonia*. The type specimen was 5 mm. long, the average being about 3 mm., but Mr. Bridwell collected one specimen 9 mm. long which is undoubtedly the largest *Proterhinus* ever collected.

Insects on ti.—Mr. Bridwell stated that heretofore he had found this plant very free from insects, but on June 28th he had found both *Cis* and *Proterhinus* on dead ti and ieie leaves on the ground in a ravine on the Pali road on windward Oahu.

Delphacid on Baumea.—Mr. Bridwell reported collecting one specimen of an unknown Delphacid on the large sedge *Baumea*.

AUGUST 2ND, 1917.

The one hundred forty-third meeting of the Society was held in the entomological laboratory of the new building of the Hawaiian Sugar Planters' Experiment Station, Vice-President Pemberton in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Kuhns, Muir, Swezey, Timberlake, and Willard, and Mr. D. L. Crawford, visitor.

In the absence of the Secretary, Mr. Swezey was appointed Secretary pro tem.

Minutes of the previous meeting read and approved.

Mr. Swezey proposed the name of Mr. D. L. Crawford for active membership.

ENTOMOLOGICAL PROGRAM.

Gonioryctes koae and *Callithmysus* sp.—These two beetles exhibited by Mr. Bridwell. He had collected them recently on Mt. Kaala. The *Callithmysus* was a very large species and was taken on *Broussaisia*. It was recognized by Mr. Swezey as the same species of which he had taken a specimen on ohia last year on Mt. Kaala.

Carabid.—Mr. Bridwell reported having taken more specimens of a moss-inhabiting species previously collected by him on Mt. Kaala.

Nesosydne gunnerae.—Mr. Bridwell reported recently finding this leafhopper abundant at the same place where it had been formerly collected on Mt. Kaala. It was most abundant on the partly dead leaves of its host-plant, *Gunnera.*

Proterhinus sp.—A golden-colored species exhibited by Mr. Bridwell, taken recently by him on *Clermontia,* and probably a new species.

Lycaena boetica in pigeon peas.—Mr. Swezey reported that of 233 pods of pigeon peas gathered in his garden in Kaimuki, 44 pods, or 18.88%, contained one or more peas destroyed by the larvae of this butterfly. A count of the seeds in these pods gave 985 good peas, and 69 that had been destroyed, or 6.54%.

Coptotermes sp.—A stalk of sugar cane quite badly honeycombed by this termite was exhibited by Mr. Swezey. It was the first instance of termites damaging sugar cane in Hawaii. A few stools of cane had recently been found attacked in a field on the peninsula in Pearl Harbor below the R. R. station at Waipahu. This is the same termite which was found so abundant in the floor timbers of the Chapel at the Kamehameha School in 1913, and the following year in the band stand and flag pole at the Capitol grounds; also in the Alakea street wharf. The species has not yet been determined.

Kelisia swezeyi.—Reported by Mr. Bridwell from the lower slope of Mt. Kaala. The first record of this Delphacid from the Waianae Mountains.

Potato mite.—Mr. Bridwell reported that Mr. Carpenter of the Agricultural Experiment Station had found that sulphur dusted onto potato plants was quite successful in combating this pest.

PAPERS.

Notes on the Habits of Brosconymus optatus Sharp (Carabidae).

BY J. C. BRIDWELL.

The genera *Derobroscus* and *Brosconymus* were described* from eight specimens collected by Dr. Perkins in the mountains of Oahu and I have been unable to find any records of their having been taken since. Upon two occasions while in company with Mr. Timberlake it has been my good fortune to take what I take to be *Brosconymus optatus* in considerable numbers. The locality in which it was found is somewhat out of the range of Dr. Perkins' collecting grounds.

The trail which leads up from Leilehua to the summit of Mount Kaala in the Waianae Mountains ascends a lateral spur at right angles to the main ridge, the initial sharp ascent ending at about 2500 feet in elevation and for a mile or more the ascent is much more gradual, the ridge joining the main mass of the mountain at about 3500 feet. Along this ridge the ohia lehua (*Metrosideros polymorpha*) trees have their trunks covered with mosses and on their branches from six to eight feet from the ground are mats of moss of several species but principally of two species, one pale green, erect and densely matted together, the other dark green, branched and in loose mats. While *Brosconymus* was occasionally found among the

* Sharp, Fauna Hawaiiensis 3:197-9 and 290, 1903.

mosses on the trunks of the trees, their usual and apparently proper habitat seemed to be on the moss-mats on the branches, for here were to be found both larvae and pupae.

These moss-mats furnish food for a number of lepidopterous larvae, among them *Scoparia bucolica* and *Scoparia dactyliopa* and a new and as yet undescribed species of *Mestolobes.* Other lepidopterous larvae also shelter themselves in these mats either in intervals of feeding or for moulting and pupation. It is probable that these form the major part of the food of these beetles and their larvae.

Adults showed surprising hardiness upon being brought down into the summer temperatures of the coast region, remaining alive with but little attention from late July until the end of September in moss enclosed in a tightly covered tumbler, devouring ant larvae and pupae placed with them. The pupae brought down, however, were not very successful in completing their transformation.

Brosconymus optatus is described as lacking prothoracic setae and this is true of a few of the individuals taken, but the great majority of about a hundred taken have a seta on the posterior angles.

In this connection it is perhaps worth while to record taking several individuals at various times of the closely related *Derobroscus politus* from the type locality on Lanihuli Ridge in the Koolau Mountains and from the parallel ridges bounding the adjacent Kalihi and Nuuanu valleys. Part of these were taken in small moss-mats and others in small cavities in low dead trees.

Notes on Hawaiian Prosopidae.

BY D. T. FULLAWAY.

These notes are based upon an examination of the large collection of bees belonging to Mr. W. M. Giffard, who, as is well known, has been an indefatigable collector of insects for years, paying special attention in his collecting to the Aculeate Hymenoptera. Of the 60 described species and varieties of native bees, 49 are represented in the collection, most of them by fine series. Oahu forms are complete, only two are missing out of the large number found on the island of Hawaii, with Maui and Kauai not so well represented. The principal result of this examination has been the accumulation of data on distribution and variability which tends to weaken the value of certain species in groups of closely related forms. Owing to the contradictory nature of some of the evidence, however, it is considered inadvisable to go further than to point out certain well marked duplications. An attempt has also been made, with some success, to match up forms represented by but one sex. Novelties, at this date, were hardly expected, but a few have turned up, notably the much-sought male of *rugulosa*. Altogether, it is believed considerable is added to our knowledge of the bees. Acknowledgment is gratefully made of help received from Dr. R. C. L. Perkins.

SIMPLEX—*loc. rec.* Hilea, Kau, many specimens. Honuapo, 2. Kilauea-Honuapo auto road, 1.

LAETA—*loc. rec.* Hawaii, Kau lava flows, many. Kilauea, several.

KONA—*loc. rec.* Kilauea and Kau. Not common.

RUGULOSA—Two specimens, taken on different occasions, are referred to this. Both bear tags in Dr. Perkins' handwriting indicating their peculiarity but without attaching a name. The type of *rugulosa* is not available but these specimens approach the description closely. A peculiar unique is believed to be the ♂. It is described as follows:

Male black, only the anterior face of the front tibiae, as usual, and the front tarsi a dull orange yellow, and the flagellum of the antennae dull reddish beneath. Face a trifle broader than long, not convex longitudinally, moderately emarginate behind, dull, front roughly rugulose, fairly closely but not deeply punctate, clothed with pale hairs, smoother alongside the antennal fossae, where there is a well marked depression, the clypeus with rather large punctures towards the apex, cheeks very short, the base of the mandibles nearly touching the eye, the supraclypeal plate wide and short, the anterior margin nearly twice as long as the lateral, antennal scape strongly dilated though evidently longer than wide, posterior margin strongly curved, anterior margin straight, punctate above, arched beneath. Mesonotum and scutellum dull but not excessively so, and even with a faint sheen in certain lights, the former with a microscopically fine surface sculpture and shallowly though fairly closely punctate, the latter somewhat more deeply and closely pitted and both clothed with pale silvery hairs. Propodeum rugose, the anterior area with an irregular network of wrinkles extending to the brow. Abdomen more or less dull, the wings of the 7th ventral segment rather wide as in *assimulans* and the process of the 8th ventral segment expanded at the bend, the upper arm fairly long with a fringe of long hairs above and bifurcated outwardly somewhat as in *coniceps*. Wings clear.

Vicina—*vicina*, *koae* and *connectens* appear to be closely related forms. Is there not ground for considering only one species present? The complex has a representative on each island in the group. Kauai, Oahu, Molokai and Maui examples are brighter than the Hawaii ones, but the genitalia are uniform throughout, confirming the closeness of the relationship. It is impossible to separate *koae* and *vicina* for instance on the presence or absence of yellow markings on the supraclypeal plate and hind tibiae when Kauai examples resemble the Hawaii ones, with Oahu, Molokai and Maui examples different.

Unica—*unica, laticeps* and *kauaiensis* form another complex similar to the preceding.

Neglecta—*neglecta*=*haleakalae*.

Comes—bears a strong resemblance to *coniceps*. I have not material to compare the genitalia.

Coniceps—A common form at Kilauea. As the description in the Fauna is very meagre in details, I redescribe it below:

♂ black, the clypeus however with the exception of a narrow strip along the anterior margin and a wider area along the lateral and posterior margins, also somewhat produced triangular markings laterally outside the clypeus, the anterior tibiae in front and the posterior ones narrowly at the base yellow; tarsi reddish brown. Dull, the head emarginate behind, the face fairly wide, closely and rather deeply punctate above the antennae, with a very evident plaga immediately behind the antennae, supraclypeal plate a little wider than long, cheeks extremely short, scape of antennae dilated but nearly twice as long as wide, hind margin somewhat curved, anterior margin almost straight, arched beneath. Mesoscutum and scutellum rugulose, shallowly and not too closely punctate, propodeum finely rugose and wrinkled anteriorly. Wings somewhat infuscate. Abdomen brighter than the head and thorax but hardly shining, the wings of the 7th ventral segment narrow, short and slender, process of the 8th ventral segment short and slightly curved, greatly expanded above, the expansion fringed with long hairs; the bifurcations also expanded with the surfaces clothed and the edges fringed with fairly long hairs.

Described from a specimen authenticated by Dr. Perkins.

♀ referred to this ♂ black throughout and brighter than the ♂, shining. Head deeply emarginate, closely and deeply punctate above the antennae, the punctures rather coarse, becoming finer near the center, supraclypeal plate short and wide, clypeus rugulose, shallowly but not finely punctate, mesoscutum and scutellum finely rugulose, evenly and closely punctate, the punctures sparser on the latter. Propodeum finely rugose and wrinkled anteriorly. Abdomen fairly smooth and shining. Wings infuscate with pronounced bluish reflections.

Dumetorum—common at Kilauea.

Specularis—considered the ♀ of *homeochroma* on the strength of their similarity and having been taken together on several occasions.

Dimidiata—2 ♂♂ and 1 ♀ specimens taken at Kahuku, Kau, are referred to this. These forms are certainly rightly associated, but the ♀ does not conform to the description in Fauna Hawaiiensis, and it is believed the original association was wrong. The Kahuku specimen is described as follows:

Female black with two yellow lateral spots, an interrupted thin yellow line on prothorax posteriorly, yellow tubercles and the base of the front and middle tibiae narrowly and the hind tibiae rather widely yellow banded. Head wide and of moderate length, fairly thick, emarginate behind and slightly convex longitudinally, the face dull, microscopically rugulose and shallowly and remotely punctate on the front. Mesonotum and scutellum dull but with a faint sheen, microscopically fine surface sculpture, the former very shallowly and remotely punctate, the latter shallowly but more closely punctate, the punctuation inconspicuous in both cases. Propodeum microscopically rugose with a few short longitudinal wrinkles at the anterior margin. Abdomen a little brighter than the thorax, especially the 1st segment. Wings clear.

Blackburni—*loc. rec.* coast of Lanai, 2 ♀♀.

Longiceps—*loc. rec.* Makapuu, Oahu, 1 ♂ 3 ♀♀. Lanai specimens with yellow spot on labrum. Oahu ♂ with yellow spot near apex of scape.

Obscurata—*loc. rec.* Kawaihae, Kohala, 3 ♂♂, 1 ♀. Kilauea, 2 ♂♂.

Flavipes=*blackburni.* *Loc. rec.* Honuapo, Hilea, Kau, many specimens.

Hilaris—*loc. rec.* Molokai, one specimen.

Satelles—*loc. rec.* Iao Valley, Maui, 1 ♀.

Filicum—occasionally with an interrupted yellow line on prothorax.

The following descriptions are to amplify and complete those in Fauna Hawaiiensis.

Nesoprosopis vicina.

♂ black, the clypeus however with the exception of a narrow strip along the anterior and lateral margins, the anterior part of the supraclypeal plate, anterior tibiae in front and posterior tibiae narrowly at the base yellow. Face fairly long, dull, finely rugulose, closely and rather shallowly punctate above antennae, supraclypeal plate a trifle wider than long—to antennal fossae, cheeks rather short, antennal scape dilated but much longer than wide, posterior margin curved, anterior almost straight, strongly arched beneath. Thorax dull throughout, mesoscutum finely rugulose, closely and finely punctate, scutellum closely and shallowly punctate, the punctures larger, clothed with grayish hairs, propodeum rugulose, with longitudinal wrinkles anteriorly extending almost to the brow. Abdomen shining throughout, with dark hairs at the tip. Wings clear. Wings of 7th ventral segment not very wide nor long, the process of the 8th ventral segment much expanded in the upper arm, bearing long hairs outwardly, the bifurcations also expanded and very hairy.

♀ black throughout, head and thorax and the abdomen except at the posterior margin of the segments, dull. Head emarginate behind, clothed with pale hairs, closely and finely punctate above the antennae, clypeus also punctate and a trifle convex, supraclypeal plate short and wide, mesoscutum closely and finely punctate, scutellum finely punctate but not so closely, propodeum with rather short longitudinal wrinkles. Wings clear.

N. flavipes.

♂ with the whole face below the antennae yellow, the marking being continued up the side of the face along the eye margin as a broad vitta, often a yellow spot on the scape outwardly and the labrum and prothoracic tubercle yellow, all the tibiae and tarsi likewise yellow, the middle and anterior tibiae however with a black spot behind and the posterior tibiae incompletely banded with black. Face longer than wide, not at all convex, the cheeks between the eyes and mandibles short, scape of antennae hardly dilated, more than twice as long as wide, gently arched beneath, the supraclypeal plate not much longer than wide, head above the antennae hardly shining but not altogether dull, rather coarsely rugulose and fairly closely, irregularly, shallowly and not too finely punctate. Mesoscutum and scutellum dull, probably more so than the head, mesoscutum with the surface finely rugulose and rather regularly, closely shallowly and finely punctate, scutellum a little more shining, the punctures of larger diameter and not so regular. Propodeum rugose with a few rather long wrinkles at anterior end. Abdomen not so dull as the thorax, finely rugulose, the 1st segment especially smooth. Wings slightly infuscate. Wings of the 7th ventral segment narrow and short, the process of the 8th ventral segment expanded at the flexure, the bifurcations turned upward.

♀ entirely black, only the front of the anterior tibiae and the under side of the flagellum reddish yellow, shining but not highly polished, sculpture of the head distinct, the punctures large but shallow, the punctuation of the mesoscutum and scutellum regular, close and fine, the punctures a trifle larger on the scutellum and not so close together, propodeum rugose and much wrinkled anteriorly, abdomen fairly smooth. Wings clear.

N. anomola.

♂ black, the face marked with yellow on the clypeus anteriorly and (sometimes) on the supraclypeal plate, also two fairly wide yellow vittae along the orbital margin extending beyond the antennae, the mandibles also bear yellow markings, the antennal scape is orange red as is also the under side of the flagellum, there is a complete thin yellow line on the prothorax, the legs also are orange red with the exception of the coxae and sometimes with fuscous markings, and abdominal segments 1, 2 and 3 (sometimes) are orange red at the base. Head and thorax dull, the abdomen shining, head wider than long, closely and rather coarsely punctate above the antennae, supraclypeal plate with the anterior margin about as long as the lateral, the clypeus shallowly punctate bearing pale setae, the antennal scape is somewhat expanded, almost straight in front but well curved behind and arched beneath, mesoscutum and scutellum closely, shallowly punctate, propodeum short, rugose, irregularly wrinkled in front, the entire thorax with a heavy clothing of pale brown to cinerous hairs, abdomen with a delicate surface sculpture and finely, shallowly punctured and hairy, the punctures on the 1st segment sparse, the hairs more thickly set towards apex. Wings clear. The genitalia are not much different from those of *setosifrons,* its ally.

SEPTEMBER 6TH, 1917.

The one hundred forty-fourth meeting of the Society was held in the usual place, President Potter in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Muir and Timberlake.

Minutes of previous meeting read and approved.

Mr. D. L. Crawford was elected to active membership.

ENTOMOLOGICAL PROGRAM.

Heterospilus prosopidis.—This Braconid was reported by Mr. Bridwell, he having recovered it by sweeping in Kapiolani Park, Honolulu. It was introduced as a Bruchid parasite by Mr. Fullaway in 1910, and had not yet been known to have become established.

Bruchus pruininus.—Mr. Bridwell reported the capture of this Bruchid in Kapiolani Park, being the first record of its occurrence in the Islands.

Anthicid.—Mr. Bridwell reported collecting a strange beetle with enlarged femora in Kapiolani Park, which is probably an Anthicid.

Alphitobius diaperinus.—A large number of these beetles found in a fallen mynah bird's nest by Mr. Bridwell.

Nesosydne nephrolepidis.—The capture of this Delphacid in the Koolau Range back of Honolulu, reported by Mr. Bridwell.

Nesosydne timberlakei.—Mr. Muir reported the capture of a male specimen of this Delphacid on *Cyanea truncata* near Waiahole tunnel, August 26th.

Apterocyclus sp.—Mr. Bridwell reported that Mr. Forbes, the botanist at the Bishop Museum, on a recent collecting tour on Kauai, had collected a number of dead specimens of this rare Lucanid beetle.

Pycnophion fuscipennis.—Mr. Bridwell also reported that Mr. Forbes collected this Ophionid on Kauai.

Megachile palmarum.—Mr. Timberlake reported that in examining collections of this bee he had separated out some which are of a different species, hitherto not recognized. This makes the fourth species of *Megachile* known here. Some specimens of it bore date of 1902; and were collected at the Government Nursery.

Alphitobius sp.—Mr. Fullaway exhibited specimens of a Tenebrionid beetle near to this genus, collected by Mr. Ehrhorn in destroying a nest of the fire ant on the waterfront.

Hormiopterus sp.—Mr. Fullaway exhibited specimens of this and another Braconid near *Eubadizon* which had been in the collections a long time without notice.

Notes on Some of the Immigrant Parasitic Hymenoptera of the Hawaiian Islands.

BY P. H. TIMBERLAKE.

During a recent visit in Washington, D. C., the writer compared certain of our introduced or immigrant parasitic Hymenoptera with types or other specimens in the U. S. National Museum. The comparisons in some cases confirmed previous determinations, but brought to light errors of identification in other cases. The writer's thanks are due to Mr. A. B. Gahan for aid in the determination of several species.

Ichneumonidae.

Exochus femoralis (Fourcroy). A female from Honolulu (Oct. 16, 1916) was found identical with a female from

Blankenburg, Thüringen, Germany, except for a slight difference in the degree of infuscation of the head.

Hemiteles tenellus (Say). Ashmead divided our *Hemiteles* among three so-called species, namely *tenellus* (Say), *variegatus* Ashmead and *melitaeae* Ashmead. Ever since the writer became acquainted with the character of the Hawaiian fauna he had been skeptical about these determinations. It seemed improbable, to say the least, that three closely allied species should become established here, and moreover all the material that was extant in the local collections was clearly referable to a single species. A study of the *Hemiteles* in the National Museum showed that the following described forms are extremely alike and might well belong to a single species, although showing some variations in size and coloration. The list includes *tenellus* (Say), *utilis* Norton, and the following all described by Ashmead: *melitaeae, variegatus, coleophorae, orgyiae* and *periliti,* the last two under *Otacustes.* Although there may be more than one species included here it would be hopeless to attempt to distinguish more than one by means of any descriptions so far published, and until the genus receives a thorough revision at the hands of a competent specialist, the writer recommends that the earliest American name, or *tenellus* (Say), be used for our Hawaiian parasite. In his work on the Hymenoptera of Connecticut, Viereck goes one step further and makes *tenellus* a variety or subspecies of the European *areator* (Panzer). This parasite has been reared frequently in the Islands from the cocoons of *Chrysopa microphya* McLachlan. It is probably distributed on all of the Islands, as the writer has seen it from Kauai, Oahu and Hawaii.

Angitia polynesialis (Cameron). Viereck's species *plutellae* and *hellulae* are synonymous with Cameron's *polynesialis.* Viereck separated his two species on the presence or absence of yellowish markings on the sides of the abdomen. Hawaiian specimens usually have the yellowish markings and are thus identical with the types of *hellulae.* Such specimens have been reared in the United States from *Plutella maculipennis* Curtis and this is the usual host here. It is also not unlikely that this species occurs in Europe and an earlier name may possibly be found for it.

Braconidae.

Ephedrus incompletus (Provancher). Our *Ephedrus* was determined by Mr. Gahan as Provancher's species. It has been reared by the writer from a green species of *Macrosiphum* on rose bushes at Honolulu, and Mr. Swezey obtained it from the same host at Wailuku, Maui, on June 18, 1916. This species seems to have been first collected by Dr. Lyon on April 18, 1914, on the same host.

Diaeretus chenopodiaphidis (Ashmead). Our species of *Diaeretus* is not *rapae* (Curtis), but Ashmead's species which is chiefly distinguished by having 13 antennal joints in the female and 16 in the male, instead of 14 and 17 respectively, and by a slight difference in coloration and sculpture. This species has been reared from *Aphis brassicae* Linnaeus, and *Rhopalosiphum persicae* (Sulzer) from several localities near Honolulu.

Dinocampus terminatus (Nees). The writer has examined specimens of this species from Hungary; Barcelona, Spain; Palroa, New Zealand; Fiji; Okitsu, Japan; and from many localities in the United States from Massachusetts and Virginia to California and Washington. Perkins also records it from Queensland, Australia. *Perilitus americanus* Riley and *Euphorus sculptus* Cresson are synonyms, (the latter synonymy taken from a female in the National Museum which was compared with Cresson's type by Mr. R. A. Cushman). The species is extremely constant throughout its vast range, and although there is a slight variation in color this seems to be independent of its geographic distribution. In the Hawaiian Islands it was probably introduced with *Olla abdominalis* (Say) from North America, but it now usually attacks *Coel-*

ophora inaequalis (Fabricius). It does not seem to be nearly so common here now, as it was when Perkins first found it.

Apanteles sp. According to Mr. Gahan, our banded-winged *Apanteles* is entirely distinct from any known North American species. The species was first taken in 1911 at Honolulu, unless it is one of those mentioned by Perkins in 1910 without name or description. Mr. Swezey has reared it from *Opogona.*

Opius sp. The small *Opius* that has been reared recently by Messrs. Swezey, Bridwell, and the writer from the Lantana *Agromyza* on Oahu was determined by Mr. Gahan as most probably a new species close to *nanus* Provancher.

Hormiopterus sp. This is another recent immigrant which has been taken in Honolulu, Palolo, Niu, Kuliouou, and on Tantalus by several collectors. The first specimens examined by the writer were taken by Mr. Swezey in 1914.

Pteromalidae.

Pachyneuron siphonophorae (Ashmead). This species is readily recognized in the female sex by having three ring-joints and only five funicle joints. Mr. A. A. Girault has recently erected a new genus or subgenus, *Propachyneuronia,* for this species, but it is hardly worth recognition as the male sex does not show the supposed generic character. He has also synonymized *Pachyneuron micans* Howard and *P. aphidivorum* Ashmead with it, the latter incorrectly, as Mr. Gahan's notes on the types, taken when they were in a better state of preservation than at present, show that *aphidivorum* has only two ring-joints.

This species is hyperparasitic in Aphidids, and with us attacks both *Ephedrus incompletus* and *Diaeretus chenopodiaphidis.* It has been found at or near Honolulu, and at Wailuku, Maui, by Mr. Swezey.

Pachyneuron syrphi (Ashmead). This species was reared from a puparium of *Xanthogramma grandicorne* Macquart, from the plantation of the Oahu Sugar Company in April, 1904, by F. W. Terry. Apparently it is not common here. In the United States it has a wide range of Syrphid hosts, apparently all aphidivorous or coccidivorous species however, and is widely distributed. It is a primary parasite of the Syrphids and in consequence beneficial to the Aphidids and inimical to man.

Mr. Girault has synonymized this species with *albutius* Walker, but the recognition of Walker's species is extremely doubtful from the descriptions alone. Mr. Girault's recent synopsis of the North American species of *Pachyneuron* is marred by too much reliance being placed on colorational characters, and does not prove to be very helpful in the identification of the species.

Encyrtidae.

Encyrtus infelix (Embleton). This is the species which was wrongly determined by Ashmead as *Encyrtus fuscus* (Howard). *Infelix* is a widely distributed species parasitic on *Saissetia hemisphaerica* (Targioni). The writer has seen it from Edinburg, Scotland; South Kensington, England; Torto, Portugal; and San Francisco and Sacramento, California. Masi has recently recorded it from the Sychelles Islands.

Blepyrus mexicanus Howard. The writer is unable to distinguish the three species of *Blepyrus* described by Howard, after a careful comparison of the types with a large series from Honolulu. *Mexicanus* was described from Monterey and was reared from a host said to be *Ceroputo yuccae* (Coquillett). The host remains mounted with the types, however, show the long, glassy filiaments so characteristic of *Pseudococcus virgatus* (Cockerell) and an error of identification is evident. *Texanus* was described from Brownsville, Texas, and the recorded host is *P. virgatus* which is definitely known to be the only host of *Blepyrus* here, described by Howard under the name of *marsdeni*. *Coccophoctonus dactylopii* Ashmead is another synonym of *Blepyrus mexicanus.* Ashmead recorded his species from Australia and cited an undetermined *Pseudococcus* as the host. The eleven type specimens, however, are labeled Honolulu and bear the same Insectary No. (of the U. S. Department of Agriculture) and date as Howard's types of *marsdeni,* so that undoubtedly both series were reared from the same lot of material.

Aphelinidae.

Prococcophagus orientalis (Howard). Our abundant, small, banded-winged Coccophagus-like parasite of Lecaniine scales, seems to be altogether too close to Howard's species for separation. The usual size of our specimens is nearly twice that of the types and the coloration of the pleura and legs is blacker. The types, however, are evidently undersized specimens, and have been considerably bleached by the action of alcohol in which they were preserved at some former time. The species has been recorded in the local literature variously as *Coccophagus orientalis, Aneristus* sp. and *Aneristus ceroplastae.* It seems to agree very well with Silvestri's conception of *Prococcophagus,* and is kept out of *Aneristus* by the absence of well developed bristles on the hind tibiae.

This is one of our most efficient coccid parasites, and has a wide range of hosts. It is extremely active, and carries the abdomen tilted upward.

Figitidae.

Eucoilidea micromorpha Perkins. This is clearly congeneric with Ashmead's genotype species, and is distinct from any of the species in the National Museum. It is parasitic in the puparia of *Agromyza pusilla* Meigen and has a wide distribution on Oahu, chiefly in the lowlands.

OCTOBER 4TH, 1917.

The one hundred forty-fifth meeting of the Society was held in the usual place, Vice-President Pemberton in the chair. Other members present: Messrs. Bridwell, Crawford, Ehrhorn, Fullaway, Giffard, Muir, Timberlake and Willard; and Mr. Robert Veitch of Suva, Fiji, visitor.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Mr. Giffard exhibited two boxes of Delphacids and Fulgorids collected by him in California, during certain months of 1916. There were many new species. The collection was worked up by Mr. Van Duzee of the California Academy of Sciences and will be published elsewhere.

Lerp-forming Psyllid.—Mr. Ehrhorn exhibited specimens of a lerp-forming Psyllid from Australia.

Mr. Veitch spoke of the principal sugar cane insects in Fiji—cane borer, root grubs and wire-worms, and of their peculiar problems and methods of control.

PAPERS.

Certain Aspects of Medical and Sanitary Entomology in the Hawaiian Islands.

BY J. C. BRIDWELL.

[Withdrawn for publication in Report Hawaiian Medical Association, 1916-1917.]

Two New Species of Nesosydne (Delphacidae).

BY F. MUIR.

Nesosydne phyllostegiae sp. nov.

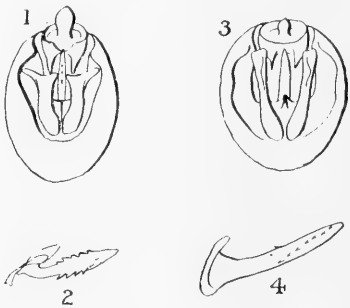
♂ Vertex slightly longer than broad, apex rounded; length of face twice the width, slightly widened in the middle; median carina furcate near base; antennae reaching well beyond base of clypeus, second joint nearly one and one-half times the length of first (1.4); hind tibia longer than the tarsi, first tarsal joint slightly longer than the other two together. Tegmina reaching to the base of pygophor.

Green to yellowish brown in fresh specimens, the green turning yellowish and the yellow turning reddish in old specimens; infuscate between carinae of head, on pleura, coxae and over most of the abdomen. Tegmina hyaline, yellowish or greenish, veins concolorous with membrane with a few small granules bearing black hairs, a small dark mark at the apex of clavus and another at the apex of costal cell.

Genitalia figured (figs. Nos. 3, 4). The armature on the diaphragm below the aedeagus is produced into two curved spines; anal spines small, wide apart.

Length 2.5 mm.; tegmen 1.5 mm.

♀ Similar to male but the average color is lighter, some specimens being with little or no infuscation.



EXPLANATION OF FIGURES.

Figure 1. *Nesosydne cyrtandricola*, full view of pygophor.
2. *N. cyrtandricola*, lateral view of aedeagus.
3. *N. phyllostegiae*, full view of pygophor.
4. *N. phyllostegiae*, lateral view of aedeagus.

Hab. Puuwaawaa, North Kona, Hawaii, 3700 feet elevation; a long series of both sexes and young feeding on *Phyllostegia racemosa* Benth. (W. M. Giffard). There are two fairly distinct series including both sexes, one with the ground color light green, the other light brown or yellow. The aedeagus shows relationship to *N. cyrtandrae* but the genital styles are quite distinct. Type deposited in the collection of the H. S. P. A. Experiment Station.

Nesosydne cyrtandricola sp. nov.

♂ Vertex longer than wide, length of face 2.5 times the width, slightly narrowed between the eyes, the sides subparallel, median carina furcate about one-third from base; antennae reaching beyond the middle of the clypeus, second joint 1.7 times the length of first; first joint of hind tarsi distinctly longer than the other two together.

Light green, a fuscous or black line between the carinae of face, clypeus, genae and thorax; pleura and first and second legs (especially the tibiae) light fuscous, hind legs with a longitudinal line along femora and tibiae, the tarsi fuscous; pygophor and styles dark brown, a few fuscous marks or spots along the medio-lateral line of abdominal tergites. Tegmina hyaline, yellowish, a small dark mark at apex of costal cell and dark along the costa, a larger dark mark at apex of clavus which spreads out over the middle of the tegmen, becoming lighter as it reaches the radius where it reaches to near the apex and to near the base; veins thick, especially the radius, with minute granules bearing black hairs, apical veins and border light.

Genitalia figured (figs. Nos. 1, 2). Armature of diaphragm forming a thin, small, perpendicular plate below the aedeagus.

Length 2.6 mm.; tegmen 1.5 mm.

♀ Similar to male but somewhat lighter, the ovipositor brown.

Length 2.9 mm.; tegmen 1.7 mm.

Hab. Glenwood, Olaa, Hawaii, 2300 feet elevation; a long series of both sexes and young from *Cyrtandra* sp. Also some young reared to adults on *Charpentiera obovata* Gaud. (W. M. Giffard). The young nymphs are light green, later acquiring dark marks similar to the adults. This species comes near to *N. anceps* but is quite distinct. Type deposited in the collection H. S. P. A. Experiment Station.

Notes on Delphacids Collected on a Short Visit to Portions of the Intermediate Forests in Olaa and in North and South Kona, Island of Hawaii.

BY WALTER M. GIFFARD.

During the latter part of August, 1917, I had occasion to make a very hurried visit by automobile from Kilauea to Puuwaawaa, North Kona, Hawaii, via the belt road through the districts of Kau and South Kona. Accompanying me were

Prof. J. F. Rock of Honolulu and A. Holm of San Francisco, who were botanizing and collecting seeds from our indigenous forest trees for the Golden Gate Park in San Francisco. Our stay of one and one-half days at Puuwaawaa was quite too brief for systematic collecting of the insect fauna of that interesting region and I therefore utilized the few hours at my disposal searching for Delphacids and other Homoptera and such Heteroptera and Coleoptera as could be incidentally captured. The rough nature of this region, covered as it is with old lava flows of the a-a type, makes very slow walking or riding and by the time the interesting forest region is reached much of the day has been wasted getting there, and even then due to loose scoria it is most difficult walking and collecting amongst the sparse vegetation. Much of the latter, including the lower foliage of the trees, has been destroyed of late years by cattle and very many of the trees themselves destroyed by continuous drought and from other causes. A full week or ten days insect collecting in these forests would undoubtedly produce very satisfactory results but due to the limited time at my disposal (five hours in all of actual collecting) I endeavored to confine myself to the Delphacids none of which had as yet been recorded from this particular region in the district of North Kona. As a result only one new species (*Nesosydne phyllostegiae*) was collected, but several new food plants of certain known species of Delphacids were found which in itself was well worth the trip. These latter and the fact that a series of *Aloha swezeyi* was captured for the first time on any other island than Oahu, will be referred to in detail in the accompanying field notes. Incidentally, I believe this to be the third species of the Genus *Aloha* taken on the Island of Hawaii.

Before returning to Hilo from Kilauea a portion of the "inside" forests located at 29 Miles (so-called) about two miles north of the Volcano House, were visited for a few hours but nothing of any special importance not already published was captured. Due to a protracted drought in the neighborhood of Glenwood and "25 Miles" (so-called) Olaa, much interesting data as to the insects of this almost continuously wet region might have been gathered had it been possible for me to remain at Kilauea for a sufficient length of time. As it was I was able to visit and collect at these latter places for a few hours on two separate days with satisfactory results. Besides the discovery of one new species of Delphacid (*Nesosydne cyrtandricola*) the hitherto unknown food plant of the single male *N. anceps* taken by Muir in 1915 was found to be *Freycinetia arnotti* (ieie vine). A good series of both sexes of the last named Delphacid was taken. Undoubtedly the absence of moisture overhead and on foot in the boggy forests of this region would have produced much better collecting had I been able to stay over another week, as insects in general were more plentiful there at the time than I had ever found them on previous visits, which were always attended by more or less precipitation and consequent inability to properly collect.

I am indebted to my friends Messrs. Muir and Rock for assistance, by the former in the determination of the Delphacids collected and by the latter of the food plants.

Following are the detailed field notes* covering certain of the species taken during the visits referred to, viz.:

Leialoha lehuae hawaiiensis Muir. Olaa 29 miles (Nos. 7 and 30. Long series males and females off *Metrosideros polymorpha* var. *incana* (Ohia lehua). Also reared a number of adults from nymphs on the leaves of this food plant. One male (No. 44) Olaa 25 miles, 3000 ft. elev., off *Platydesma* sp. Probably this was an accidental capture although no ohia was growing in this particular section of forest.

Nesodryas dryope Kirk. Glenwood 22 miles, 2300 ft. elev. (Nos. 26, 34 and 38) 12 males and 3 females off *Antidesma platyphyllum*.

Nesodryas maculata Muir. Kapua, South Kona, 2000 ft.

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* Numbers refer to writer's field notes.

elev., near main road. Long series males and females (No. 9) off *Maba sandwicensis.*

Aloha myoporicola Kirk. Puuwaawaa (Waihou) N. Kona, 3700 ft. elev., 2 males and 2 females and nymphs (No. 14) off *Myoporum sandwicense* var. *seratum;* one male and one female (No. 11) ex *Phyllostegia racemosa* and 1 adult (No. 19) ex *Acacia koa* (no *Myoporum* near, both are possibly accidental captures); at Huehue, N. Kona, 1800 ft. elev., 12 males and 5 females (No. 10), all typical, off *Myoporum sandwicense.*

Aloha swezeyi Muir. Puuwaawaa (below Waihou) N. Kona, 3000 ft. elev., 10 males, 5 females and nymphs (No. 17) ex *Cheirodendron gaudichaudii.* Puuwaawaa hill, N. Kona, 3800 ft. elev., 8 adults and 3 young, including 2 macropterous females (No. 20), off the lower branches of *Anona cherimolia* under which and almost touching were a mixture of weeds including *Bidens pilosa, Verbena bonariensis* and *Erigeron canadense.* At same spot 2 males and 5 females with 2 nymphs (No. 20a) were taken off the mixed weeds above mentioned. In same locality on a large area where there were no trees or shrubs but only large patches of dwarf *Bidens pilosa* growing amongst immature and almost dry Bermuda grass, 3 males and 4 females and nymphs, including 1 macropterous female (No. 21) were taken. The macropterous form was not previously known and the species has hitherto been taken only on Oahu viz.: in Palolo Valley and on Tantalus. In North Kona it is evidently attached to the obnoxious weed *Bidens pilosa* and *Cheriodendron gaudichaudii,* but unfortunately I had no opportunity to rear any of the nymphs taken. On Oahu, Timberlake has taken series of both sexes off *Campylotheca macrocarpa* and Swezey one male off *Lythrum* sp., which latter may have been accidental.

Nesosydne koae Kirk. Puuwaawaa (Waihou forest) N. Kona, 3700 ft. elev., 2 males and 1 female (No. 16), sweeping young leaves sprouting from large roots of *Acacia koa.* Olaa 25 miles, 3000 ft. elev., 1 female (No. 44) sweeping. Olaa 29 miles, 4000 ft. elev., 5 females (No. 5) off *Acacia koa* (phyllodia only).

Nesosydne rubescens Kirk. Puuwaawaa hill, N. Kona, 3800 ft. elev., 2 adults (No. 20) off *Anona cherimolia* growing under tall koa trees and 2 adults and nymphs off phyllodia of *Acacia koa.*

Nesosydne rubescens var. *pulla* Muir. Puuwaawaa, N. Kona, 3700 ft. elev., 3 specimens (Nos. 15 and 19) off phyllodia of *Acacia koa.* Olaa 29 miles, 4000 ft. elev., 3 adults (No. 5) off phyllodia of *Acacia koa* and several specimens (No. 2) from *Broussaisia pellucida* and *Cyrtandra* sp. growing below koa trees. Olaa 25 miles, 3000 ft. elev., several nymphs (No. 48) off *Platydesma companulata,* one male of which was reared from this latter food plant.

Nesosydne pseudorubescens Muir. Olaa 29 miles, 4000 ft. elev., 2 adults (No. 6) off *Clermontia parviflora.*

Nesosydne anceps Muir. Olaa 25 miles, 3000 ft. elev., 4 males and 4 females off *Freycinetia arnotti* (ieie vine). This species was only known by one male before; the female is similar to the male and both show the usual range of coloration, the thorax being either dark or light. Hitherto the food plant for this species was unknown.

Nesosydne blackburni Muir. South Kona on main road at 1400 ft. elev., 7 males and 15 females and nymphs (No. 23), a dark form, off *Charpentiera obovata.* Two of the nymphs were later on reared to maturity on leaves of this tree. At Glenwood, Olaa, 2300 ft. elev., 1 male (No. 33) off *Strongylodon lucidum* (Nukuiwi vine) and 2 males and 6 females and nymphs, dark form (No. 36), off *Touchardia latifolia.* In the inside forest at Olaa 29 miles, 4000 ft. elev., 3 males, 1 female and nymphs (No. 31) off *Clermontia parviflora.* This makes up to the present 7 food plants recorded from which large or small series of this species have been taken on the island of Hawaii.

Nesosydne ipomoeicola Kirk. Puuwaawaa, N. Kona, 3700 ft. elev., 1 male and 10 females and nymphs (No. 13) off *Lythrum maritinum* sparsely distributed amongst cover of weeds, also 20 males, 16 females and nymphs (No. 22) in a large sparsely covered area of the Lythrum and Bermuda grass at somewhat higher elevation. These are all of the light form similar to that taken on *Sadleria* at Kilauea. In S. Kona along the main road at 1600 ft. elev., 2 males (No. 24) off *Gouldia elongata*. At Glenwood, Olaa, 3 females and 3 young (No. 27) off *Antidesma* sp. and *Cyrtandra* sp. mixed. Also a long series of both sexes (18 males and 19 females and nymphs), all dark forms (No. 33), off *Strongylodon lucidum* (Nukuiwi vine). Later 1 male was reared on leaves of the latter vine.

Nesosydne phyllostegiae Muir. Puuwaawaa (Waihou forest), N. Kona, at 3700 ft. elev., 8 males, 21 females (greenish in color) (No. 11) with a few nymphs off *Phyllostegia racemosa*. This proved to be a new species and has just been described by Mr. Muir.

Nesosydne cyrtandricola Muir. Olaa 25 miles, 3000 ft. elev., and Glenwood, Olaa, 22 miles, 2300 ft. elev., 18 males and 9 females together with nymphs (Nos. 27, 37, 39 and 43) off a tall and branching species of *Cyrtandra* as yet not described. Several nymphs were later on reared to maturity on leaves of this tree. This new species (a brachypterous form) when first captured is of a very bright green color but in the course of a few days changes to a dullish green.

Nesosydne (undetermined). Puuwaawaa, N. Kona, 3700 ft. elev., 2 females off *Coprosma cynosa* (Pilo).

NOVEMBER 1st, 1917.

The one hundred forty-sixth meeting of the Society was held in the usual place, Vice-President Pemberton in the chair. Other members present: Messrs. Bridwell, Crawford, Ehrhorn, Fullaway, Kuhns and Swezey. Visitors: Mr. Robert Veitch and Mr. K. C. Brewster.

Minutes of previous meeting read and approved.

Mr. Swezey proposed the name of Francis X. Williams for active membership in the Society.

ENTOMOLOGICAL PROGRAM.

Bruchus pruininus.—Mr. Bridwell presented some observations on this weevil, which he has found infesting the seeds of *Leucaena glauca.*

Heterospilus prosopidis.—Mr. Bridwell gave some notes on this Braconid and gave it as his opinion that it was a parasite of the above Bruchid, from the fact of his collecting both of them in the same localities, tho he had not actually bred the parasite yet from the weevil.

Omiodes blackburni.—Mr. Bridwell remarked on the scarcity of the coconut leafroller at the present time.

Odynerus oahuensis.—A specimen of this wasp was exhibited by Mr. Bridwell, collected by him in Ainahau Park, Honolulu.

Euscelinus sp.—A specimen exhibited by Mr. Bridwell, collected in Honolulu.

Bostrychid.—A specimen of a hitherto undetermined Bostrychid beetle was exhibited by Mr. Bridwell. A small species with red marking on the elytra.

Gelechia gossypiella.—Mr. Swezey exhibited specimens of the pink boll worm bred by Mr. Giffard in September of this year, from fruits of *Hibiscadelphus hualalaiensis* collected by Mr. J. F. Rock at Puuwaawaa, Hawaii. Mr. Rock reported the seeds to have been very badly infested. This is the first record of this insect in seeds of this native tree, altho Mr. Rock had previously reported its seeds badly eaten by some Lepidopterous larvae.

Colobicus parilis.—Mr. Fullaway reported the collecting of two specimens of this beetle.

Passer domesticus.—Mr. Fullaway reported having observed the English sparrow picking mealybugs from the leaves of poinsettia.

PAPERS.

A Note on Euxestus minor.

BY F. MUIR.

The insect described by Dr. Sharp as *Euxestus minor* (Fauna Hawaiiensis, III, p. 415) is stated by Arrow to be the same as *E. parki* Woll., which was first described from Madeira and now recognized by Arrow from China, Burma, Malay Peninsula, Philippine Islands, Java, Hawaii, Haiti and Central America (vide Ann. Mag. Nat. Hist., (8) 20, p. 138, 1917).

Homopterous Notes II.*

BY F. MUIR.

[Presented by O. H. Swezey.]

The material dealt with in these notes are two small collections, one kindly loaned to me by the American Museum of Natural History, New York, and the other by Prof. H. Osborn, and a few specimens belonging to the collection of the Hawaiian Sugar Planters' Association, Honolulu.

Measurements are from apex of head to anus and from

* Homopterous Notes I was published in Proc. Haw. Ent. Soc., III, 4, p. 311, 1917.

apex to base of one tegmen; colors are according to the Ridgeway standard.

The more one works upon the Fulgorids the more one is convinced of the necessity of using the genitalia for specific distinction. Unfortunately these characters are seldom mentioned by describers, except in one group of the Delphacidae, and in a great many instances the sex of the insect being described is not mentioned, or it is wrongly mentioned. There are good characters in both sexes for dividing the Homoptera into groups, and even among the Fulgorids there are good group distinctions which have not yet been fully worked out.

DERBIDAE.

Genus Herpis Stål.

Herpis obscura? (Ball).

Lamenia obscura Ball, 1902, Can. Entom. XXXIV., p. 262.

The specimens I have agree with the descriptions of this species as far as the descriptions go, but they are incomplete.

Anal segment much longer than broad, gradually constricted to the middle, apex truncate, anus near apex; length of genital styles twice the width, ventral or inner margin entire, slightly convexly curved, apex produced into a broad, sharp point turned inward, dorsal or outer margin turned at right angle to disk leaving an entire, nearly straight false margin when viewed from outside, the true margin strongly convexly curved on apical two-thirds with a slender projection near the base with its pointed apex at right angles to the stem.

One pair from Cabanas, P. de R., Cuba, one female from Pinar d. Rio, P. de R., Cuba, September, 1913; also one pair from Rockstone, British Guiana, July, 1911.

My specimens of *H. vulgaris* (Fitch) is a larger insect, the genital styles are longer in proportion to the width, the apical spine more slender, the dorsal margin more angularly produced and its basal process with two apical spines.

Genus Cyclokara Muir.

In my table of genera of Derbidae* I placed *Patara* West. in Group II. Westwood's figure was not clear to me at that time, but since then I have examined allied forms from the West Indies and now see that *Patara* should have been placed in Group I, as it comes near to *Cyclokara* Muir. *Dawnaria* Distant is close to *Cyclokara*. *Patara* West. differs from both of these in having a large, flattened antenna. I place *Patara vanduzei* Ball in *Cyclokara* but the neuration is not quite typical.

C. sordidulum sp. nov.

♂ In neuration, shape of head and antennae this species is typical of the genus. Head, thorax and abdominal sternites sordid pale orange yellow, carinae of face between eyes slightly infuscate, abdominal tergites cadmium orange. Tegmina sordid yellow, opaque with waxy secretion, slightly fuscous over apical cells, veins brownish in places; wings white opaque with waxy secretion, veins brown.

Edges of pygophor straight, entire, with a small, sharp point projecting on each side of the anal segment; anal segment small, about as long as wide; styles large, broad, apex roundly truncate, ventral edge slightly convexly curved, roundly produced in middle, dorsal edge very slightly and concavely curved, with a quadrate projection on basal half.

Length 2.1 mm.; tegmen 4.5 mm.

♀ Similar to male. Anal segment very small, as long as broad; pregenital ventral plate short, posterior edge widely angularly produced, the apex of the projection turned slightly dorsad.

Length 2.2 mm.; tegmen 5.5 mm.

Hab. Porto Rico, Aibonito, Mayaguez, July, 1914. Described from five males and five females. Type in the American Mus. of Nat. Hist., New York.

Genus Persis Stål.

The following species agrees with Stål's description of the genus. It has a similar neuration but the head is much more acutely angular in profile and the shoulder keels are only represented by a ridge. It differs from *Goneokara* Muir in having the head more produced, in profile the vertex and face form an acute angle, and the tegmen is longer and narrower.

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* Haw. Sugar Planters' Assn. Exp. Sta. Ent. Bull. 12, p. 43, 1913.

P. ståli sp. nov.

♂ Mikado orange, fuscous along carinae of face and a little spot over the eyes, antennae lighter, genital styles much paler, nearly white. Tegmina with the veins and an adjoining portion of membrane white or creamy white with the median portion of the cells orange-buff.

Medio-ventral edge of pygophor subangularly produced, lateral edges broadly convex; anal segment very long and narrow, suddenly constricted slightly above base then gradually widened to the truncate apex, with each apical corner produced into a point and turned ventrad, anus near apex; genital styles long, the dorsal edge near base produced into a subquadrate, flat process with a rounded process in the middle of the apical margin, beyond this the dorsal margin is entire and slightly curved dorsad, ventral edge produced into a broad, blunt spine near base, beyond which it is sinuous, widest beyond middle, the apex forming a slender point.

Length 4 mm.; tegmen 6 mm.

♀ Similar to male. Preanal segment deeply emarginate to receive anal segment; anal segment much longer than broad, anus before middle where the segment is broadest, beyond anus it narrows to apex which is deeply emarginate leaving the corners projecting as spines; pregenital plate large, longer than wide, hind margin at first gradually and then steeply produced, the middle portion forming a subconical plate.

Length 4.2 mm.; tegmen 7 mm.

Hab. Paramaribo, Dutch Guiana, August, 1911. Described from four males and five females, also one damaged female from Bartica, British Guiana, March, 1901. Type in the American Mus. of Nat. Hist., New York.

P. fuscinervis sp. nov.

♀ Head not produced so greatly as in *P. stali.* Ochraceous-orange, slightly fuscous over abdominal tergites; tegmina hyaline, opaquely white with waxy secretion, veins yellowish with fuscous patches; wings hyaline, opaquely white with waxy secretion, veins concolorous with membrane.

Pregenital plate large, posterior edge produced from sides to middle into a large plate subconicle in outline, the produced portion as long as the rest of the segment; anal segment longer than broad, anus before middle, apex produced into two fine spines with a rounded emargination between; style well developed, projecting silghtly beyond pregenital plate.

Length 2.7 mm.; tegmen 5 mm.

Hab. Bartica, British Guiana, May, 1901 (*Coll. H. S. Parish*). Described from one female. Type in coll. Prof. H. Osborn.

Genus Phaciocephalus Kirk.

Until the types of *Phaciocephalus* Kirk. and *Cenchrea* Westw. are compared there must be some doubt as to the distinction of these two genera. *C. dorsalis* Westw. is described and figured as having the subcostal cell short whereas in *Phaciocephalus* it is long. I shall retain for the present the name *Phaciocephalus* Kirk. for those forms having the subcostal cell long.

P. uhleri (Ball).

Cenchrea uhleri Ball, 1902, Can. Entom., XXXIV, p. 261.

P. sp.?

Two female specimens from Cuba which do not agree with any description, but I refrain from naming them without having males.

P. parishi sp. nov.

♂ First claval vein joining suture before it joins second claval, clavus closed.

Mikado-orange; tegmina hyaline, opaque with waxy secretion, light fuscous yellow over costal and apical portion of subcostal cells, veins yellowish; wings hyaline, opaquely white with waxy secretion, veins concolorous with membrane.

Medio-ventral edge of pygophor produced into a quadrate plate, slightly longer than wide, apex slightly narrower than base, turned slightly dorsad; anal segment very long and narrow, anus at apex, apex turned slightly ventrad and produced into two angular points; genital styles large, gradually widening to truncate apex, ventro apical corner produced into a long, thin spine turned inward, ventral edge slightly convex with a small quadrate process near base, dorsal edge concave with a small rounded process about middle.

Hab. Bartica, British Guiana, March, 1901 (*Coll. H. S. Parish*). Described from one male. Type in coll. of Prof. H. Osborn.

P. ? bipunctata sp. nov. (fig. 1).

This differs from the generic type in having a shorter subcostal cell, but not very short, the media has three sectors, the first two arising very near together, the media being bent at that spot. Pronotum with two distinct and one indistinct carinae; shoulder keels large.

♂ Light orange yellow. Tegmina hyaline, very light yellow over costal and apical cells, opaquely white with waxy secretion, a small brown spot at fork of cubitus and another near cross vein of first median sector; wings hyaline, veins concolorous, opaquely white with waxy secretion.

Ventral edge of pygophor straight, ventral surface tumid in middle, lateral edges slightly convex; anal segment long, narrow, slightly widened at apex which is bilobed, anus near apex; genital styles long, ventral edge with an angular projection near base, beyond which edge is slightly sinuous, apex rounded with a subangular projection on the dorso-apical margin, dorsal margin entire, a carina runs down the outer surface near dorsal margin, on the inner surface in middle there is a spine with a curve and somewhat flattened crook at the apex.

Length 2.6 mm.; tegmen 3.7 mm.

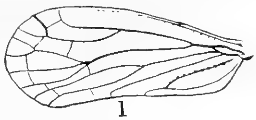

Figure 1. *Phaciocephalus bipunctata,* tegmen.

Hab. Bartica, British Guiana, August, 1901 (*Coll. H. S. Parish*). Described from one male specimen. Type in coll. Prof. H. Osborn.

Genus SYNTAMES Fowler.

Fowler describes *S. delicatus* from what he states to be males but they are females. The variety *chiriquensis* appears to me to be specifically distinct from *S. delicatus.*

When tabulating the genera of Derbidae* I had only a damaged specimen to examine and I placed the genus in Group I. In the two following species one has the clavus narrowly open and the other has it closed, otherwise they are congeneric with *S. delicatus.*

S. nigrolineatus sp. nov.

♀ Clavus closed, claval veins joining the suture a little before the apex. Shoulder keels large; no subantennal process; medio-frontal carina somewhat obscured towards the apex.

* H. S. P. A. Ent. Bull., XII, 1913.

Ochraceous-orange, fuscous over middle of base of face, fuscous over the lateral portions of mesothorax and continued as a broad, fuscous line down the inner half of tegmen; tegmina hyaline, light yellow, opaque with waxy secretion, veins concolorous; wings white with yellowish veins.

Pregenital sternite large, middle area tumid, medio-posterior edge produced into a semi-circular plate, the latero-posterior edge being slightly concave; styles and ovipositor well developed, reaching well beyond pregenital sternites.

Length 4.7 mm.; tegmen 6 mm.

Hab. Bartica, British Guiana, May, 1901 (*Coll. H. S. Parish*). Described from one female. Type in coll. Prof. H. Osborn.

S. sufflavus sp. nov.

♀ Clavus narrowly open, cubital veins not reaching hind margin.

Ochraceous-buff; tegmina lighter with darker veins, opaque with waxy secretion; a light fuscous mark in middle of clavus, in middle of cubital fork, near base of first median sector across to apex of subcostal cell.

Pregenital sternite large, base slightly tumid, posterior margin straight with a median portion produced into nearly a circular plate; styles and ovipositor well developed.
Length 4 mm.; tegmen 6 mm.

Hab. Bartica, British Guiana, June, 1901 (*Coll. H. S. Parish*). Described from one female. Type in coll. Prof. H. Osborn.

Genus Otiocerus Kirby.

O. schonherri ? Stål.

♂ I have not seen the original description of this species. The specimen before me is a little smaller but somewhat similar in color to *O. degeerii* Kirby. The head in profile is more slender and the apex turned slightly dorsad, the antenna has two long processes, one reaching to apex of head and the other a little shorter. Medio-ventral edge of pygophor roundly produced into a small plate, a depression runs across the base of this plate which gives the margin the impression of being entire, lateral edges roundly produced; anal segment long, narrow, apex curved slightly ventrad and rounded, anus near apex, lateral edges turned ventrad, the basal half subangularly produced; genital styles widely apart at bases, ventral edge sinuous, apex produced into a point and turned dorsad, dorsal edge entire, straight.

Hab. One male specimen from Aibonito, Porto Rico, July, 1914.

Genus Dendrokara Melichar.

D. monstrosa Mel.

I have examined twenty males and eighteen females; in all the former the antennae are typical of *D. monstrosa* while in the latter they are typical of *D. torva*. It is possible that Melichar described *torva* from a female and not a male, and that they are the sexual forms of the same species.

Genus Platocera Muir.

The distinction between *Platocera* and *Heronax* is likely to break down with the increase of specific forms, the antennae are not good generic characters.

P. rubicundum sp. nov.

♀ Face in profile not ascendingly produced as in the type of the genus; antennae as long as the face, second joint flattened, attached to first joint by the basal corner, arista at apex.

Brown tinged with red, or claret brown; rostrum, vertex and base of face and legs yellowish, abdominal sternites deeper red. Tegmina fuscous, a clear hyaline half circle on hind margin beyond clavus, another clear space on margin over median area, over costal cell and apical subcostal and radial cells, veins tinged with red.

Pregenital plate large, flattened, shield-shape, posterior margin angularly produced from sides to middle, the produced portion turned ventrad, apex with small angular emargination; anal segment fairly large, apex with rounded emargination in middle half; styles fairly well developed.

Length 4.33 mm.; tegmen 10 mm.

Hab. Bartica, British Guiana, July, 1901 (*Coll. H. S. Parish*). Type in coll. Prof. H. Osborn.

Genus Nicerta Walker.

N. cruenta Muir.

Philippine Islands; Luzon, Mt. Maquiling, Baguio; Mindanao, Davao.

This species was described from one female specimen from Amboina. I have five females and two male specimens from the Philippine Islands which I cannot separate from the

Amboina females. There is a large amount of variation in the size and intensity of the red splashes.

Genus PARAPROUTISTA Muir.

P. matsumurae sp. nov.

Pamendanga rubilinea Matsumura (not Distant), 1914, Ann. Mus. Nat. Hungary, XII, p. 297.

♂ Typical of the genus. The face is very narrow, formed of two contiguous carinae; antennae about as long as face.

Warm buff, slightly fuscous on apex of clypeus and over abdominal segments. Tegmina hyaline, opaquely white with waxy secretion, fuscous over basal third, along cubitus to hind margin and along media to third sector, from near the apex of radial cell to hind margin and along the fourth sector to its base, all the quadrate cross veins and some irregular marks at the end of veins; veins concolorous with adjoining membrane, or slightly yellowish, apical portion of sub-costal and radial veins reddish; wings hyaline, opaque with waxy secretion, veins fuscous spreading out into the membrane.

Ventral edge of pygophor very slightly convexly curved, lateral edges straight; anal segment longer than broad, slightly constricted near base, apex rounded, anus near apex, a small, transverse ridge just basad of anus; styles large, subquadrate, ventral edge strongly convexly curved near base, with a tooth about the middle, apex slightly convex, dorsal edge with a pointed process near base.

Length 3.3 mm.; tegmen 7.4 mm.

♀ In color similar to male. Pregenital plate large, longer than broad, posterior edge produced in middle into a small truncate process, with two sinuous emarginations reaching to the lateral angles.

Length 3.6 mm.; tegmen 8.6 mm.

Hab. Hokkaido, Japan, and Formosa. I have one specimen from Sapparo (det. Matsumura) and three from Horisha, Formosa (*coll. Muir*). These cannot be placed under *Pamendanga* as the face does not conform to that genus. Type in coll. H. S. P. A. Experiment Station, Honolulu.

Genus MYSIDIA Westw.

The facies of some of the species of this genus are very much alike and the best specific characters lie in the genitalia; unfortunately these characters have hardly been mentioned in descriptions of these insects.

M. nebulosa (Germ.).

I have specimens from Bartica, British Guiana, which agree with the descriptions of this species. The male pygophor short, mostly hidden within preceding segment, ventral edge straight, a thin projection from each lateral edge beside the anal segment; anal segment short, base hidden within pygophor, portion beyond anus roundly bilobed, a ridge running from each side of anus along each lobe to medio-apical edge; genital styles large, ventral edge curved, more strongly so on apical half, dorsal edge straight, a little beyond the middle there is a process pointing inward, flat, sub-quadrate, longer than broad with its truncate apex oblique, its plane at right angles to the plane of style.

♀ The female I associate with the above has a very short anal segment sunk within the preceding segment, the styles are flat, subconical, somewhat longer than width of base, broadest at base and rounded on basal inner margin; ovipositor very small.

M. costata ? (Fabr.).

This agrees with the descriptions and figure of *costata*. There is a brown spot on each lateral portion of the pronotum, tegulae dark.

♂ Pygophor very short, ventral edge entire, lateral edges roundly produced in middle and turned inward, the produced portion can only be seen when the genital styles are widely parted; anal segment about as long as broad, subovate, the lateral edges slanting downward, apex with a small emargination, anus at base, a keel runs from each side of anus to near apical margin; genital styles large, narrow at base, widest in middle, apex rounded, ventral edge slightly convex and the rim slightly thickened, dorsal edge subangularly produced in middle, the margins being slightly concave, near base there arises a curved spine, rounded and slightly flattened at apex, a keel runs from base to near apex down the outer surface.

♀ Pregenital plate much wider than long, posterior edge medially produced into a subtriangular lip; styles and ovipositor abortive, the latter appearing as two small curved spines, genital area arcuate along the dorsal margin, the ventral margin formed by the pregenital plate; anal segment about middle, very short.

Hab. Three specimens from Bartica, British Guiana, April and July, 1901.

M. pseudonebulosa sp. nov.

♂ This differs from *M. nebulosa* as recognized above by the genitalia. Pygophor very short, ventral edge entire, lateral edges produced into a large, curved, flattened spine beside the anal segment; anal segment longer than wide, subconical in outline, apex with angular emargination, anus near base, a keel runs from each side of anus to apex at each side of emargination; genital styles large, ventral edge slightly convex, apex rounded, dorsal edge subangularly produced on apical half, from near base a curved, flattened spine arises.

Length 3.7 mm.; tegmen 8.5 mm.

Hab. Bartica, British Guiana, May, 1901. Described from one male specimen. Type in coll. Prof. H. Osborn.

M. neonebulosa sp. nov.

♂ Similar to *M. nebulosa* as recognized above but the bands on tegmina fainter and narrower. Pygophor very short, edges entire; anal segment subquadrate, about as long as wide, sides very slightly convex, apex truncate or slightly concave, anus near middle, a carina runs from each side of anus to apical edge; genital styles broadest at apex, ventral edge slightly curved, apex slightly convex, dorso-apical corner angular, ventro-apical corner round, dorsal edge concave, from the middle arises a curved spine with a rounded apex.

Length 3 mm.; tegmen damaged.

Hab. Bartica, British Guiana, July, 1901. Described from one male with damaged tegmina. Type in coll. Prof. H. Osborn.

M. ? sp. nov.

♀ I have one female specimen with immaculate tegmina with the antennae longer than the face and the arista arising one-third from apex; the genital styles (ovipositor sheath) are abortive but the ovipositor is well developed and exposed. I refrain from naming from only a female.

Hab. Bartica, British Guiana, April, 1901.

M. sp. nov.

♀ Orange-buff, veins of tegmina and wings slightly darker than membrane; posterior margins of tegmina and wings bordered with fuscous. Posterior edge of pregenital plate produced in middle into a quadrate plate slightly longer than wide; styles small, covering ovipositor.

Length 3.4 mm.; tegmen 7.8 mm.

Hab. Bartica, British Guiana, May, 1901 (*Coll. H. S. Parish*). I refrain from naming only a female.

DELPHACIDAE.

Genus Ugyops Guerin.

U. occidentalis sp. nov.

This species is congeneric with *U. liturifrons* (Walk.), the tegmina are broadly tectiform, the median frontal carina double to near apex and the first joint of antennae slightly shorter than the second.

Ochraceous-buff with brown markings as follows: carinae of head and thorax, small spots alongside of median carinae of face, spreading across to sides at apex, two rings on apical antennal joint, bands on front and middle femora and tibiae, a longitudinal mark on hind femora, lateral areas of pro- and mesonotum, on the apical abdominal segment, base of pygophor and the anal segment. Tegmina hyaline, veins dark, broken with light patches, granules minute, bearing small hairs concolorous with vein.

Genitalia of the *Ugyops* type; anal segment dome-shape with anus at top, apical edge slightly emarginate, ventral edge of pygophor quadrately emarginate, a small angular emargination in the medio-ventral line; styles sub-cylindrical, the curve of apical two-thirds slight.

Length 4.5 mm.; tegmen 5.5 mm.

♀ Similar to male. Anal segment small, about as long as broad; ovipositor with more than one-third extending beyond pygophor; lateral plates reaching beyond middle of pygophor.

Length 5 mm.; tegmen 5.7 mm.

Hab. Aibonito, Porto Rico, July, 1914. Described from one pair in the American Mus. of Nat. Hist., New York.

Genus Punana Muir.

P. puertoricensis sp. nov.

♂ Width of vertex more than double the length along the middle line, projecting very slightly beyond eyes, base concave, apex convex, the Y-shape carina obscure, the fork forming a small areola at apex; face slightly broader than long, subcircular except at apex, face and clypeus medially and laterally carinate, carinae obscure; antennae not reaching to middle of clypeus, second joint 2.5 times the length of first, first subsagittate, second subovate, considerably flattened, with large sense organs on dorso-apical portion, both joints with stout hairs, arista apical. Pronotum slightly longer than vertex, hind margin shallowly and roundly emarginate, tricarinate, the lateral carinae curving parallel with hind margin of eyes and do not reach the hind margin. Tegmina broad, slightly decumbent beyond apex of abdomen, radius not touching media, cubitus and media touching at base of first median sector. Hind tibiae with one basal, one median, one subapical and five apical spines, hind tarsus two-thirds the length of tibia, first joint slightly longer than the other two together, spur subulate with circular cross section, about half the length of first tarsal joint.

I have described the generic characters of this species as it differs in some points from the type of the genus and approaches *Onkelos* Distant in others; unfortunately the shape of the antennae and of the spur of the latter genus are not stated.

Ochraceous-buff, face between eyes and the clypeus slightly darker, antennae brown, carinae of pronotum, median portion of mesonotum and carinae lighter; a slight brown band on front coxae, and fainter ones on first and second tibiae. Tegmina pale, veins concolorous or lighter, thickly studded with brown granules bearing dark brown hairs.

Genitalia of the same type as *Asiraca*. Anal segment large, lateral edges turned ventrad so as to form a convexity on ventral surface, the apical edge not turned ventrad and, together with the square emargination of the ventral edge of the pygophor, forming a five-sided ventral opening; styles subulate, widest and slightly flattened at base, curved, bases and apices approximate.

Length 3.3 mm.; tegmen 3.9 mm.

♀ Similar to the male. Lateral plates small, reaching less than one-third from base, styles (ovipositor sheath) narrow, projecting well beyond pygophor, and slightly beyond anal segment, anal segment as long as wide in ventral view, styles dark brown.

Length 4.3 mm.; tegmen 4.4 mm.

Hab. Aibonito, Coamo Springs and Mayaguez, Porto Rico, July, 1914. Described from five males and five females in good condition, and one broken female in the American Museum of Nat. Hist., New York.

Genus Neomalaxa nov.

Head considerably narrower than thorax; vertex prolonged well beyond eyes, broadest at base, apical two-thirds with sides parallel, length 1.6 times the width in middle; base of Y-shape carina obsolete leaving a semiobsolete, quadrate areola near apex, basal half excavate, base straight with carina; length of face four times the width, sides parallel, a simple median carina, sides carinate, an oblique carina from beneath antennae to apical corner of face; clypeus slightly wider than face, with three subobsolete carinae, antennae long, slender, both joints terete, reaching to beyond middle of clypeus, joints subequal in length, arista apical, long. Pronotum shorter than vertex, hind margin slightly concave, tricarinate, lateral carinae straight, diverging posteroirly, reaching hind margin; mesonotum normal, tricarinate. Hind tibiae with one basal, one median and seven or eight minute apical spines, hind tarsi subequal in length to tibia, first joint longer than other two together, spur two-thirds the length of the first tarsal joint, laminate, teciform, 14-16 small teeth on hind margin. Tegmina large, radius not touching media, first median sector joined to cubitus for a short distance near its base.

This genus comes near *Zulcika* Distant if that genus possesses the spur of the Delphacini; apart from the spur it approaches *Malaxa* Melichar.

N. flava sp. nov.

♀ Pale yellow-orange, eyes light brown, ocelli black, a longitudinal brown mark down antennae not quite reaching the base of each joint. Tegmina hyaline, milky white with waxy secretion, veins basad of cross-veins concolorous, cross-veins and veins apical of cross-veins brown.

Styles broad at base, gradually narrowing to apex, reaching to apex of pygophor and covering the greater portion thereof.

Length 2.4 mm.; tegmen 3.6 mm.

Hab. Mayaguez, Porto Rico, July, 1914. Described from two females, one in bad condition, in the American Mus. Nat. Hist., New York.

Genus Delphacodes Fieb.

D. erectus nigripennis (Crawford)*.

Megamelus erectus nigripennis Crawford, 1914. Proc. U. S. Nat. Mus., Vol. 46, p. 625.

One male specimen from Point a Pitre, Guadalupe, W. I. This insect is very close to the brachypterous form of *D. matanitu* (Kirk.) from Fiji and Papua. They are hard to distinguish except for the aedeagi, which are quite distinct (figs. 2, 3). *D. erectus* is most likely the macropterous form of *nigripennis* and is paralleled by the light, macropterous form of *D. matanitu.*

D. mardininae sp. nov.

♂ Macropterous. Lateral pronotal carinae divergingly curved, not reaching hind margin; vertex square, carinae distinct; face slightly narrowed between eyes, sides subparallel, median carina simple; antennae reaching slightly beyond base of clypeus, second joint 1.5 times the length of first; hind tarsi shorter than hind tibiae, first joint longer than other two together, spur slightly shorter than first joint, laminate, subtectiform, with minute teeth on hind margin.

Head and thorax ochraceous-buff, abdomen ochraceous orange, carinae of head and thorax lighter, face and clypeus between carinae slightly fuscous, apical portion of each antennal segment, apex of rostrum and apices of tarsi brown. Tegmina and wings hyaline, veins fine, yellowish, fuscous at apices, granules very small.

Pygophor figured (figs. 4, 4a).

Length 2 mm.; tegmen 3 mm.

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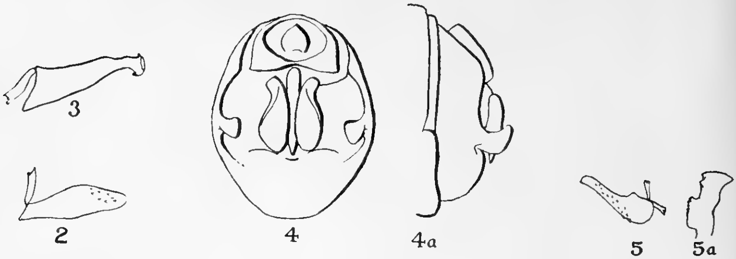
* I propose the new name *pseudonigripennis* for *D. nigripennis* Muir. 1917 Proc. Haw. Ent. Soc., III, No. 4, p. 338.



Explanation of Figures.

2. *D. matanitu*, aedeagus.
3. *D. matanitu*, aedeagus.
4. *D. mardininae*, full view of pygophor.
4a. *D. mardininae*, lateral view of pygophor.
5. *D. nigrifacies*, aedeagus.
5a. *D. nigrifacies*, right genital style of aedeagus.

Hab. Fort de France, Martinique (Mardinina), B. W. I., June, 1911. Described from one male in the American Mus. Nat. Hist., New York.

D. nigrifacies sp. nov. figs. 5, 5a.

♂ Brachypterous. Lateral pronotal carinae divergingly curved posteriorly, not reaching hind margin; vertex square, carinae not distinct; length of face less than twice the width (1.70 to 1) sides arcuate, carinae very fine, median carina simple, vertex and face in profile rounded; antennae reaching slightly beyond base of clypeus, second joint twice the length of first; hind tibia slightly longer than tarsi, first tarsal joint equal to the other two together, spur longer than first tarsal joint, broad, laminate, tectiform, with many minute teeth on hind margin.

Face, genae, vertex pro- and mesonotum shiny black, middle of vertex, posterior and lateral margins of pronotum and lateral and posterior angles of mesonotum yellowish, first segment of antennae dark, second lighter, clypeus, thorax (except parts of pro- and mesonotum), base of abdomen and legs capucine yellow or orange buff, abdomen brown, anal segment yellowish, tegmina reaching to middle of abdomen, hyaline, light orange buff, marginal border slightly fuscous.

Pygophor nearly as broad as long, edges entire, a wide emargination on dorsal edge, anal segment sunk within pygophor, with a pair of broad, short spines near basal corners which are not visible without dissection or without having the anal segment turned up dorsally; styles broad, apex truncate and very slightly convex, the inner edge near apex thickened and elevated, the inner edge on basal half squarely produced and meets the fellow style on the median line; aedeagus cylindrical, largest at base, curved dorsad, many small spines pointing basad, starting from an apico-dorsal position and crossing over the sides to a ventrobasal point.

Length 1.5 mm.; tegmen .7 mm.

Hab. Fort de France, Martinique, B. W. I., June 27, 1911. Described from two male specimens, the type in the American Mus. of Nat. Hist., New York.

The Australian Sheep Fly in Hawaii.

BY J. F. ILLINGWORTH, QUEENSLAND, AUSTRALIA.

[Presented by O. H. Swezey.]

I was surprised to learn that the screw-worm fly that I bred in such abundance from dead cat and rat, before leaving Hawaii, is the common sheep-fly of Australia. Froggatt* calls it *Calliphora rufifacies,* but it should be placed in the genus *Chrysomyia.*

I collected this species in Fiji in 1913; and found it very abundant in Brisbane, during June of this year. At the present time (August, 1917) I am breeding these flies abundantly from dead animals at Gordonvale. This species was bred by Terry in Hawaii, in 1905, and four of his specimens are in the collection of the Experiment Station, H. S. P. A., but bear no name.

The species is of tremendous importance in Australia, where it has taken to living sheep, after breeding for many years in the dead carcasses—just as our *Chrysomyia dux* did in Hawaii.

The development of the species is very rapid as my Hawaiian notes would indicate. An animal exposed on the 16th of July; larvae hatching on the morning of the 17th and fully developed on the 20th ready to enter soil; pupal stage about 6 days.

* N. S. W. Dept. Agric. Farmer's Bul. 95, illustrated, page 31.
Agr. Gaz. N. S. W., XXV, p. 756, 1914.

The Jumping Plant Lice (Family Psyllidae) of the Hawaiian Islands.

A Study in Insect Evolution.

BY D. L. CRAWFORD.

The fauna and flora of the Hawaiian archipelago are of more than common interest because of the great isolation of these islands from other land bodies and also because they appear to have held such an isolated position for a very great lapse of time—perhaps since the Paleozoic era.

The native vertebrate fauna is exceedingly limited, an endemic bat being the only mammalian species surely native. A considerable number of birds occur, most of the species having developed here from a few early immigrants. No endemic reptiles nor amphibia are found here, with the possible exception of a species or two of skinks and these probably were brought in by human agency.

Among invertebrates, certain groups of land shells (Mollusca) and insects are the most abundant, and at the same time present some very remarkable features. First among these remarkable features is the large number of endemic species representing a comparatively small number of groups. That is to say a comparatively small number of insect and molluscan species have in the more or less remote past chanced to arrive here and establish themselves and, rejuvenated by the new and favorable environment in which they found themselves, have split up into a large number of derivative species and even genera, and in several cases even endemic families—one endemic family of beetles (Proterhinidae), one of land shells (Achatinellidae), and one of birds (Drepanididae). This of course indicates that plant immigrants had already established a flora of the Islands upon which these animal immigrants found sustenance.

A second remarkable and significant feature of the endemic

Proc. Haw. Ent. Soc., III, No. 5, April, 1918.

fauna is the fact that nearly all groups are inhabitants of dead wood and debris of the kind that sometimes drifts about the oceans, or if not of that type are usually strong in flight. There are no native leaf-eating beetles or grasshoppers or similar insects. The beetles are nearly all wood-borers or ground beetles which commonly hide away under bark. Nearly all the Hymenoptera are borers or forms which nest in logs, etc. Diptera are represented mostly by debris inhabiting forms, while of the Lepidoptera we have no native butterflies except one comparatively recent immigrant, but a considerable number of moths some of which are strong in flight and others pupate under bark or in similar situations.

The conclusion to be drawn from these facts is that these Islands have been in existence for a very great length of time—long enough for many species to have originated here from a few ancestors—a conclusion which is also supported by geological evidence which points to the existence of the land mass as far back as the Paleozoic. Another conclusion to be drawn from our data is that the islands have always been isolated and never a part of a continental land mass, hence receiving no migrations of animals overland but only by long and very precarious voyages over the ocean in logs and floating debris, and perhaps by flight and carriage by winds. From the very small number of ancestral types represented by the endemic species it would appear that only very rarely did insects and shells succeed in establishing themselves in these Islands.

The presence here of some very delicate insects is more difficult to explain. They do not inhabit logs nor debris although some are gall makers, and their span of life is very short, especially short in the absence of living foliage to furnish them food. Certain homopterous insects, the leaf hoppers and jumping plant lice, are good examples of this type. It is not possible to explain their entrance here by way of a land bridge now disappeared, for if there had been such a bridge beyond doubt more than the meagre few would have become established here. There remains, then, only the agency of migrating birds, or high winds or ocean currents to account for the arrival here of such delicate insects.

Bird migrations hither are mostly, if not entirely, from America, and the Hawaiian jumping plant lice and leaf hoppers do not seem to have come from there. Windstorms seldom, if ever, blow from present land areas of the South Pacific to these Islands, nor do ocean currents come this way from that part of the world. However, we must consider that not more than one ancient immigrant of the Psyllidae and probably only three or four of leaf hoppers succeeded in establishing themselves here during several million years. It must be admitted that what now seems impossible might have succeeded by chance once in a million years. It is conceivable that once in several million years a windstorm might have carried a leaf with galls containing nymphal psyllids and dropped the leaf in an Hawaiian forest of the same kind of trees—an exceedingly rare chance!—whereupon the insect might establish itself. Another psyllid species has been a less ancient immigrant, but how it arrived or when it is not possible even to surmise. This one apparently has not given rise to other species than one which now lives on the native palms, but nevertheless seems to have arrived a long time ago.

The Jumping Plant Lice.

Psyllidae, or Chermidae (Homoptera).

The jumping plant lice (Psyllidae or Chermidae) constitute a family of the homopterous sucking bugs, being allied to the true plant lice and scale bugs and also to the leaf hoppers and lantern flies. They are small insects, from 1-32 to 1-4 inch in length, with four wings, the third pair of legs usually developed for leaping from which habit the first part of their popular name has been derived. Their superlcial resemblance to true plant lice (Aphididae) has suggested the latter part of their name.

The psyllids live by sucking the juice from plants by means of their slender, pointed beak which arises from the lower part of the head next to the thorax and passes back pressed against the ventral surface of the thorax between the front pair of legs and then bends downward. In this way a greater leverage by more of the body is brought to bear upon the beak in forcing it into plant tissues.

The immature, or nymphal, stages of these insects are passed upon the same plants with the adults, and in the same active, sap-sucking manner detrimental to the plant. In many species the reaction of the insects' activities on the leaves or stems of the plant and the poison wastes secreted by the insects cause the growth of tumors or excrescences of characteristic forms, known as galls. The galls are usually characteristic of certain species and may often be used as an index of the species even though the insects themselves may not be discovered.

The feeding habits of jumping plant lice render them harmful to plant life, but fortunately these tiny insects do not attack many of our cultivated or garden plants and therefore they are considered of relatively small economic importance in agriculture. Moreover, they are far less prolific than are the true plant lice and scale bugs, and for this reason also are viewed with much less concern by economic entomologists.

There are a few species of the family which cause considerable damage in the orchard, field or garden. The pear psylla (several species, one in each of several countries) causes extensive damage to pear and allied orchard trees and receives much attention and expensive treatment. The tomato psyllid (*Paratrioza cockerelli*) is responsible for severe injury to tomatoes and peppers and other plants in southwestern United States. The laurel psyllid (*Trioza alacris*) seriously disfigures bay trees in Northern Europe and now in the United States, causing the leaves to become much rolled, curled up and generally distorted. Other species attack alder trees in America and Europe, while another is a pest on citrus trees in the Malay Archipelago and India.

The family is a relatively small and homogeneous group, with representatives present in nearly all land areas of the earth. In Europe, North America and Australia the largest number of species have been described but some are known from most all other countries. Much remains to be learned about the psyllid fauna of the south Pacific lands, Asia, South America and Africa, and until more is known especially of the first our knowledge of the Hawaiian fauna and its origin will be limited.

The several hundred species of Psyllidae of the world have been grouped into six subfamilies[1] characterized by wing venational features or peculiarities of the skeleton of the head or thorax. In North America five of the six subfamilies are represented, three very extensively and two less so. In Asia five of the six have representatives known and perhaps of the other also. In the Philippine Islands and Malay Archipelago at least four and perhaps all of the six groups have representatives. In other words, these insects have been well disseminated throughout the world, especially where land bridges have permitted a wider migration.

In the Hawaiian Archipelago, however, only one of the six subfamilies is represented, so far as known at present, and that by fifteen species falling into five genera, and thirteen of the fifteen are so suggestively similar in certain fundamental characteristics that one can scarcely avoid the conclusion that they have sprung from *one* common ancestral form. The extent of evolutional changes effected in this small fauna seems to indicate a considerable lapse of time since the first introduction.

The subfamily Triozinae, to which all the Hawaiian species belong, is a specialized group set apart from the others by certain wing venational characters. The largest genus in the subfamily is *Trioza,* to which about one hundred species have been assigned throughout the world. Most of these species live free on leaf surfaces, sucking out the juices without forming galls

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[1] For details of classification the reader is referred to the author's monograph of this family, Bulletin 85 of the U. S. National Museum, 1914.

or at most merely distorting or curling the leaves. There are a few species, however, which have the habit of causing characteristic galls to grow on leaves and inhabiting the inside of these galls.

These species are found in a good many regions of the southern hemisphere and of the southern part of the northern hemisphere. The most northerly representative of this type of *Trioza* is the species *arbolensis* found in southern United States. One species occurs in Mexico, making galls on avocado leaves, two have been recorded from South America and several from southern Asia, a large number from Australia, a few from Malay Archipelago and still others from other southern countries. A few of these have been assigned to another genus, *Cecidotrioza,* and it is possible that when our knowledge is more complete all these gall makers will be referred to such a genus.

Nearly all of these gall-forming species of *Trioza* resemble each other in certain wing venational characteristics and in the male genitalia, thus indicating perhaps a generic relationship to each other and distinct from other species of *Trioza.* The first marginal cell of the forewing is of a peculiar shape, the cubitus forking at about the midpoint or basad of it. The male anal valve in lateral, or profile, view has a straight anterior margin but the posterior margins (the lateral wings) are characteristically convex.

Although the Hawaiian species have undergone changes in the shape and form of the head, armature of the legs and size and shape of the wings, yet a marked homogeneity in the characters above referred to shows not only a close inter-relationship among these species but also points to a close affinity of these with the gall forming species of *Trioza* in Malay Archipelago and elsewhere. The fact that many of the Hawaiian species are gall forming is further indication of this affinity.

Most of the Hawaiian species live upon the foliage of *Metrosideros polymorpha* Gaud., called by the Hawaiians "Ohia lehua", and other species of the same genus. One (and perhaps others also), a much modified species, inhabits galls on leaves of several native species of *Pelea*. Three others have been found on foliage of other native plants but their feeding habits are not fully known. Ohia lehua appears to be, by far, the most commonly attacked tree in these Islands. Several make galls on ohia leaves while others live free on the leaf surfaces.

The genus *Metrosideros,* according to Rock[1] is represented in the Hawaiian archipelago by five species, four of which are endemic and one widely distributed over Polynesia, New Zealand, Tahiti and other Pacific islands. It is the cosmopolitan species which is the chief food plant of the Hawaiian psyllids. Thus far no psyllid galls have been reported from the south Pacific or elsewhere the insects making which seem to be in any close way related to the Hawaiian species.

It seems probable that the four native species of *Metrosideros* have not sprung from the cosmopolitan species, but that the latter has been introduced more recently. That its introduction was very ancient, however, is evidenced by its position in the forests and its relations in these forests with the more recent trees. It is quite probable that these trees were first introduced by the very small and light seeds which are blown to great distances by winds. At what time after the establishment of the Ohia lehua here the gall psyllids came in is impossible to say, because of the absence of fossils.

Because of the volcanic nature of the rocks of these Islands, fossil remains of plants or animals are almost never found. A few have been discovered in the stratum overlying the volcanic rock—obviously of comparatively recent date, for the lava flows followed a long, previous existence of the Islands. One such fossil, found by J. C. Bridwell on the Island of Oahu but very unfortunately lost, was evidently an imprint of a leaf of *Metrosideros*. Upon this leaf imprint, it is said, were galls which beyond doubt were of psyllid origin. This is

[1] "The Ohia Lehua Trees of Hawaii," by Joseph F. Rock. Hawaii Bd. of Agric. and Forestry, Bot. Bull. 4, 1917.

a most interesting and significant discovery, showing that these gall-making psyllids have been present here and living upon *Metrosideros* for a considerable period of time.

Probably the original immigrant species was one inhabiting leaf galls of *Metrosideros* and, as new species have evolved from this, some have retained the gall-making habit on the same plant, others have taken to living free on the leaf surface in the nymphal stages, while still others have gone off to other plants, making leaf galls or living free.

From this ancestral species, a *Trioza,* have been derived thirteen species in three genera. Five of these belong to the cosmopolitan genus *Trioza,* five to an endemic genus, *Hevaheva,* and the remaining three to a more or less cosmopolitan genus, *Kuwayama,* members of which have arisen independently it would seem in various countries. These three species here appear to be not related directly to other species of the genus in other lands but rather to species of *Trioza* here.

Hevaheva is the most specialized of the genera and indicates a long evolution. The five species are closely interrelated, but *H. giffardi* shows considerably more specialization than the others. The genus is more closely related to *Trioza iolani* than to the other species of the Islands, but this relationship shows a gap not now bridged over. The relationships of the species of each genus are discussed later.

The other two genera are both Polynesian and apparently have come in at a much later date than the ancestral forms of the other assemblage. *Megatrioza* is abundantly represented in the Malay and Philippine archipelagoes and probably elsewhere in the tropics of the Old World. The one species here probably has not arrived recently and probably is endemic, for it occurs only in the higher mountains on the native palm (*Pritchardia*). It does not occur on lowland introduced palms and hence it seems that its arrival here must have long antedated the modern epoch. Less is known of the other genus, *Cerotrioza,* both here and elsewhere. It is possible that our species here dates back to a less remote period, but appears to be endemic.

On the basis of land shell distribution, Pilsbry and others have advanced a theory that all these islands once constituted a single large island and that by continued subsidence the higher points of the large island were left as individual islands separated by channels.

Our knowledge of the distribution of the native jumping plant lice is not yet sufficient to allow generalization, nor does it seem probable that this group has been resident here farther back than the Pliocene and possibly not as far back as that, while Pilsbry assumes the subsidence to have been earlier than that. So far as our present knowledge of this group goes it does not seem to indicate any union of the islands of this archipelago within the period of time in which this family has been resident here. Chance winds or currents or flights of birds might account for the present distribution of the species, for it is not wide. Most of them seem to be limited to one island, but *Trioza ohiacola* occurs on both Oahu and Hawaii, nearly at opposite ends of the archipelago, but apparently on none of the islands between.

Acknowledgements.

The author wishes to acknowledge with thanks the assistance rendered by other entomologists of Honolulu by placing at his disposal their collections of Psyllidae. Messrs. W. M. Giffard, O. H. Swezey, P. H. Timberlake, and others of the entomological staff of the Hawaiian Sugar Planters' Association, D. T. Fullaway and E. M. Ehrhorn have all contributed to this study. The collections represent, though probably very incompletely, the psyllid fauna of the Islands of Oahu, Hawaii, Lanai, Molokai and Maui. The two latter and the northern Island of Kauai need much more exploration for these insects.

The type specimens of new species and a representative collection of all the Hawaiian species have been deposited with the custodian of types of the Hawaiian Entomological Society, Honolulu.

Synopsis of Genera.

A[1]. Forewings not opaque; vertex not produced into processes in front.

B[1]. Hind tibiae without basal spurs.

C.[1]. Forewing with three narrow black spots on hind margin, one in each marginal cell and a third between them; veins without prominent setae.

D[1]. Genal cones present............................*Trioza* Foerster

D[2]. Genal cones wanting..............*Kuwayama* Crawford

C[2]. Forewing without marginal spots; veins with prominent setae.......................................*Hevaheva* Kirkaldy

B[2]. Hind tibiae with basal spur and subapical spine.... ....*Megatrioza* Crawford

A[2]. Forewings opaque or nearly so; vertex produced in front into two protuberances above genae................. ....*Cerotrioza* Crawford

Genus Trioza Foerster.

This genus has representatives in practically all countries where Psyllidae occur. There are five closely related endemic species in this archipelago, so far as known all living on the foliage of ohia lehua (*Metrosideros* spp.). It seems quite certain that all are derivatives of a common ancestor which established itself here long ago, coming probably from some land area in the south Pacific. Living species resembling these in essential characters and certainly allied to them are known in Polynesia, Australia and South America, but it is not possible yet to make a more definite statement of the ancestry of these species.

The ancestral species has apparently divided by variation in the following manner: *Trioza iolani* and *ohiacola* are probably concurrent derivatives from the original species on the

Island of Oahu; *Trioza lanaiensis* split off from *T. iolani* by segregation on an island (Lanai) by itself and later gave rise to *T. pullata; T. hawaiiensis* was probably derived independently from the ancestral species but bears a closer resemblance to *T. iolani* than to *T. ohiacola.* The latter occurs now on both Oahu and Hawaii, but probably originated on the former.

Kuwayama and *Hevaheva* are derivatives here of the ancestral *Trioza* species.

Key to the Species.

A[1]. Genal cones not as long as vertex; color of body typically dark brown; antennae not more than twice as long as width of head, usually less; cubital vein of forewing forked at or distad of midpoint; costa without visible setae. Oahu and Hawaii.
T. ohiacola n. sp.

A[2]. Genal cones as long as vertex or longer.

B[1]. Costa of forewing with setae; cubitus forked at or basad of midpoint; antennae twice as long as width of head or more; genal cones about as long as vertex; male forceps notched behind near apex; color usually orange or yellow. Oahu.
T. iolani Kirkaldy.

B[2]. Costa of forewing without setae, or exceedingly short ones if present; male forceps not notched behind near apex.

C[1]. Genal cones longer than vertex; antennae 2½ to 3 times as long as width of head; thoracic dorsum usually striped with brown; male forceps abruptly narrowed near apex. Lanai.
T. lanaiensis n. sp.

C[2]. Genal cones about as long as vertex, rarely longer.

D[1]. Color of body black, dorsum conspicuously reticulated; antennae about twice as long as width of head. Lanai. *T. pullata* n. sp.

D². Color orange or flavous, dorsum not conspicuously reticulated; antennae a little more than twice as long as width of head; male forceps converging uniformly to subacute apex; body usually large Hawaii. *T. hawaiiensis* n. sp.

Trioza iolani Kirkaldy.

Length of body, male 1.3 to 1.5 mm.; female 1.8 to 2.1; length of forewing 2.5 to 3.1. General color flavous, often pale greenish yellow, or darker orange yellow, rarely brown; mesonotum usually with two darker spots cephalad and sometimes more or less distinct brownish streaks on mesoscutum; antennal segments 4–10 and often distal half or all of 3d brown; tarsi and tips of genal cones brown; femora often brown; abdomen usually irregularly browned ventrad; forewings hyaline, often fumate slightly or flavous, or more commonly clear.

Head nearly as broad as mesothorax, much narrower than metathorax, somewhat deflexed; vertex nearly twice as broad as long, elevated at posterior ocelli, with a prominent foveal depression on each side of median suture, posterior margin narrowly elevated, median suture deeply impressed in anterior half and on each side of it the vertex roundly bulging; a few short setae on vertex; anterior ocellus at bottom of impression of median suture and scarcely visible from above. Genae large; genal cones usually about as long as vertex, sometimes a little shorter, subacute, somewhat divergent, with a few setae on ventral surface and one longer seta at tip of each cone. Clypeus small. Eyes large, hemispherical. Antennae somewhat variable in length, about twice as long as width of head with eyes, or more or occasionally less, slender, third segment longest.

Thorax rather broad, not strongly arched; pronotum short; dorsulum narrow cephalad; legs moderately long and stout; tarsi thick; hind tibiae with two or rarely three small black spines at apex on inside and one outside. Forewings reaching half their length beyond abdomen, hyaline, rounded at apex, veins usually black and prominent, minutely setose, costal setae longer; first marginal cell larger than second; cubitus forked at or basad of midpoint.

Abdomen moderately long, male much shorter than female. Male genital segment not large; forceps three-quarters as long as anal valve or a little more, arched, slightly broadening to near apex then more or less deeply notched on hind margin and coming to a narrow point; anal valve straight on anterior margin, truncate at apex, lateral wings angulately convex, broadest below middle. Female genital segment nearly as long as abdomen, converging to acute apex, dorsal valve a little longer than ventral and both acuminate at tip.

Described from several males and females collected on Oahu and determined by Mr. Kirkaldy. The distribution of this species is as follows:—Island of Oahu—Mt. Tantalus (elevation 1500 ft.), 65 specimens collected by W. M. Giffard and others by Swezey mostly in the months of December and January; Pacific Heights, May 30, 1905; Palolo Hills; Wailupe, January 23, 1915; Opaeula, March 30, 1913; Kuliouou; Mt. Kaala (at elevation of 1500 ft.); Kaumuohona.

This and the following are the two most common species on Oahu, and may be found at most any season of the year on leaves of Ohia lehua (*Metrosideros polymorpha*).

Trioza ohiacola n. sp.

This species appears to be very close to *T. iolani* and, in fact, more or less grades into it. The habitat and the food plant are the same and both are found on the Island of Oahu. Although the two species are found together and resemble each other, there are nevertheless differences sufficient to indicate that they are distinct species.

In average size of body and wings *T. ohiacola* is a little smaller than the other and differs in the following characteristics:—General color typically much darker, usually dark reddish or chocolate brown, but sometimes light reddish or light brown or even orange yellow (the latter seem to be newly emerged adults); legs and antennae usually all or nearly all brown or chocolate colored.

Head narrower than in *T. iolani;* vertex with shallower discal depressions; genal cones usually about two-thirds as long as vertex, but sometimes more than two-thirds or rarely as long as vertex; antennae seldom twice as long as width of head, usually about 1½ to 1¾ times as long. Thorax much more distinctly reticulated. Legs similar, less stout. Forewings usually clear, radius shorter than in *T. iolani;* cubitus forked at or distad of midpoint; costal setae much smaller, not easily visible.

Male forceps nearly or quite as long as anal valve, converging (in lateral view) gradually from near base to narrowly subacute apex, not as broad as in *T. iolani;* anal valve broadest at center, posterior margin angulately convex.

Distribution:—Island of Oahu—Alewa Heights, Pacific Heights, Mt. Tantalus, Kuliouou, Kaumuohona, Lanihuli, Palolo Hills, Palolo Crater, Mt. Kaala (at elevation of about 1600 ft.). Island of Hawaii—Niulii, May 19, 1917 (Swezey), on ohia lehua; Kilauea, June 27, 1917 (Swezey), on ohia lehua and also some collected at same locality by W. M. Giffard on August 21, 1917. The food plant in all cases seems to be ohia lehua (*Metrosideros* spp.).

Trioza lanaiensis n. sp.

Length of body, male 1.5 to 2.2 mm.; female 1.7 to 3.0; length of forewing 2.5 to 3.2. General color orange yellow to straw color, or commonly reddish brown, usually with darker streaks on mesonotum, and abdomen blotched with brown ventrad; antennae darker on distal half; tarsi dark; forewings usually clear but sometimes slightly milky or faintly yellowed. Body surface sparsely clothed with soft pubescence, stiffer and longer on vertex and mesoscutum.

Very similar in general to *T. iolani,* of which it appears to be a derivative, differing in some characteristics, however. Genal cones longer than vertex, sometimes one-quarter longer, acute, divergent, more hirsute. Antennae 2½ to 3 times as long as width of head. Legs stouter and longer; hind tibiae usually with three, rarely four black spines at apex. Forewings a little longer, clear or slightly milky; veins with smaller, scarcely visible setae, even the costal setae scarcely visible under considerable magnification. Male forceps nearly as long as anal valve, constricted near base and narrowed abruptly near apex into a narrower, somewhat finger-like ending. Anal valve large, convex on posterior margin, with broadest point at middle. Female genital segment as long as abdomen or nearly so.

Distribution:—Island of Lanai—200 males and females collected at various points, Kaikolani, Kapano, and others, at altitudes ranging from 1500 to 3400 ft., in December, 1916, and January and February, 1917 (W. M. Giffard). Most of these were taken on foliage of ohia lehua (*Metrosideros* spp.), which is probably the only regular food plant of the species.

This appears to be an incipient, not yet clearly marked, species developing from the Oahuan species, *T. iolani*. Thus far it has not been found on any other island of the group, but it appears to be a very common one on this Island.

In this species there is considerable variation in size, but none that in itself seems to mark off a distinct species. Out of 200 specimens, about six are very large and seven very small, but between these there is almost every degree of variation so that it would be impracticable to designate either of these extremes as distinct species, which one quite probably would do if the series which Mr. Giffard collected had not been so extensive. It is quite possible that in time these variations will break the species into several distinct ones, for along with size fluctuations are also fluctuations in size of anatomical parts. It would appear that the species is right now in process of rapid evolution, probably having been a relatively recent immigrant to this Island.

Out of the 200 specimens, one individual has genal cones a little shorter than the vertex but otherwise conforming to the species. Some individuals were killed too soon after emergence and parts of the exo-skeleton have shrunk, thus shortening the genal cones, but the one female referred to above was not of this category.

Trioza pullata n. sp.

This appears to be an incipient species derived from *T. lanaiensis*, paralleling in its differentiation another species, *T. ohiacola*, but evidently not directly related to the latter:

In size of body similar to the average example of *T. lanaiensis*. Color wholly black, or in spots dark brown; thoracic dorsum conspicuously reticulately marked, sparsely hairy. Genal cones about as long as vertex, seldom shorter, divergent. Antennae twice as long as width of head or sometimes less. Forewings clear, venation as in *T. lanaiensis* except radius shorter. Female genitalia similar; male unknown.

Distribution:—Island of Lanai—three females from Waiopao, November 29, 1916 (W. M. Giffard, on leaves of *Cyathodes;* six females from another part of the Island not designated, December, 1916, and February, 1917 (Giffard).

The distinctive and constant characters of color, shorter genal cones and antennae probably mark this off as a separate species, though it is possible that a biologic study would show it to be but a local or perhaps even seasonal variation. The occurrence of some on *Cyathodes* does not indicate necessarily a difference in food habits, though that is possible.

Trioza hawaiiensis n. sp.

Length of body 2.0 to 3.0 mm.; length of forewing 2.8 to 3.9 mm. General color about as in *T. iolani;* front and middle tibiae on distal third or half and all tarsi black or brown; venter of abdomen blotched with brown; forewings clear.

Closely resembling *T. iolani* in many ways but larger and stouter; genal cones about as long as vertex, somewhat divergent, more pubescent. Antennae 2 to 2½ times as long as width of head. Legs longer and stouter; hind tibiae with a serrated callus at base. Forewings large, veins and costa without visible setae or with very short setae. Female genitalia similar. Male forceps nearly or quite as long as anal valve, stout, uniformly converging on both margins to subacute apex, black pointed; anal valve short, posterior margin acuately rounded, broadest near mid-point.

Distribution:—Island of Hawaii—Kilauea, near Volcano, 4000 ft. elevation, August 21, 1917 (W. M. Giffard); Kau Road, January 16, 1917 (Giffard); Kahuku, January 15, 1917 (Giffard); Kilauea, June 27, 1917 (O. H. Swezey), on ohia lehua; Niulii, May 22, 1917 (Swezey).

This appears to be closely related to *T. iolani* but nevertheless not a derivative of it. It is more probably a corelated derivative form of the ancestor of both. It seems to be limited to the Island of Hawaii. Large individuals of *T. iolani*, equalling in size this present species, occur on Oahu but these differ sharply in male genitalia, costal setae and other minor characters.

Genus *Kuwayama* Crawford.

The chief distinguishing characteristic of this genus is the absence of genal cones, the genae beneath the antennal sockets being more or less roundly swollen but not produced into conical processes as in *Trioza*. The form of the genae in this subfamily appears to be not at all fixed but varies more readily than wing characters and some others. For this reason, it seems certain that the species placed in this genus from various countries of the world do not represent a common origin at all, but independent or parallel evolution toward the same end.

The three species of this genus, native to these Islands, seem almost certainly to have been derived from some *Trioza* species, probably *T. ohiacola* or an ancestral type preceding it.

Key to the Species.

A[1]. Color of body nearly all black or dark brown; dorsum conspicuously reticulately marked; cubital vein of forewing forked a little distad of midpoint; antennae scarcely longer than width of head; male forceps very short, not more than three times as long as broad. Oahu and Molokai. *K. gracilis* n. sp.

A[2]. Color not uniformly black, very rarely even brown over most of body; cubital vein of forewing forked at or very slightly distad of midpoint; male forceps at least 4 times as long as broad.

B[1]. Color typically yellow and black; head and some of notum black and remainder yellow, but sometimes color mostly yellowish or rarely mostly brown; reticulation of dorsum indistinct; antennae distinctly longer than width of head; insect about 2.5 mm. long to tip of folded wings. Hawaii and Lanai. *K. nigricapita* n. sp.

B[2]. Color uniformly orange or yellowish; reticulation sometimes distinct; antennae not longer than width of head; insect about 2.0 mm. long to tip of folded wings. Hawaii. *K. minuta* n. sp.

Kuwayama nigricapita n. sp.

Length of body, male 1.1 mm.; female 1.6 mm.; length of forewing, male 1.8; female 2.3. Color dark brown or black contrasted with yellow; head usually entirely black, sometimes brown on vertex but eyes black; male usually orange or pale yellow on thorax and abdomen; female usually with pronotum, anterior portion of dorsulum, mesoscutum, metascutum and narrow longitudinal band on abdominal notum black or brown, but sometimes some or all of these areas pale; remainder of female body orange or pale yellow; legs yellow in both sexes, with tarsi often black; antennae paler than head, the distal third or half sometimes darker than the basal portion; beak black.

Head nearly as broad as metathorax, somewhat declivous; vertex more than half as long as broad, with a prominent discal depression on each side of median line, reticulately marked, sometimes slightly hairy. Genae subspherically swollen beneath each antennal socket, lobes nearly contiguous beneath front ocellus, cones wanting and clypeus therefore not concealed from view. Beak short, conspicuous by its dark color against the orange venter. Antennae slender, about $1\frac{1}{4}$ times as long as width of head.

Thorax narrow, scarcely arched, not hairy. Legs rather small, slender; forewings hyaline, clear, radius short, first marginal cell a little larger than second, veins not setose. Male genitalia small; forceps slender, acuminate, subacute, nearly or quite as long as anal valve. Anal valve straight on anterior margin but convex on posterior margin, broadest sub-basally. Female genital segment nearly as long as abdomen, dorsal valve longer than ventral, both acute.

Distribution:—Island of Hawaii—Niulii, May 19-24, 1917 (O. H. Swezey), 44 specimens of both sexes on foliage of ohia lehua (*Metrosideros* sp.). Some of these were bred from nymphs living free on the surface of the leaves. Other related species make galls on these same leaves. Kohala Mountains (Swezey), May 24, 1917, on ohia lehua; Mt. Kilauea, January 1, 1917 (W. M. Giffard). Island of Lanai—several localities at elevation of 2500 to 3000 ft., January, 1917 (Giffard).

Kuwayama minuta n. sp.

Length of body 0.8 to 1.1 mm.; length of forewing 1.6 mm. General color pale lemon yellow to orange; eyes brown or black; hind femora lemon yellow in dark forms as well as light; antennae brown except basal one-fourth pale.

Very similar to *K. nigricapita,* from which it appears to have been derived, but differing in the following respects: Body uniformly smaller in both sexes; color nearly uniform over entire body; antennae scarcely longer than width of head. Male genitalia smaller; forceps shorter and more slender.

Island of Hawaii—Mt. Kilauea, June 27, 1917 (O. H. Swezey), bred from free-living nymphs on surface of leaves of ohia lehua.

Kuwayama gracilis n. sp.

Length of body, male 1.0 mm.; female 1.7 mm.; length of forewing, male 1.3, female 1.9. General color black to dark brown; tibiae and sometimes basal half of antennae a lighter shade of brown. Body robust, small.

Head deflexed, not quite as broad as mesothorax; vertex reticulately marked, a little more than half as long as broad, with a shallow, broad foveal depression on each side of median suture. Genae swollen subspherically beneath antennal bases, with several long hairs. Eyes large. Antennae about as long as width of head, or a little longer, slender.

Thorax broad, arched, reticulately marked. Legs short and stout; hind tibiae with three short spines at apex. Forewings short, rounded at apex, hyaline, clear, veins black or reddish. Abdomen short. Male forceps short, relatively broad, about half or three-fourths as long as anal valve, narrowing to acute apex. Anal valve moderately broad, anterior margin straight, posterior margin arcuately convex, broadest below middle; female genital segment nearly as long as abdomen, dorsal valve longer than ventral, both acutely pointed.

Distribution:—Island of Oahu—Alewa Heights, March 26, 1916; Waialae Ridge, April 22, 1917; Mt. Kaala at elevation of 2000 to 2300 ft., March 4, 1917; Wailupe, January 23, 1916; Niu, Feb. 10, 1918 (Swezey), on ohia lehua; in all, there are 52 specimens, both sexes, collected by O. H. Swezey and P. H. Timberlake on leaves of ohia lehua. Island of Molokai—One female apparently of this species from Kamoku, July 15, 1910 (D. T. Fullaway).

Genus Hevaheva Kirkaldy.

Several good characters distinguish this from other genera of the Triozinae. The forewings lack the three narrow, granular spots on the hind margin which are present, so far as I know, in all other genera of the subfamily; the veins, as well as body surface, are covered with long stiff hairs. The hind tibiae have five to ten black spines at apex instead of the three or four present in most other genera of the subfamily. Genal cones are present, but variable in length and form.

This genus is probably endemic here and probably a derivative of *Trioza*. The wing venation is suggestively similar in these two genera here, and in the *Trioza* species the veins and body surface have minute setae which have apparently been highly developed in *Hevaheva*. The marginal granular spots are variable in size in our species of *Trioza* and slight indications of their presence in a few species of *Hevaheva* suggest the possibility of the transition.

Key to the Species.

A[1]. Forewings hyaline, not colored nor clouded.

B[1]. Body straw-yellow or pale orange colored; wing veins and body surface with long setae; living in galls on leaves of *Pelea*. Oahu. *H. perkinsi* Kirkaldy.

B[2]. Body brown or black; wing veins and body surface with short setae. Hawaii. *H. hyalina* n. sp.

A[2]. Forewings colored, not transparent.

B[1]. Forewings nearly all brown or black; body black, dorsum reticulately marked. Oahu. *H. silvestris* Kirkaldy.

B[2]. Forewings irregularly maculated or clouded with brown.

C[1]. Notum more or less variegated brown and reddish or orange; genal cones 2-3 as long as vertex; wing veins with moderately long setae; wing nearly all brown or black. Oahu. *H. monticola* Kirkaldy.

C[2]. Notum mostly brown or black; genal cones 1-3 as long as vertex or less; wing veins with very long setae (see wing pattern in figure). Hawaii. *H. giffardi* n. sp.

Hevaheva perkinsi Kirkaldy.

Length of body 0.8 to 1.4 mm.; length of forewing 1.7 to 2.3 mm. General color pale lemon yellow to orange red, vertex and dorsulum sometimes a little darker; antennae often brownish on distal half or two-thirds; tarsi dark. Body surface covered sparsely with stiff hairs.

Head nearly as broad as mesothorax, much narrower than metathorax, small, deflexed; vertex half as long as broad, deeply impressed discally on each side of median suture, with several very long stiff hairs near each posterior ocellus; genal cones not quite as long as vertex, conical, subacute, somewhat divergent and sparsely hirsute. Antennae about as long as or a little longer than width of head, slender, with several moderately long setae on apical third.

Thorax broad, not much arched, sparsely hirsute; pronotum short. Legs rather large, femora large; hind tibiae with 5 to 7 short black spines at apex; tarsi thick. Forewings hyaline, clear or slightly fumate or ochreous, veins setiferous; first marginal cell a little larger than second, latter variable in size.

Abdomen short. Male genitalia small; anal valve a little longer than forceps, truncate at apex, straight on anterior margin, very convex on posterior margin; forceps slender, subterete, arched, black-pointed at tips. Female genital segment about half as long as abdomen, thick at base and abruptly converging to acute apex, valves subequal in length.

Distribution:—Island of Oahu—Mt. Olympus (1800 to 2500 ft.), bred from conical galls on leaves of *Pelea clusiaefolia* and *P. lydgatei*, August 20, 1917 (Crawford); same locality on foliage of *Pelea* (Swezey); Wailupe, January 23, 1915, on *Pelea* (Swezey); Mt. Kaala, on *Pelea* (Swezey).

Hevaheva silvestris Kirkaldy.

Length of body about 1.3 mm.; length of forewing 1.9 mm. General color dark brown to blackish or reddish; legs and antennae pale, latter yellowish except last two segments dark; femora and tarsi darker than tibiae; forewings dark brown, with one or two irregular, more hyaline areas. Body surface covered sparsely with stiff hairs.

Head not quite as broad as mesothorax, much narrower than metathorax, deflexed; vertex not quite twice as broad as long, with a deep discal depression on each side of median suture, sharply elevated on posterior margin, with a few stiff hairs near posterior ocelli. Genal cones about half as long as vertex, conical, acute, sparsley hairy, scarcely divergent. Antennae not longer than width of head, slender.

Thorax moderately broad, stiffly pubescent. Legs short, femora thick; hind tibiae with about six short black spines at apex. Forewings not transparent, rounded at apex, narrow, veins setigerous, radial margin thick. Abdomen short. Male genital segment small; forceps a little more than half as long as anal valve, slender, terete on basal half but angulate above, apex sharply curved inward and subacutely pointed. Anal valve broad in caudal view, longer than forceps, anterior margin (lateral view) straight and posterior margin convex with greatest breadth sub-basally. Female genital segment short, thick at base, abruptly converging to subacute apex.

Distribution:—Island of Oahu—Mt. Tantalus (Perkins); Kaumuohona (Swezey), 1 female determined by Kirkaldy; Mt. Olympus, elevation 2000 ft. (Swezey); Wailupe, January 23, 1915 (Swezey); Palolo Hills, on foliage of *Pelea rotundifolia*, many males and females. The life habits of this species are not well known.

Hevaheva hyalina n. sp.

Size of body and wings about the same as in *H. silvestris.* Color of body about the same or a little lighter, but forewings hyaline or nearly so, very slightly browned or smoky, not opaquely colored; legs and antennae lighter colored or similar. Hairs on body surface and wing veins much shorter and somewhat less conspicuous.

Structural characters about the same, but antennae a little longer and genal cones a little larger; wing venation similar, but setae shorter; genitalia similar, differing only in minor characters.

Distribution:—Island of Hawaii—Olaa, Glenwood, elevation 2400 ft., September 9, 1917 (W. M. Giffard), 1 pair.

This species appears to be a derivative of *H. silvestris* by segregation on a separate island. Further collecting, however, is necessary to establish the relationships beyond doubt.

Hevaheva monticola Kirkaldy.

Length of body 1.4 mm.; length of forewing 2.1 mm. General color brown; vertex, posterior half of dorsulum, and notum between forewings very light brown or orange; antennae orange, except last two segments black; femora and tibiae brown, tarsi lighter; forewings hyaline but clouded and maculated with brown as indicated in figure. Body surface with stiff pubescence.

Head rather broad, as broad as mesothorax but narrower than metathorax, declivous; vertex about half as long as broad, with a deep discal depression on each side of median suture and much elevated narrowly on posterior margin, with a few long hairs near posterior ocelli. Genal cones about two-thirds as long as vertex, conical, subacute, only a little divergent, sparsely pubescent. Antennae only a little longer than width of head, slender, distal segments with setae.

Thorax rather narrow, not much arched, surface with scattered, stiff hairs; leg rather short, stout, femora thick; hind tibiae with about 7 short black spines at apex. Forewings elongate, rounded at apex, veins prominent, setose; marginal cells subequal or first a little larger than second; radial margin thick; membrane maculated with brown conspicuously.

Male genitalia small; forceps about half as long as anal valve, sharply curved inward and acute at apex, rather slender. Anal valve straight on anterior margin, roundly convex on posterior. Female genital segment short and thick, about half as long as abdomen, abruptly tapering to acute apex; valves subequal.

Distribution:—Island of Oahu—Mt. Tantalus, elevation 2000 ft., October (Perkins); Palolo Hills (Swezey); Kaumuohona (Swezey).

Hevaheva giffardi n. sp.

Length of body 1.7 mm.; length of forewing 3.0 mm.; general color dark brown to dull black; legs, metacoxae, pleurae and antennae light or pale brown or yellowish. Body surface covered sparsely with long stiff hairs.

Head as broad as mesothorax, not quite as broad as metathorax, somewhat declivous; vertex broad, about half as long as broad, narrowly elevated on posterior margin, with a deep, discal fossal depression on each side of median suture extending obliquely toward antennal bases, roundly convex between each depression and median suture; with a few long stiff hairs along median suture and near each posterior ocellus, genal cones short, one-third or one-fourth as long as vertex, divergent, subacute, with a tuft of short hairs at base of each near anterior ocellus. Antennae about as long as width of head, or sometimes a little longer, slender with a few setae distad.

Thorax moderately broad and arched, with conspicuously long and stiff hairs; legs rather long, slender, hary; hind tibiae with 4 or 5 short black spines at apex. Forewings broad, hyaline but maculated conspicuously with brown (as indicated in figure), veins and margins beset with long setae, the costal and apical margins with a double row and the others with single row; first marginal cell very large; radius long.

Abdomen short. Male forceps slender, acuminate, about ¾ as long as anal valve or more, subacute at apex. Anal valve with anterior margin straight, posterior margin convex, broadest near base, fringed caudad with long, fine hairs. Female genital segment not as long as abdomen, acutely pointed, dorsal valve a little longer than ventral, with a large tuft of long hairs at about the middle of the dorsal valve dorsad.

Distribution:—Island of Hawaii—Olaa, elevation 3000 ft., September 8, 1917 (W. M. Giffard), 26 specimens, both sexes. Taken on leaves of *Platydesma campanulata*.

This is the most ornate of the species thus far known in these Islands and appears to be limited to Hawaii in the mountains.

Megatrioza palmicola n. sp.

Length of body, male 2.7 mm.; female 4.0 mm.; length of forewing, male 3.8 mm.; female 4.7 mm. General color brown to light brown; head tawny or flavous, eyes dark, and often a short narrow dark streak on each side of median suture of vertex; pronotum usually brown; thoracic dorsum with several more or less prominent, longitudinal brown streaks; abdomen brown; venter, legs and antennae flavous. Body large, surface somewhat hairy.

Head about as broad as mesothorax but not as broad as metathorax, declivous; vertex about half as long as broad, with a discal depression on each side of median suture, posterior ocelli slightly elevated, anterior half bulging and clothed with moderately long hairs. Genal cones short, seldom more than ¼ or 1-3 as long as vertex, subacute, divergent, somewhat separated. Eyes very large. Antennae slender, not quite twice as long as width of head.

Thorax large, broad, well arched, surface briefly and sparsely pubescent; legs rather long, stout, pubescent; hind tibiae with a spur at base and two prominent teeth at apex, one bifid and one simple and a third long tooth a little before the apex. Forewings large, long, hyaline or very slightly smoky, with four dark spots on hind margin, one at tip of clavus and the other three the regular marginal spots characteristic of this subfamily but darker and more prominent.

Abdomen long in both sexes; male forceps nearly as long as anal valve, slender, narrowing slightly toward subacute apex, hairy. Anal valve much broader than forceps, posterior margin convex, broadest near base and narrowing distad to truncate apex. Female genital segment large, not as long as abdomen but often nearly so, both valves acutely pointed, dorsal longer than ventral.

Distribution:—Island of Oahu—Punaluu (O. H. Swezey); Wailupe, January 23, 1915 (Swezey); Mt. Olympus, elevation 2500 ft., September, 1917 (Swezey and Crawford); Waiahole, August 23, 1916.

Food plant: Fan palm (*Pritchardia* spp.), native palms. This species appears to occur only on the endemic palms which are comparatively rare on Oahu. The insects live on the younger fronds, especially those just unfolding, from which they can readily suck the sap and in the folds of which they find good refuge and seclusion.

Megatrioza is a Polynesian genus, distinguished by the armature of the hind tibiae together with certain cephalic and wing characters. Thus far there are ten known species of this genus[1] in the Malay Archipelago and Peninsula and the Philippines, though there are doubtless many more to be discovered, as this appears to be a large genus. None of these known ten species shows any marked relationship to the Hawaiian species, so that it is probable that the latter is derived from some other still unknown species. It is possible that it may occur elsewhere, being merely an introduction here, but the indications

1 These species are described in a forthcoming paper on paleotropical Psyllidae by the author of this paper.

are that it is truly endemic since it occurs only on the native palms in the mountains and not on cultivated palms in the coast lands.

The species bears some resemblance to the endemic *Trioza* species and at first was believed by the writer to have been derived from the same ancestry. In wing venation and male genitalia there is a similarity but the form of the genal cones and especially the tibial armature are distinct, while in all these characters there is considerable similarity to *Megatrioza*.

Genus *Cerotrioza* novum.

Head scarcely declivous, rather long; vertex produced in front into two horn-like epiphyses over antennal bases; genae produced more or less into cones or subspherically swollen. Antennae slender. Thorax not much arched, narrow; hind tibiae with small basal spur or callus and small subapical spine. Forewings narrow, opaque or semi-opaque, maculated; first marginal cell usually larger than second; hind wings nearly as long as forewings.

Type of genus:—*Cerotrioza bivittata.*

Two additional species, not yet described, are known from the South Pacific—one from Borneo and another from Singapore. The genus appears to be somewhat related to *Megatrioza* but has become very specialized in some features. The Hawaiian species is manifestly related to the other two but hardly derived from either. It is probably endemic here but its origin must still be a matter of conjecture. It appears to have no relationship to the other endemic species of psyllids here.

Cerotrioza bivittata n. sp.

Length of body 1.8 mm.; length of forewing 2.2 mm. General color pale greenish yellow on dorsum and venter; eyes dark and a broad, dark brown vitta alongside of head continued on pleurae of thorax to base of forewings and thence along central axis of each forewing to apex; legs pale yellow or straw colored; antennae whitish, except two basal segments brownish and apical two black. Body slender.

Head scarcely deflexed, very long. Vertex longer than broad, with a discal, sulcate depression on each side of median line and the two meeting at median line near anterior end; with two rounded, knoblike prolongations at anterior end of vertex reaching out beyond and over antennal sockets, with front ocellus at base of emargination between them. Frons visible as a very small sclerite bearing the front ocellus at one end. Genae swollen somewhat beneath antennal bases. Clypeus small. Antennae slender, about 1½ times as long as width of head.

Thorax narrow, scarcely arched. Pronotum moderately long; legs long and slender, slightly hairy; tibial spines very small, black. Forewings long and slender, opaque and whitish, subacute at apex, venation similar to that of other species of this genus, with a broad, axial brown band from base to apex with numerous darker brown spots within it; veins beset with short setae.

Abdomen slender, long. Male genitalia small; forceps small, terete, acute, arcuate, about 2-3 as long as anal valve; latter broad in caudal view, posterior margin (lateral view) convex. Female genital segment half as long as abdomen, dorsal valve blunt, a little longer than ventral.

Distribution:—Island of Oahu—Opaeula, March 30, 1913 (O. H. Swezey), 3 males on *Xylosma Hawaiiense;* Niu, Feb. 10, 1918 (Swezey), 2 females and 1 male, on same plant.

Plate VIII.

Explanation of Figures.

Figure 1. *Trioza iolani*, forewing.

1a. Wing margin highly magnified and showing setae.

1b. Frontal view of head and genal cones.

1c. Profile view of male genitalia.

2. *Trioza lanaiensis*, forewing.

2a—2c. same views as in 1.

3. *Kuwayama nigricapita*, forewing.

3a—3c. Same as in 1, drawn to same scale.

4. *Heraheva perkinsi*, forewing.

4a—4c. Same as above, drawn to same scale.

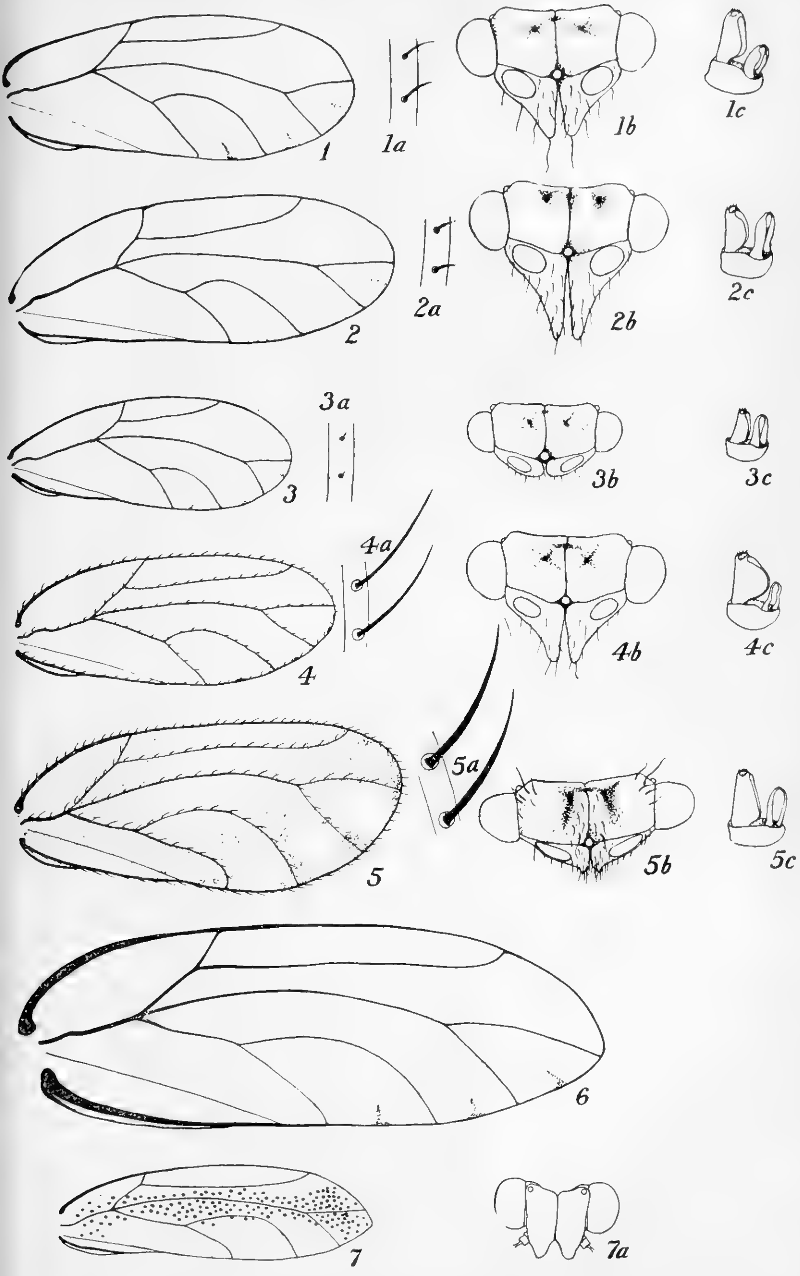
5. *Hevaheva giffardi*, forewing.

5a—5c. Same as above, drawn to same scale.

6. *Megatrioza palmicola*, forewing, drawn to same scale as others.

7. *Cerotrioza bivittata*, forewing.

7a. Dorsal view of head, showing processes of vertex; genae not visible.


1
1a
1b
1c
2
2a
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4b
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5a
5b
5c
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7a

DECEMBER 13TH, 1917.

The one hundred forty-seventh meeting of the Society was held in the usual place, President Potter in the chair. Other members present: Messrs. Bridwell, Crawford, Ehrhorn, Fullaway, Pemberton, Swezey, Timberlake and Wilder.

Minutes of previous meeting read and approved.

The Committee on dispositon of "types" of Hawaiian insects, submitted a recommendation that the Society establish a collection to be located at present in the Entomological Department of the Experiment Station of the Hawaiian Sugar Planters' Association, to be in the custody of the Executive Committee, and to be maintained especially for the deposition of types. The recommendation was unanimously approved.

Mr. F. X. Williams was elected to active membership in the Society.

The Treasurer's report for the year was submitted. It showed a balance of $19.51, and was accepted subject to being audited.

OFFICERS ELECTED FOR 1918:

President..C. E. PEMBERTON
Vice-President................................P. H. TIMBERLAKE
Secretary-Treasurer........................D. T. FULLAWAY

NOTES AND EXHIBITIONS.

Scolia manilae.—Mr. Bridwell reported finding recently a female of this recently introduced wasp in Makiki Valley at least a mile from where any had been liberated.

Trypoxylon sp.—Mr. Timberlake exhibited a nest of this wasp made in a glass pipette, less than one-fourth inch in diameter and open at the top. The wasp had made the nest while the pipette was standing in a rack in the chemical laboratory.

Trioza sp.—Mr. Ehrhorn exhibited the peculiar larva of a Psyllid, taken by him on a canna leaf.

Gryllus pacificus.—Mr. Swezey exhibited sticks of sugar cane from a field in Oahu Sugar Company's plantation, showing large holes which had been eaten by this cricket. A large number were thus eaten in parts of the field. It was the first record of injury to cane by this cricket.

Phanerotoma sp.—A cocoon of this Braconid was found by Mr. Rosa near the remains of the larva of *Caryoborus gonagra* in a *Cassia* pod. In another case a cocoon of the same Braconid was found near the remains of a Lepidopterous larva in a *Cassia* pod.

Annual Address.

BY W. R. R. POTTER.

Before presenting these notes for the guidance of fellow members of the Hawaiian Entomological Society in the Art of Illustrating and the various means whereby they may most easily attain the end desired I wish to thank Mr. Fullaway for the public spirit he showed in assuming at a moment's notice the duties of the Secretary, Captain H. T. Osborn, when the latter was called to the Reserve Officers' Training Camp.

The methods used in reproducing photographs wash line and pencil drawings are very little understood by the average man and it is with the idea of simplifying matters for the engraver and the entomologist that these brief notes are written.

We will first take up the production of a line drawing. A line drawing is a drawing made with pen or brush, as distinguished from one made by washes of monochrome or sepia. We will assume that the specimen has been drawn in pencil and the author wishes it reproduced as a figure or plate to accompany his article for publication. The material required: Ross board, Winsor & Newton's Mandarin ink, a piece of blue transfer paper that will give easily discernible blue lines when traced, having been procured, we will proceed to produce a drawing that will satisfy both illustrator and engraver. Your drawing we take for granted has been made two or three diameters larger than it is desired to appear as a finished plate. The advantages of drawing larger than the size of the illustration required, is that it allows of a coarser line which is conducive to blackness or density in the lines used. This is an all-important matter. Drawings made the same size generally have a lot of weak lines which are reproduced in the negative as grey as distinguished from the clear glass of a black line. The grey line in the engraver's parlance comes up "rotten" and not giving sufficient resistance to the acid used in etching, is etched away or lost and the engraving assumes a bald or ragged apearance. Having carefully fastened your pencil drawing by two or more corners to the Ross or Bristol board, place your transfer paper coated side down on the Ross board beneath the drawing, then take a tracing point and go over your drawing line for line, raising your copy and transfer paper at intervals to assure yourself that you have not missed any portion of the drawing. When a complete tracing has been made remove your pencil sketch and cover your copy with the exception of the portion you wish to work on with a clean piece of paper and proceed to put in your heaviest lines and portions of solid black. Your lines should curve with the curvature of the surface you are representing. Pits, protuberances and hollows should be shown by careful drawing, trying at all times to keep your lines open and free from any scratchiness and breaks. To one not used to line, stipple is far simpler and may be used to advantage. When your drawing is complete, your figures numbered or lettered, carefully rub out your tracing lines with stale bread or soft rubber, mark the reduction in blue pencil on the margin clear of the drawing and it is ready for the engraver.

We will now follow the drawing in its course of reproduction. The engraver having satisfied himself of the reduction required and focussed accurately takes a collodion plate and immerses it in a silver bath, then inserts it into a dark slide or plate-carrier and exposes it by the aid of the electric light for a time known to be sufficient. The plate is then carried to the dark room and developed, fixed and washed, dried, coated with a rubber solution and stript from the glass, being then floated on to a thick sheet of plate glass with other negatives and put into a printing frame with a piece of sensitized zinc plate and printed, after which it is taken to the coating room and a light coating of etching ink is applied by means of a roller. This coats the whole of the plate. The parts affected by the light, the clear lines in the negative, are insoluble. The parts not affected are soluble and when the plate is washed under the faucet the soluble parts are washed away, leaving your drawing reduced to scale on a background of bright zinc. The plate is then dried and rosin is dusted on so as to strengthen the acid-resisting etching ink. It is then given a light etch sufficient to give a sharp line but of little depth. It is then further dusted to protect the sides of the lines, heated so that the resin becomes incorporated with the etching ink and etched until sufficient depth is attained. It then goes to the router, who routs out all the metal which is not wanted, and is ready for the blocker, who mounts it on a type-high block of pear or apple wood, and it is then ready for the press.

With your wash drawing the method you use is distinctly different. Your tones are secured by the depth of color applied and you assure texture by the fidelity of your drawing. The material used is Bristol board, India ink or sepia and your first wash will be of the same value and density as the lightest portion of your drawing, putting in successive washes and detail until the drawing is complete. We will now follow the wash drawing in its course thru the engraver's hands, who, to reproduce it, has to interpose a Levy screen at a known distance in front of his wet plate. These screens are ruled with lines varying from 50 to 400 lines to the inch and ruled in both directions. This when the negative is made you will find has broken up your drawing into thousands of small dots and the whole of the drawing is covered—not only the parts you have drawn but the white background as well. This is then printed on copper in the manner outlined for zinc plates, using a sensitized enamel in place of etching ink and etched in perchloride of iron. The plate is then bevelled and mounted and made ready for the printer.

Just two methods have been briefly described and the others are more or less similar. A pencil drawing is reproduced by

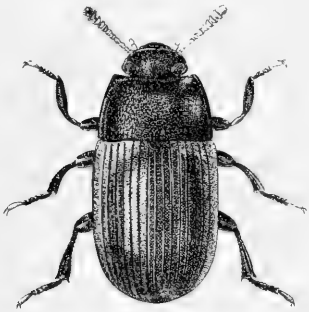

Fig. 1.

Fig. 3.

the halftone process, as is also photographs, drawings made with Conti crayon or lithographic crayon on prepared boards, having its surface specially prepared by rolling over an engraved cylinder, are reproduced without the aid of a Levy screen. The plate reproduced gives in fig. 1 a line engraving of a pen and ink sketch, in fig. 2 a halftone of a wash drawing, in fig. 3 a reproduction of a drawing on Ross's stipple board, and in fig. 4 of a pencil sketch made on

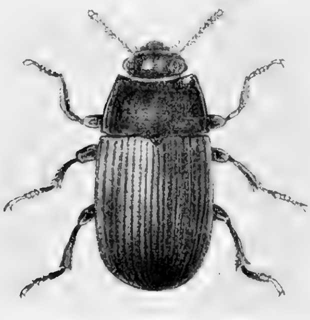

Fig. 2.

Fig. 4.

Whatman's paper and reproduced by halftone. This will give you some idea of the possibilities of each method and in conclusion it is advisable to state that black lines of good density, photographs with a fair amount of contrast and wash drawings of accurate and foreceful drawing are desirable from the engraver's as well as the illustrator's point of view.

A New Genus of Pteroptricine Aphelininae (Hymenoptera).

BY D. T. FULLAWAY.

In 1913 I characterized the genus *Pteroptrichoides* to receive a truly remarkable insect bred by Mr. Jacob Kotinsky from a diaspine scale on a Bombay mango (*Leucaspis indica*?). Since then I have found other specimens of the same insect, bred from *Morganella longispina*, among which the male sex is represented, and as the original description was based on a slide mount and I now have abundant fresh as well as preserved material, I am able to add to its accuracy and completeness.

The head is transverse and the lower part, below the eyes, is strongly chitinized and protuberant. The lateral ocelli are separated from the margin of the eye by a space nearly as wide as their diameter. The antennae in both sexes are flattened outwardly. In the male the 1st and 3rd funicle joints and the three joints of the club are subequal, each a little longer than the pedicel and each fluted. The 2nd funicle joint is transverse, its length only one-third its width. The scutellum is short and wide and the posterior margin is rounded. The marginal vein is very much thickened and there is no postmarginal or stigmal.

In life *P. perkinsi* is black, the head (mostly) and a semicircular band on the thorax following the parapsidal grooves to and including the tegulae and the posterior margin of the mosonotum brown, scutellum lemon yellow, antennae and legs brown to fuscous.

The species referred at the same time to *Pteroptrichoides* and supposedly bred from *Asterolecanium pustulans* and *Howardia biclavis*, has since been recovered abundantly from the latter scale but not from the former, which I believe to be an erroneous record. It differs to such an extent from *P. perkinsi* that the two cannot be included in the same genus, and I therefore propose a new genus for it, characterized as follows:

Pseudopteroptrix gen. nov.

Belongs in the same category as *Pteroptrix* and *Pteroptrichoides* but wing and antennal characteristics essentially different. Short and stout, head transverse and widely impressed between the eyes, antennae attached just above the mouth, 8-jointed, scape slender, fusiform, nearly reaching vertex, flagellum stouter, pedicel obconic, less than one-half scape, 3-jointed funicle about twice the length of the pedicel, the two first joints short and narrow, almost moniliform, the 3rd wide and longer, of equal width with club, which is 3-jointed and about as long as funicle and pedicel together, flattened and fluted, the ultimate joint thin and pointed. Eyes fairly small and hairy, cheeks almost as long, ocelli forming an isosceles triangle, the anterior angle of which is obtuse, lateral members about twice their diameter from eye margin. Thorax rather flat, pronotum inconspicuous, mesonotum full and rounded, parapsidal grooves distinct, scutellum broad and rounded behind. Abdomen short and rounded behind, the ovipositor only slightly exserted, a fascia of long hairs coming from anterior lateral angle of ultimate segment. Wings with discal ciliation complete (except at very base and at apex of stigmal vein) and rather closely set, marginal ciliation short, longest on posterior margin outwardly, inwardly the margin is plainly chitinized, marginal vein shorter than submarginal and greatly thickened, the submarginal also at extremity and the short stigmal of equal width, the latter curved, no postmarginal.

P. imitatrix n. sp.

Black, legs and antennae pallid, scutellum lemon yellow often with a greenish or bluish tinge. Length .8 mm., antennae .35 mm., wing .5 mm. long, .2 mm. wide.

There is also a slide mount of this species marked "ex *Aspidiotus rapax*".

Notes on the Bruchidae and Their Parasites in the Hawaiian Islands.

BY JOHN COLBURN BRIDWELL.

Geographical.

The *Bruchidae* constitute one of the smaller families of Coleoptera, about 700 species being listed in the most recent catalogue, that of Pic (Coleopterorum Catalogus, pars. 55, 1913). In this work they are arranged in thirteen genera of which *Bruchus* alone is cosmopolitan in the sense that it extends into all the major zoogeographical regions. However, when this polymorphic genus is dismembered into its constituents it will doubtless be found that none of these are so widely distributed. Of the other genera *Spermophagus* and *Pachymerus* (=*Caryoborus* auct.) are widely distributed but do not extend into the Australian region if we include New Caledonia in the Indo-Malayan region where it belongs entomologically. *Pseudopachymerus* Pic (=*Pachymerus* auct.) has its metropolis in the Neotropical and extends into the Ethiopian and Palaearctic. *Carymenopon* occurs in the Indo-Malayan and Ethiopian regions. The remaining genera are known from a single region; *Rhaebus, Pygobruchus,* and *Kytorrhinus* from the Palaearctic; *Pygiopachymerus, Phelomerus, Impressobruchus, Megalorhipis,* from the Neotropical; *Diegobruchus* from the Ethiopian; no peculiar genera occur in the Indo-Malayan, the Australian, or the Nearctic regions. The Neotropical region has the greatest number of recorded species with about 300; next comes the Palaearctic with about 200; the Ethiopian and Nearctic have each about a hundred species known but when the African species are as well known as the North American they will doubtless approach the numbers of the Palaearctic; from the Indo-Malayan only about 50 species are recorded and from the Australian only about 10; none are known to occur in the Polynesian Islands or in New Zealand excepting those introduced through commerce.

Bruchidae Recent Immigrants Into Hawaii.

No species of *Bruchidae* are then members of endemic fauna of the Hawaiian Islands but at least eight species belonging to three genera have already become established here and several have been intercepted in quarantine inspection.

The following species have previously been reported as occurring in the Hawaiian Islands: *Bruchus obtectus* Say, the common bean weevil; *Bruchus chinensis* Linne, the cowpea weevil; *Bruchus quadrimaculatus* Fabricius, the four-spotted bean weevil; *Bruchus prosopis* Leconte, the mesquite or algaroba weevil; *Caryoborus gonagra* Fabricius, the tamarind weevil. To these may now be added (1) *Bruchus pruininus* Horn; (2) an undetermined *Bruchus* of the group of *B. chinensis* and *B. quadrimaculatus* closely related to *Bruchus ornatus* Boheman which may for convenience be termed the Dolichos weevil; and (3) a small *Spermophagus* or *Zabrotes,* as yet undetermined but perhaps identical with *Spermophagus* (*Zabrotes*) *pectoralis* Sharp. Aside from these *Bruchus pisorum* Linne and *B. rufimanus* Boheman occur commonly in imported peas (*Pisum sativum*) and broad or horse beans (*Vicia faba*) respectively.*

Table of Hawaiian *Bruchidae.*

The recognition of these species may perhaps be facilitated by the following table:

1. Hind femora slender, without teeth of any kind, hind tibiae with weak spinules within and two stout movable spines at the apex. A small, compact species, the female with two whitish transverse spots of pubescence on the sides of the elytra near the middle.......................... *Zabrotes.*

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*In discussing these species I have preferred, in the absence of any general acceptance of any one set of proposed emendations of the nomenclature of the species and genera and lacking the necessary time or literature to arrive at independent conclusions, to use the terms in general use. At the same time I fully recognize the desirability of separating the natural genera confused under the old genus *Bruchus* and also the necessity of basing coleopterous nomenclature on the law of priority.

Hind femora thickened, with one tooth or more beneath near the apex 2

2. Hind femora strongly swollen, with several teeth beneath. A large, rather elongate species, reddish brown throughout .... *Caryoborus gonagra.*

Hind femora less swollen, with one or two teeth and sometimes two denticles.. 3.

3. Hind femora with one tooth without and one within........ 4.

Hind femora with one tooth, with or without denticles.... 6.

4. Form compact, posterior middle lobe of pronotum clothed with snowy-white pubescence, antennae of male pectinate .... *Bruchus chinensis*

Form more slender, pubescence of middle lobe dull, antennae of male serrate.. 5.

5. Smaller, pronotum and elytra more sparsely pubescent, integument of elytra dark along the lateral and hind margins usually expanded in the female into a dark semicircular spot, integument of pronotum largely dark, pygidium of female with large, distinctly separated, lateral, integumentary dark spots, outer subapical tooth of hind femora acute .... *Bruchus quadrimaculatus*

Larger, pronotum and elytra more densely pubescent, pronotum and elytra reddish, narrowly crescentic dark integumentary spot on the sides of the elytra, pygidium of female reddish with a dark narrowly divided subapical cloudy spot, outer subapical tooth of hind femora blunt.. *Dolichos weevil*

6. Pronotum with a blunt obsolescent tooth on either side near the middle, hind femora with a single tooth............ 7.

Pronotum with the sides evenly rounded, hind femora with one tooth, with or without two denticles...................... 8.

7. Hind femora acutely toothed, pronotum broader, pygidium with two definite dark spots........................ *Bruchus pisorum*

Hind femora obtusely or obsoletely toothed, pronotum narrower, dark spots of pygidium absent or poorly defined.... .... *Bruchus rufimanus*

8. Hind femora with one tooth and no denticles. A small, compact species, entirely leaden gray above........................ .... *Bruchus pruininus*
9. Hind femora with one tooth and two denticles beyond the tooth. Larger, more elongate species, more or less mottled or marked above...9.
9. Elytra reddish, hind femora entirely reddish, pygidium more nearly horizontal, sides of three ventral segments visible from above..*Bruchus prosopis*
   Elytra dark, hind femora dark above, pygidium more nearly vertical, no ventral segments visible from above...... ....*Bruchus obtectus*

Bruchus pruininus.

Bruchus pruininus was taken in August, 1917, while sweeping beneath a clump of the bushes of *Leucaena glauca,* locally known as false koa or koa haole, from a fancied resemblance to the leaf-bearing shoots or young trees of *Acacia koa.* The plant was investigated as a host plant and *B. pruininus* has since been bred in large numbers from its seeds, both those naturally infested and those with eggs deposited on them by the beetles in captivity.

The pods of *Leucaena* are flat, about six inches long by a half inch broad, and contain about a dozen rich brown flat ovate seeds. They are produced in great abundance and hang in clusters upon the bushes for some time after they have ripened and turned brown. Then they split apart from the edges in the middle and thus the seeds are exposed for a little while before they drop to the ground and during this period a few of the eggs are deposited on them. Apparently most of them are, however, laid after the seeds have dropped. I have seen no signs of any eggs being laid upon the pods of this plant or on those of any other of its host plants. In one instance the eggs of this species were found deposited upon the seeds of indigo. (*Indigifera anil*) and subsequently some undersized adults emerged. The pods of the indigo are small and curved and remain attached to the plant for long periods after they have split open and exposed the little blackish seeds but little larger than a full-sized adult *B. pruininus*. I have also found it attacking the seeds of *Sesbania sesban* in the open. In this plant the pods are long and slender and hang for a long time upon the tree, in time splitting open on one side so as to permit oviposition upon the seeds, though the opening is so narrow as to cause one to wonder how the beetle is able to reach them. The adults from these seeds are also somewhat under-sized. From less than a pint of these seeds I secured more than a thousand seeds upon which eggs had been laid, and a large part of these later produced beetles. It has been recorded from California as breeding in the seeds of the desert iron wood (*Olneya tesota*), from black locust (*Robinia pseudacacia*) and from some of the introduced species of *Acacia*.

In confinement I have induced *Bruchus pruininus* to oviposit upon 44 species of seeds, as may be seen in the table presented further on in this paper. Of these *Glycine hispida, Arachis hypogaea, Prosopis juliflora, Cassia fistula, C. nodosa, Desmodium uncinatum, Albizzia saponaria, Desmanthus virgatus, Acacia koa,* and *Caesalpinia pulcherrima* can serve as larval food and from them adults have been bred. It is hardly to be expected that any of these excepting perhaps *Desmanthus* and *Albizzia saponaria* will be found infested naturally.

Bruchus pruininus is easily reared in captivity, the adults mating immediately after emergence, the females ovipositing in about three days. The adults in nature visit the flowers of the host plants and feed upon the pollen. On the heads of *Leucaena* they soon work their way down among the stamens and remain for some time. In captivity they readily feed upon nectar, sugar and water, or honey, and if fed will live for a number of days. I should judge that they may live for a month or more. Feeding need not precede oviposition though apparently it does normally.

In mating the hind tibiae of the male are bent beneath the abdomen of the female, while the front and middle legs keep up a tickling movement on the edges of the elytra and abdomen of the female, which responds with occasional slow kicking movements of her hind legs against the sternum of the male, which tends to dislodge him from his position.

The eggs of *Bruchus pruininus* are of a type common among Bruchid eggs broadly ovate and flattened by the glue-like substance which cements them to the seed, entirely covering the egg and affording after hardening a strong support from which the first-stage larva works in penetrating the tough seedcoat. As will be seen in a later discussion the female exercises but little discrimination in oviposition with regard to the fitness of the seed for larval food. Several eggs may be laid upon a single seed but the seed of *Leucaena* can supply nourishment for only about three larvae. A single larva can develop in an indigo or sesban seed, while in captivity several large individuals can be bred from a single kernel of a peanut.

None of the plants in which *Bruchus pruininus* breeds in the Islands is of any particular economic value at present and all are so free-seeding that it plays very little part in checking their spread. Whether it will continue to breed in stored seeds indefinitely remains to be seen. It is easy enough by securing unopened pods to keep seed free from infestation.

It is impossible to say with any certainty when *Bruchus pruininus* made its way into the Islands but the method of its coming is indicated by some notes accompanying some specimens of the species contained in the entomological collections of the Hawaii Agricultural Experiment Station. They were taken by Mr. Van Dine from a package of seeds of *Acacia mollissima* purchased from the Cox Seed Company, San Francisco, Cal., in 1904. This note by Van Dine under the head of Insect Enemies of the black wattle (*Acacia decurrens*) appears to refer to this insect, "An undescribed species of weevil (*Bruchus*) was taken from seeds purchased in San Francisco. It was presumably introduced into California from Australia or South Africa." There can be little doubt, however, of its identity with *B. pruininus,* with the description of which it agrees. The insect is apparently extending its range in California since I have seen specimens taken by Mr. Swezey at Chico, while all the earlier records were from Southern California. Its establishment in the Hawaiian Islands was not, however, probably due to this particular shipment of seed, since this was probably fumigated at once, as is the custom there. It must, however, have been established from similar shipments about that time or earlier, since I am informed by Mr. David Haughs, plantings of *Acacia mollissima* and *A. decurrens* have practically ceased since that time because these trees have not proved adaptable to Hawaiian conditions.

Bruchus pruininus has been found generally distributed wherever looked for in the warmer coastal belt of Oahu and has been taken by Mr. Swezey in similar localities on Maui.

The Dolichos Weevil.

Mr. Swezey bred the Dolichos weevil in 1908 from the beans of a white variety of *Dolichos lablab* escaped from cultivation, and called my attention to it and to its peculiar method of oviposition upon the pods of its host-plant. The eggs are laid upon the pods often while still quite green in masses of from three to six and are attached to each other and to the pod by means of a glue-like substance extruded by the female, as are the single eggs of *B. pruininus* and many other species. The larvae from an egg mass enter a single bean and develop there, practically destroying it during their development. Upon emerging from the bean the adults pair immediately and eggs are laid within 24 hours. These eggs instead of being laid in egg masses are scattered singly over the surface of the other beans of the pod, several upon each bean. From 133 beans of a dark variety of *Dolichos lablab* naturally infested in the pods in the field, 563 weevils emerged or an average of 4.23 weevils. From 296 beans of a white-seeded variety also apparently naturally infested, 1286 adults were produced or 4.34 per bean. The greatest number of adults for any one bean was 14 and the greatest number of adults were produced from beans developing 4 and 5 adults in the first lot and from those developing 5 adults in the second. The adults emerge from the pod by cutting circular openings similar to those made in emerging from the bean.

The Dolichos weevil apparently breeds commonly here only in *Dolichos lablab,* though I have found the eggs on the pods of the lima bean (*Phaseolus lunatus*) and have bred one diminutive individual from a lima bean apparently naturally infested. In captivity I have succeeded in breeding it from the pigeon pea, cowpea, soy bean, chick pea, adsuki bean, broad bean, mung bean and common pea. Repeated experiments failed to induce it to breed in common beans.

The Dolichos weevil is rather short-lived in confinement and I doubt if it will succeed in maintaining itself in storage though I have bred it from old cowpeas and Dolichos beans in which the cotyledons were very tough and hard. My breedings gave from 40 to 55 days as the period required for its development from egg to adult during the cooler part of the year in Honolulu.

Dolichos lablab, locally known as the papapa bean, is used to some extent as food, but the weevil would seriously interfere with its further use since the weevil is generally distributed and abundant. Dr. H. L. Lyon, who has been studying the varieties of *Dolichos,* tells me that it has often prevented his securing satisfactory seed. In examining some of his samples of seeds grown by him it is interesting to note that all varieties grown except one known as *Dolichos sudanensis* were attacked by this weevil. What were said to be samples of the original stocks of seed secured from a seed company in Philadelphia and from a German firm were infested, apparently having been infested at the time they were brought into the Islands. These shipments were long subsequent to the establishment of the weevil as shown by Mr. Swezey's breeding it in 1908.

The species appears closely related to *Bruchus quadrimacu-*

latus and is probably, like that species, Oriental, or possibly, African, like its host-plant.

Bruchus obtectus in Hawaii.

Bruchus obtectus was reported by Van Dine in 1904 as bred from stored beans from Kauai and has been frequently bred since then from beans purchased in stores in Honolulu but there has always been some uncertainty as to the source of the material from which they had been bred and in consequence some uncertainty as to its status here. I have seen abundant material bred from beans grown in Honolulu and from the island of Maui. No doubt remains as to its establishment and its presence in such abundance as to form a serious problem in the local production of beans. Its presence necessitates the fumigation of all of the large crop produced on Maui. While the data at hand do not indicate the time required for development there can be no doubt that from eight to ten generations may be produced in a year and that breeding is continuous here in stored beans infested while in the field.

Lima beans and tepary beans may be readily infested experimentally and the former have been found appreciably injured in the field. It is curious that the individuals developing at the expense of lima beans are much smaller than those from either common or tepary beans. This is also true of the individuals of *Bruchus quadrimaculatus* and the Dolichos weevil bred from the same host. I have so far been unable to rear the bean weevil from other beans and peas, though my experiments are as yet inconclusive.

From 187 beans of three different varieties including red kidney and bayou, the third of a similar size, all naturally infested in the field, 370 weevils emerged or a little less than 2 per bean. Of these 115 emerged from beans which produced only a single beetle.

Bruchus chinensis in Hawaii.

This species has been recorded elsewhere as breeding in seeds of *Phaseolus radiatus* (=*articulatus*), *Phaseolus mungo*, *P. vulgaris*, *Cajanus indicus*, *Pisum sativum*, *Ervum lens*, *Cicer arietinum*, *Dolichos lablab*, *Glycine hispida*, *Vigna chinensis*, and indefinitely from beans. It is common here, attacking pigeon peas in the field, the eggs being laid either upon the unbroken pod or if the pod has cracked open, as is common when the ripe pods have remained for some time on the bushes, upon the peas. When the eggs have been laid upon the pod and adults have bred out from the peas, they mate and oviposit before cutting their way out of the pod. Oviposition takes place within a few hours after emergence and mating, often within a few minutes.

Experimentally I have been able to secure oviposition upon 40 species of leguminous seeds and adults have been bred from *Phaseolus articulatus*, *P. aureus*, *Vigna chinensis*, *Cajanus indicus*, *Glycine hispida*, *Cicer arietinum*, *Vicia faba*, and *Pisum sativum*. Repeated experiments have failed to secure breeding in common beans, lima beans, tepary beans.

Bruchus chinensis has the shortest life cycle of any of the species studied, adults often emerging during the winter season here in 29 days from oviposition.

In storage *B. chinensis* does not seem to be able to hold its own in competition with *B. quadrimaculatus* though why this should be true is not apparent since in the only experiment made when adsuki beans were placed with large numbers of adults of both species *B. chinensis* emerged in large numbers from the infested beans in due time.

Bruchus quadrimaculatus.

This species has been met with here only as a stored bean and pea weevil, in no case so far has it been found depositing its eggs upon the pods of its host-plants in the field. In one instance the pods of pigeon peas were picked from the immediate vicinity of a building in which the adults were emerging in large numbers from the stored pigeon peas and cowpeas but only *B. chinensis* emerged from the peas. In North America it readily attacks its hosts in the field but in India this tendency to limit its attacks to stored seeds has been noted.

The species is recorded as breeding in cowpeas and peas. I have bred it experimentally from *Phaseolus lunatus, P. articulatus, P. aureus, P. acutifolius, Vigna chinensis, Vigna lutea, Cajanus indicus, Dolichos lablab, D. sudanensis, Glycine hispida, Cicer arietinum, Vicia faba,* and *Pisum sativum.*

It requires from 40 to 50 days to complete its transformations during the winter season in Honolulu. Mating and oviposition take place shortly after emergence from the seed.

Bruchus prosopis.

This species was originally described from the Colorado Desert of California but is now known also from South America and may well have reached us from there. In California, Arizona and Texas it is known to breed in the seeds of *Prosopis glandulosa* and *velutina,* mesquite, and *P. pubescens,* the screw bean. It has been known for many years in Hawaii as a serious enemy of the algaroba or kiawe, *Prosopis juliflora.* Mr. Fullaway records breeding it from pigeon peas, but this has not come under my observation.

Adults of *Bruchus prosopis* confined in tubes feed readily on sugar and water and upon the syrupy fluid in the pods of its host-plant, but I was for a long time unable to secure normal oviposition. Several scattered eggs were seen which later disappeared, laid at random without cement to attach them. One was placed in a crevice in the hilum of a velvet bean and another under a flap of the cuticle on a *Prosopis* pod. The habits of the closely related bean bruchus suggested that it might perhaps oviposit in crevices, but the account given by Mr. Fullaway in the Hawaii Ag. Exp. Sta. Rept. for 1912 had led me to expect an egg cemented to the surface of the pod. However, failing to secure such oviposition and failing to find any differences among the bruchid eggs deposited on the surface of the *Prosopis* pods, some of the pods were examined for openings and in the syrupy pulp of the pods were found some eggs resemblnig those of *B. obtectus,* eight or ten in a place which had been deposited through accidental openings through the cuticle and fibrous layer of the pod. Upon placing pods of *Prosopis,* in which similar holes had been made, with several individuals of *B. prosopis* among which were known to be females ready for oviposition, within fifteen minutes three females were observed with their ovipositors inserted through the artificial openings and eggs similar to those previously observed were found there. Accidental openings for oviposition can hardly ever fail to occur in sufficient numbers on account of the suspension of the pods on the spinose tree and their consequent swinging about in the wind against the branches and spines. Much breakage and penetration of the skin must also take place in falling. The cuticle also tends to flake away when the pod is ripe, giving the female a chance to oviposit under flaps of cuticle, and eggs are sometimes placed there.

Spermophagus sp.

Among some beans assembled by Director Westgate of the Hawaii Agricultural Experiment Station for some experimental work on the prevention of *Bruchus* injury were some lots purchased in the open market. A bruchid bred from these was found to be a species of *Spermophagus* not hitherto observed here. It is a smaller species than the American bean-weevil and shorter and more compact. In the female there is visible to the naked eye a transverse whitish spot on each elytron near the middle, while the male appears uniformly gray above. The body is black and the antennae slender in both sexes, about three-fourths as long as the head and body together and black except for the two basal joints, which are rufous. Examination of beans grown on the Station grounds showed that they too were infested by the same weevil.

Several varieties showed infestation, among them Maui calico, the Maui red, and small white navy beans. All those examined which showed infestation had been oviposited upon while in storage, as was to be seen from the presence of the eggs upon them. In most cases several eggs, from five to ten, and in one case as many as twenty-four, may be laid on a single bean. The eggs are cemented to the bean, much flattened, and nearly circular in outline. As many as 13 adults have been bred from a single mottled bean 10|16 by 5|16 in. in length and breadth, and six from a small white bean only 5|16 by 3|16 in. Examination of 102 mottled beans naturally infested gave an average of 4.77 beetles emerging from each bean. The species is speedily destructive to the beans, more so than *Bruchus obtectus*. Mr. Cowan, who had noticed this species as different from the common bean-weevil, observed it first during 1917.

If, as I have supposed it may be, this species is the species called the Mexican bean weevil by Chittenden, *Spermophagus* (*Zabrotes*) *pectoralis* Sharp, it has previously been bred from beans and cowpeas. I have been able to breed it experimentally from *Phaseolus vulgaris, P. lunatus, P. articulatus, P. acutifolius, Vigna chinensis, Cajanus indicus, Glycine hispida, Cicer arietinum,* and *Pisum sativum.*

Caryoborus gonagra.

This weevil breeds in the seeds of several trees and shrubs, among them *Tamarindus indicus, Cassia nodosa, Cassia fistula, Cassia grandis, Acacia farnesiana, Prosopis juliflora, Bauhinia tomentosa, Bauhinia monandra,* and *Caesalpinia pulcherrima.*

The eggs are laid indiscriminately on the pods of its host-plants, sometimes also on the seeds and frequently in other places where the larva has no chance whatever of finding food. It is remarkable that the newly hatched larva can find its way through the dense tissues of the pods and the hard seed coats unless it finds some food in the material penetrated. The larval stage passed within the seed resembles a *Bruchus* larva with functional legs. The final stage is dull reddish, the integument is finely pubescent, and there are six short functional legs. If a single seed is insufficient to nourish the larva it can enter and feed upon others. When the larva is full fed the seed is usually too small to form a comfortable pupal cell and it emerges part way or entirely from it and prepares for the emergence of the adult by scraping away a circular patch on the pod until only a thin membrane remains, and spins an oval cocoon of a coarse, silk-like substance usually attaching the scrapings produced in making preparations for emergence to the edges of the opening in the seed and spinning the cocoon partly within the seed.

Bruchid Parasites in Hawaii

*Uscana semifumipennis.**

At the time of my arrival in the Islands in 1913 *Caryoborus gonagra* was one of the most abundant insects coming to light but its numbers have become much less, probably on account of the accidental introduction of the Trichogrammatid egg parasite *Uscana semifumipennis.* This has been supposed to have been introduced from Texas in 1909-10 in some work done by Mr. Fullaway in co-operation with the Federal Bureau of Entomology, but this need not be the case, since it can hardly reach the concealed eggs of *B. prosopis.* It is quite likely that it entered with some other Bruchid such as *Bruchus chinensis* or some species which has not become established and from our experience with larger and more conspicuous species it could have been present for a long time without attracting attention. It was first discovered by Mr. Fullaway in the latter part of 1910 and by 1912 he found it parasitizing about 25% of the eggs of *Caryoborus gonagra* on the pods of *Prosopis juliflora.* At the present time it seems to be even more effective since the examination of about six hundred eggs in two lots from different parts of Honolulu of similar material

* Girault, Trans. Am. Ent. Soc., 37, p. 23, 1911.

has shown a parasitization of about 90%. I have found it attacking also the eggs of *Bruchus pruininus, B. chinensis,* and the Dolichos weevil and it will probably attack any of the species depositing their eggs on the surface of pods and seeds in the field. This species must be considered a most valuable addition to the parasitic fauna of the Island, particularly since it seems to be the only known egg parasite of *Bruchidae.*

Heterospilus prosopidis.

In the same sweepings which contained the *Bruchus pruininus* were found individuals of an unfamiliar Braconid which was later bred from *B. pruininus.* It was then recognized by Mr. Fullaway as a species of *Heterospilus* introduced by him in the work before referred to. In the Annual Report of the Hawaii Agr. Expt. Sta. for 1910 he says, under the head of algaroba weevil parasites, "At the beginning of the year shipments of bean weevil parasites were received through the cooperation of the Bureau of Entomology. * * * Later a search was made to find if they had become established but this could not be demonstrated except in the case of the minute egg parasite. * * * All attempts to breed the parasites in confinement failed. * * * On advice only *Heterospilus* was released and in all 2303 were liberated. * * * The parasites were mostly liberated on the grounds of the experiment station. One lot of 250 specimens was released on the Alexander & Baldwin plantation at Puunene, Maui, another lot of 200 on the Isenberg ranch at Waialae, Oahu, and another of 100 on the Molokai ranch near Kaunakakai."

This species was described in 1911 by Viereck (Proc. U. S. Nat. Mus. 38:381) as *Heterospilus prosopidis* from Texas and Louisiana and Cushman (Journ. Econ. Ent. 11:489-509) records it as a parasite there of *Bruchus prosopis* bred from *Prosopis pubescens, Bruchus exiguus* breeding in seeds of *Amorpha fruticosa, Bruchus ochraceus* breeding in the two-seeded pods of a species of *Vicia, Bruchus sallei* breeding in pods of *Gleditsia triacanthos* and *Bruchus bisignatus* bred from *Acuan* *illinoensis.* I have bred it in Honolulu during 1917 from *Bruchus prosopis* in the pods of *Prosopis juliflora,* from the dolichos weevil in the beans of *Dolichos lablab* within the pods, from *Bruchus pruininus* in the seeds of *Leucaena glauca* on the ground, and from *Bruchus chinensis* in pigeon peas.

It has not been observed in the Islands before since its introduction, but it may now be found quite commonly beneath the *Leucaena* bushes or bred in numbers from its various hosts.

The adults mate readily in captivity with but little preliminary courtship and the females oviposit readily in captivity in the seeds of *Leucaena,* in the pods of *Dolichos* and in various bruchus-infested seeds of legumes. The female is perhaps attracted by the movements of the bruchus larva as it prepares for pupation, oviposition taking place when the larva is full-grown the egg frequently failing to hatch before the bruchus larva has transformed *Heterospilus* then developing at the expense of the bruchus pupa. The egg is spindle-shaped; the poles are slightly different in form; and attachment is by one end and is slightly oblique to the perpendicular; the egg may be fixed on almost any part of the bruchus larva.

The species having been introduced as parasite of *Bruchus prosopis* and not proving in Mr. Fullaway's hands easy to breed in that host in captivity, it has been interesting to learn the conditions under which it oviposits in the pods of *Prosopis.* The structure of the *Prosopis* pod as it drops from the tree would seem to prevent oviposition on account of the moderately short ovipositor of *Heterospilus.* The ripe pods of *Prosopis juliflora* in the Islands may be from five to seven or eight inches in length, a half inch in width, and about five-eights of an inch in thickness, about an eighth of an inch of material intervening between the seed and the surface of the pod. The outer layer of the pod is made up of a thin, firm cuticle supported by a very thin fibrous layer; this layer is separated from the inner layer of the pod by a soft pithy substance filled with a syrupy fluid; around each seed a firm woody layer forms a separate envelope within which the seed rests loosely. *Bruchus prosopis* oviposits in the pod while on the tree or after it has fallen to the ground and the larva on hatching bores its way through the woody envelope and into the seed. Upon reaching full growth it has consumed the contents of the seed and has grown so large, ordinarily, as to make the seed too small for a comfortable pupal chamber. It then eats its way through a hole in the seedcoat, gnaws away a part of the woody envelope, marks out a circle there almost cut away so as to permit the emerging adult to force its way out of the pod easily, and attaches the seed coat and the debris to the envelop to form a pupal chamber. It is at this time that the *Heterospilus* oviposits in the pod and by this time in the moister parts of Honolulu the pod lying on the ground has been wet by the rain, the syrupy fluid and pithy substance have fermented and disappeared, and the thickness intervening between the larva and the outer world has been reduced to no more than a sixteenth of an inch, which permits oviposition. Where there is less rainfall the fermentation may not take place and this does not interfere in the least with the emergence of the bruchus but I have not as yet found the *Heterospilus* breeding in such places. The thin membranous pods and thin seed coat of *Dolichos* and the seed coat of *Lucaena* thinned for the emergence of the adult present no particular mechanical obstacles to oviposition.

The position assumed by the female in oviposition is with the legs widely separated and the abdomen slightly bent down. The sheaths of the ovipositor are used to stiffen and guide the ovipositor during the act of penetrating the pod or seed, and during the act of oviposition and while removing the ovipositor are moved slowly up and down. The sheath bases and ovipositor base are rather widely separated and while the ovipositor is inserted the thicker terminal parts of the sheaths grasp the ovipositor longitudinally and the slender basal portion of the sheaths are sharply bent to form a sort of support for it. I have been unable to distinguish the actual passage of the egg along the ovipositor or to observe an actual stinging of the bruchus larva though it probably takes place. In captivity I have succeeded in getting the *Heterospilus* to oviposit in the cocoon of *Caryoborus gonagra* though as yet I cannot say if it will develop at its expense. I have not found it attacking it in nature. Doubtless it will be found parasitizing the other species of *Bruchus* whenever favorable conditions offer in the field.

I have been able to distinguish three larval stages in *Heterospilus* and there are doubtless one or two intermediate ones not observed. The first resembles in a general way the first larval stage of the Opiine Braconids, as observed by Mr. Pemberton, though the head is, perhaps, somewhat less chitinized. The second stage is fusiform and somewhat flattened and the head is without mandibles. It is migratory and so far as I have been able to learn usually locates itself in a dorsal position on its host, in the cases observed upon the thorax. The final larva is of the usual eruciform type with mandibles and feebly chitinized head. The full-grown larva spins an elliptical brownish white silken cocoon within the pupal chamber of the bruchus host and the adult emerges from the seed or pod of the host plant through a circular emergence hole somewhat smaller than that of the bruchus

Heterospilus prosopidis is quite variable in size according to the size of its host. Those from *Bruchus prosopis,* the largest of its local hosts, being much larger than those from the little *Bruchus pruininus.*

On account of the brief period in the life of its hosts in which it can attack them, only a small proportion are parasitized, certainly not more than 10–15%. It would seem therefore to be of but minor importance in the control of Bruchids. I should not expect it to attack Bruchids in stored peas and beans.

A New *Scleroderma* Attacking *Bruchidae.*

Early in November, 1917, while examining old pods of *Prosopis juliflora* on John Ena road, Waikiki, I found a female *Scleroderma* which, however, escaped before I could examine it carefully. On November 23, while examining pods of *Acacia farnesiana* infested by *Caryoborus gonagra* along the Diamond Head road on the southeastern side of Diamond Head, I found several females of the same species without being able to note any indication of host relations. Since all of our species hitherto found in the mountains under conditions indicating their endemicity so far as their host relations are known have been parasitic upon various lepidopterous larvae, it seemed possible this species might be connected with the klu tortricid (*Cryptophlebia illepida*). However when a larva of this species had been found and placed with the *Scleroderma* no interest whatever was shown. On further search, a cocoon of *Caryoborus gonagra* was found containing the *Caryoborus* larva, a female *Scleroderma,* and three hymenopterous larvae. After this, two *Caryoborus* cocoons were found each containing remains of the *Caryoborus* larva, a female *Scleroderma,* and a compactly massed cluster of brownish, elliptical, hymenopterous cocoons, perhaps a dozen in a cluster. From one of these, sixteen days later, the first female *Scleroderma* emerged. Several of the *Scleroderma* were placed with the cocoons of *Caryoborus* and the pupal chambers of *Bruchus prosopis* and they immediately became interested in affecting their entrance into them by tearing away the wall with their mandibles. One cocoon of *Caryoborus* opened sixteen days later contained the *Caryoborus* larva, the female *Scleroderma,* and eight thick elliptical eggs, very large in proportion to the *Scleroderma* and scattered about indiscriminately in the cocoon.

This finding of the female *Scleroderma* remaining within the cocoons, not only until the eggs are laid but afterward until the larvae have hatched and become full fed and pupated, is of considerable interest and has also been observed in connection with the endemic species. There would seem to be some approach to maternal care of the larva. It may, however, be due merely to the slow maturing of the eggs.

In 1909, Mr. Swezey took the same *Scleroderma* upon a Cycad stem at Lihue, Kauai, and there are specimens of apparently the same species in the collection of the Board of Agriculture and Forestry taken by Mr. Ehrhorn in Honolulu and labeled "from *Prosoplus*", which is one of our immigrant *Cerambycidae*.

The hitherto known Hawaiian species of *Scleroderma* are supposed to be endemic and are, as has been said, parasitic upon lepidopterous larvae. So far as I have been able to examine them characters have been seen which suggest their separation into a group of perhaps subgeneric rank owing to the presence of rudimentary ocelli in the female. The present species is known only in the female sex and has not the slightest trace of ocelli. It is believed to be an immigrant perhaps from the Orient and is here described as new.

Scleroderma immigrans sp. nov.

Female apterous, ocelli and scutellum entirely lacking. Head oblong, anterior, lateral, and posterior margins almost straight; eyes oval, facetted, more than twice their length from the occipital margin of the head and about twice their width from each other; with broad distinct malar and genal spaces; mandibles stout and tridentate; antennae approximate, inserted near the anterior margin of the head, 13-jointed; scape slightly incrassate, curved, about one-third the length of the flagellum; pedicel one-half the width of the scape, about as long as the first three joints of the flagellum; flagellum stout, broadest at the base of the apical segment which is a little longer than broad, the other segments broader than long.

Thorax a little narrower than the head, nearly twice as long as broad, broadest in the middle where the pleurae project beyond the mesonotum; pronotum narrowed abruptly in front to a marrow neck, behind this evenly but slightly wider to the mesonotum, a little longer than wide, the posterior margin nearly straight; mesonotum subtriangular, evenly rounded behind; propodeum a little longer than broad slightly broader behind, rounded down to the declivity.

Legs rather stout; anterior femora somewhat incrassate; anterior and middle tibiae a little shorter than their femora; hind tibiae a little more slender and a little longer than their femora; tarsi longer than their tibiae or femora, the basal joint about as long as the three following joints together, apical joint about as long as the two preceding joints together.

Abdomen broader than the head, elongate, a little longer than the head and thorax together; first tergite rounded, occupying but little of the dorsal aspect of the abdomen, tergites two, three, four subequal in length, a little broader than long; tergites 2-5 with the posterior margins triarcuately depressed; ultimate segment acute.

Testaceous sometimes drying to piceous, tergites 1-5 castaneous except at the sutures, eyes black, mesonotum, mesopleurae, middle femora, and head somewhat darker than the other light portions of the body.

Head, thorax and abdomen minutely tessellate, shining, the propodeum somewhat duller. Head with a few scattered minute punctures. Antennae minutely pubescent; head, thorax and abdomen, particularly at apex, with a few scattered hairs; front and hind tibiae sparsely ciliate within, middle tibiae densely so on the outer side.

2.75 mm. long.

Described from 13 individuals taken from the pods of *Acacia farnesiana* on Diamond Head road, Oahu, Hawaiian Islands, on November 23, 1917, where they were parasitizing the larvae of the bruchid *Caryoborus gonagra*. Of these one has been designated as the type and deposited in the collection of the Hawaiian Entomological Society. The remaining are in the collection of the author and are designated as paratypes.

Scleroderma immigrans does not seem to be able to parasitize any great proportion of the larvae of *Caryoborus gonagra*. I should estimate that not more than 10% of the cocoons examined in the place where it was found were affected and I have not found it elsewhere in Honolulu upon this host. If Mr. Ehrhorn's material are, as I have supposed, of the same species, we may expect it to attack various other species of coleopterous larvae.

A Eupelmine Occasionally Attacking *Bruchidae,* Forming the Type of *Charitopodinus* gen. nov.

While sweeping for material on an embankment in the rice fields at Waikiki where seeds of *Leucaena glauca* were scattered on the ground and being attacked by the *Bruchus pruininus,* I took a single wingless female of a dark blue *Eupelmine* which I later placed with seeds of *Prosopis juliflora* infested with *Bruchus prosopis*. After a time she was observed in the act of oviposition and on a later examination of the seed in which oviposition had taken place there was found a pupa of the Prosopis bruchus which appeared to be too far advanced for the development of the parasite. There had been deposited two of its elliptical eggs, one on the dorsal side of the thorax and the other on the ventral side of the abdomen. Another pupa of *B. prosopis* in about the same stage was later found with a full-fed larva on the dorsal aspect of its abdomen and this latter pupated; so the parasite can develop on very advanced pupae, or perhaps we may say upon tenerous adults. In all five adults have been bred from *Bruchus prosopis,* mostly larvae. Since this paragraph was written I have bred this parasite from *Bruchus pruininus* under natural conditions in the seeds of *Sesbania sesban.* Mr. Timberlake has succeeded in breeding five adult females from the cocoons of *Caryoborus gonagra.* These were the progeny of a virgin female which I had furnished him. Whether this species is more than an occasional parasite of *Bruchidae* is doubtful since it proves to be the insect bred by Mr. Swezey from *Isosoma* and described by Mr. Crawford as *Eupelminus swezeyi* (Insec. Ins. Menst. 2:181, 1914). By a *lapsus calami* Mr. Crawford assigns the *Isosoma* from which it was bred to Johnson grass instead of Bermuda grass. Mr. Swezey has also bred it from the cocoons of *Chelonus blackburni* and from a *Cryptid* cocoon. It was taken as early as June, 1905, on Oahu by Mr. Swezey and in May, 1906, on Kauai by Mr. Terry and it was doubtless an immigrant from the Orient since there are five specimens in the collection of the Hawaiian Sugar Planters' Association taken by Mr. Muir at Macao.

This species differs so much from the type of the genus *Eupleminus, E. excavatus,* that it must be placed in a separate genus, particularly since specimens in the collection of the Hawaiian Sugar Planters' Association represent another species taken by Mr. Terry in China, agreeing with it in all the generic characters.

Charitopodinus gen. nov.

Type *Eupelminus swezeyi* Crawford.

Related to *Charitopus* Foerster but with but one pair of rudimentary wings in the female, the male unknown. Head broader than the thorax or abdomen, convex before and behind, slightly concave at the insertion of the neck, malar furrow very distinct, eyes oval, ocelli arranged in an obtuse triangle upon the vertex; antennae with scape cylindrical, slightly curved, not quite half as long as the flagellum, flagellum slender, gradually widening to the club, pedicel one-third longer than the first funicular joint, 1st funicular joint about half the length of the second, 2-4 subequal, others successively shorter, last two quadrate, club with three closely fused joints, ovate, funicular joints 5 and beyond and the club joints with rows of elongate sensoria, a few also on 3 and 4; mandibles short and stout, tridentate, the two upper teeth blunt, the lower one more produced and somewhat acute; labial palpi 3-jointed, third joint about as long as the other two, second short and oblique; maxillary palpi 4-jointed, the last joint about as long as the other three expanded suboval with one side straight.

Thorax more than one and a half as long as wide; pronotum quadrate, with a transverse median ridge upon which are two pencils of long erect blackish bristles, impressed behind the ridge; mesonotum oblong, slightly narrowed behind, rounded in front, excavated behind, a short furrow in the bottom of the excavation, lateral margins abruptly deflexed at an acute angle and the extreme edge then reflexed, a row of erect silvery cilia in the furrow thus formed, there is thus a profound furrow between the disc of the mesonotum and the prepectoral plate and the large elongate tegula; axillary furrows confluent in front, the scutellum therefore not reaching the mesonotum; a brush of about three close-set rows of erect silvery cilia on the mesosternum along the sternopleural suture.

With one pair of rudimentary wings about as long as the scutellum, consisting of a basal chitinous portion bearing a stout erect blackish bristle and an apical hyaline portion of about the same length with a longitudinal submedian vein, ciliate with erect silvery cilia.

Legs slender, anterior femora slightly thicker; plantar surface of middle tarsi with a shallow groove, basitarsus swollen with the margin of the groove ciliate with very fine hairs but very little different from those of the general surface of the joint, without the spines characteristic of the *Eupelminae,* a minute black dot on either side of the plantar surface of the basitarsus and the second tarsal joint a little before the apex, a single fine bristle on either side of the plantar surface of the second and following tarsal joints near the apex, apex of middle tibiae within bearing a row of short stout black spines, the calcar a little longer than the basitarsi; tarsi of hind legs bearing two feeble calcaria.

Abdomen with the first tergite deeply excised, 2d-4th decreasingly sinuate.

The genus runs to *Charitopus* in Ashmead's tables of *Eupelminae* but would seem to differ by the excavated mesonotum as well as the rudimentary wings in the female. From *Eupelminus* the absence of plantar spines on the middle tarsi, the more elongate and less excavated mesonotum, the less elongate axillae, and the excised tergites and other characters abundantly separate it.

The two species referable to this genus are distinguishable thus:

Tegulae, prepectoral plates, and sides of mesonotum metallic, pronotal bristles about as long as the pronotum ______ *C. swezeyi*
Tegulae, prepectoral plates, and sides of mesonotum yellowish, pronotal bristles shorter ______ *C. terryi* n. sp.

Charitopodinus swezeyi (Crawford). Mr. Crawford's description of this species may be supplemented further by these additions: Middle tarsi except apical joint, calcar except extreme apex, and tibia at base and apex pale, a pale elongate spot on the ovipositor sheaths above.

I have seen 23 examples of this species which vary greatly in size according to the host from which they have been bred. No males have been seen.

Charitopodinus terryi n. sp. Resembles *C. swezeyi* in minute details of pubescence and sculpture. The coloration differs in no significant way except as indicated above and in the pale markings of the hind legs. Hind tarsi except apical joint, apex of tibiae, trochanters, and coxae at summit pale while the hind legs in *C. swezeyi* are dark throughout. The two specimens before me are 3.6 mm. in length larger than the original specimens of *C. swezeyi* but not any larger than specimens of that species bred from *Bruchus prosopis.*

Described from two females collected by the late F. W. Terry at Kow Loon, China, in 1908, one of which has been designated as the type and the other as a paratype. Type and paratype in the collection of the Hawaiian Sugar Planters' Association.

Pteromalids Attacking *Bruchidae*.

At various times I have bred from *Bruchus quadrimaculatus* infesting pigeon peas in storage a *Pteromalid* doubtfully referred to *Pteromalus calandrae* and this species has been readily bred experimentally from the Dolichos weevil and *Bruchus chinensis.* The early part of the larval stages is passed as an internal parasite of the *Bruchus* larva. When nearing full growth the *Pteromalid* larva emerges from its host and completes its development externally. A second undetermined Pteromalid has been bred from *Bruchus pruininus* breeding in the seeds of *Sesbania sesban* in the partially opened pods upon the tree.

Pediculoides ventricosus.

In all the work undertaken upon the *Bruchidae* and their parasites the mite *Pediculoides ventricosus* has been troublesome, causing the loss of much of the material worked with, parasites and *Bruchidae* alike in larval, pupal and adult stages.

I have had whole lots of eggs of *Bruchus obtectus* destroyed by it. It is not possible to judge as yet how much influence it has upon the different species under natural conditions but there can be no doubt that it is a considerable factor in all the species. Persons handling the pods of *Prosopis juliflora* and of common beans are frequently affected by a rash produced by the young mites attaching themselves to the human skin. The mites affect the weevils more generally in some seeds than in others, according to whether the texture of the seed or its covering permits ready entrance or not. Thus all my experiments with the chick pea were seriously affected and in many cases not an adult was able to emerge on account of its attacks. The mesquite weevil is particularly subject to its attacks on account of its method of forming the pupal cell. Any introductions of the larval parasites of *Bruchidae* would need to be carried on with particular care to reduce the attacks of this mite upon them.

Observations and Reflections on the Oviposition of *Bruchidae* and Some Other Insects.

Early in November of 1917 while on the lookout for material which would throw light on the habits of *Bruchus pruininus,* a tree of opiuma (*Pithecolobium dulce*) was encountered at Waikiki, beneath which were lying on the ground considerable numbers of its seeds which were found on examination to have eggs of *Caryoborus gonagra* deposited on them, mostly on the side lying next to the ground. In all about a hundred seeds bearing eggs were found beneath this tree and thirty-five or forty of them were carefully examined and in no case were larvae found in a living condition within the seed nor were there any traces of successful breeding in them. In most cases the larvae had been able to penetrate through the seed coat into the cotyledon and had perished there as the result of their first meal upon its substance. Beneath the same tree were found scattered a number of the seeds of a *Livistonia* palm and on several of these round seeds, also utterly unfit for its food, the *Bruchid* had deposited eggs. Mr. Swezey reported, in 1912, the eggs of *Caryoborus* deposited on green bananas where they hatched and the young larvae died after eating some way into the skin of the fruit. In one case I saw its eggs densely peppered over the surface of the wooden slats of the shutters of a house. We have, then, in this species a striking failure of an insect to discriminate in regard to oviposition upon suitable material for the larval food.

In the case of the *Bruchus pruininus* I have found the eggs deposited under natural conditions on *Ipomoea* seeds, on castor beans, and on seeds of *Cassia glauca,* in none of which the larvae can breed, and on indigo seeds which give an adult so small as to suggest sexual impotence. In experimental work almost any of the legumes used would be oviposited on without regard to its suitability as larval food. It would not be difficult to assemble many similar cases among other groups of insects. Thus the Mediterranean fruitfly (*Ceratitis capitata*) seems particularly fond of ovipositing in the rough-skinned lemon locally common in Honolulu though ordinarily none of the larvae produced can mature. Mr. Pemberton has found that in captivity the Opiine parasites, *Opius humilis, Diachasma tryoni,* and *D. fullawayi,* readily oviposit in the melon fly (*Bactrocera cucurbitae*) though entirely unable to develop there. Mr. Timberlake has observed *Dinocampus terminatus* ovipositing in Coccinelids in which they fail of development. Such "failures of instinct" to employ an old-fashioned term might be dismissed as "imperfect adaptations," but they seem worthy of some consideration since they seem to me to be of some importance in the economy of the species.

I take it that oviposition is an act resulting from several sensory impulses acting together upon the female in a state of nervous tension owing to the presence in her body of eggs ready for laying. These external stimuli may be tactile, visual, or olfactory or they may be compounded of these and other factors. Oviposition then is a complex reflex and will take place whether the material encountered is suitable for food or not. In some species the factors of the sensory stimulus are so numerous or so particular that the species will react only under very narrow limits while in others the range of reaction is much broader and in such species we find these "lapses of instinct" occurring. These are the species in which we find considerable adaptability of habits and the wide range of reaction is of value to the species since the eggs laid almost at random serve to find for the species additional sources of food which would be missed by a species reacting within narrower limits.

The adaptability so secured may, as has been shown by Cushman, serve to carry over a species on unusual food when its preferred food-plant for any reason fails to seed. This adaptability may also serve to permit wider dispersal of the species. Thus the adaptability of the *Bruchus prininus* permitted it to shift to *Leucaena glauca* from *Acacia* after having shifted from *Olneya tesota* to the *Acacia,* and it has been able to establish itself in the Islands while the more narrowly reacting *Bruchus pisorum* appears as yet to have failed.

One of the curious things in experimental work with *Bruchidae* is that very often, as shown by breedings made under natural conditions, a species will not naturally breed in certain host plants but when confined with the seeds will oviposit and develop in them. From this it seems to me we must distinguish between the sensory stimuli which cause the *Bruchus* to approach and alight upon the larval food and the oviposition stimuli proper. The visual faculties of the insects appear to be most prominent in the former, at any rate I have seen what were apparently attempts of a *Bruchus* to settle on seeds within a glass tube and resting on the glass over them when actual contact was impossible. In the oviposition reflexes tactile stimuli through the antennae and perhaps the tarsi must play an important part.

In some cases it is possible to analyse the complex reflex of oviposition with interesting results. Mr. Timberlake has been able to show that there is an olfactory element in the case of *Dinocampus terminatus*. By irritating a *Coccinellid,* the natural host of *Dinocampus* so that it exuded fluid from its joints and applying this juice to *Collops* he was able to secure oviposition in *Collops* but without securing development within that host. I have been able to secure a similar result in another case in which the new host was suitable for the development of the parasite.

In April, 1915, while in Capetown, I found an undetermined species of the Ichneumonid genus *Allotypa* breeding in a *Sarcophaga* the larva of which feeds in human excrement. In extensive breedings of Diptera there I did not secure it under natural conditions from any other host. The adult female lies in wait for the larva when it emerges full-grown to enter the soil for pupation and attacks it with great fury and oviposits in its body, the adult parasite emerging from the puparium which is normally developed. On studying the species in captivity, I found that, while *Sarcophaga* larvae introduced into a tube containing the parasites stirred them up into a state of the greatest excitement in which they would attack them with great fury, charging them with the abdomen projected forward between their legs, climbing upon the body of the larvae and stinging them indiscriminately on the first part encountered and even attempted to sting the glass of the tube, any other muscid larvae such as that of *Musca lusoria* living in cow dung would be received with complete indifference, hardly moving away to avoid them as they wandered about in the tube. But if to such a tube containing the *Allotypa* parasites and the *Musca lusoria* larva even a single larva of *Sarcophaga* (of any of the species) was introduced the parasites would be almost as excited as if all the larvae were those of *Sarcophaga* and in this way the parasite was induced to oviposit in the *Musca lusoria* larva and from these larvae adults of the parasite were obtained, from a host which could never be utilized in nature since the olfactory stimulus from the *Sarcophaga* could hardly in nature ever be associated with the *Musca lusoria* larva. This limitation by an olfactory factor causes a waste by the species of large possible sources of food available if the species reacted more broadly. The advantage gained by the narrower limitation is not obvious though perhaps the species wastes no eggs and in nature must rarely fail in readily finding its host.

The complex reflex of oviposition and the physiological reactions must be, like the external physical characters of a species, subject to variation whether Mendelian or Darwinian, and it seems to me that these variations must have played a considerable part in the evolutionary process. The elimination of the olfactory limitation of *Allotypa* to the smell of the *Sarcophaga* would obviously result in a wider range of food selection for the larva, perhaps to a wider extension of the range of the species, and probably in an absolute increase in the numbers of individuals of the species produced so that it would have greater opportunity for variation whether this might be produced by internal factors, by diverse climatic conditions, by change of food, by different nautral enemies, or whatever the forces may be which result in changes in the characters of species. A new olfactory limitation might then arise and serve as a factor in species limitation and segregation.

It is interesting to revert to the *Bruchidae,* to speculate on the few species which depart from the usual habits of the family. Several species of *Caryoborus* are known to attack the seeds of palms; *C. curvipes* attacks several species of palm nuts including the cocoanut, *C. bactris* and *C. luteomarginatus* have been bred from the seeds of the carnauba palm (*Copernicia cerifera*) and an undetermined species, like the others, from South America, destroys the vegetable ivory nuts (*Phytelephas macrocarpa*), the North American *C. arthriticus* feeds in the larval stage in the seeds of palmetto. To account for the development of such food habits and the breeding of *Pseudopachymerus pandani* from Madagascar in the seeds of *Pandanus,* we need not assume that the parent species had any greater variation in its oviposition reflexes than *Caryoborus gonagra* has when it will lay its eggs on palm seeds and on bananas. What we should need to suppose is a variation in its powers of utilizing food and we do not know how little or how great a departure from the normal this would require, nor if it would have to be variation in the structure of the larval mouth parts or of its alimentary canal, or in the composition of its digestive fluids, or in its nervous control, or all these combined. We have found the *Bruchus pruininus* ovipositing on the seeds of *Ipomoea* and here again to secure the development of the habits of such species as the North American *B. discoideus* or the South African *B. convolvuli* breeding in convolvulaceous seeds it is only variation in the powers of food utilization which would be needed. Perhaps the same is true of the North American species *B. flavicornis* and *B. hibisci* breeding in the seeds of malvaceous plants and *B. alboscutellatus* in the capsules of *Ludwigia*. In the European *B. marginellus* such variation has, perhaps, been observed or at least it has an unusual variability in the utilization of food; for while it seems ordinarily to breed in the pods of the legume, *Oxytropis glycophyllos* it has been observed breeding in the capsules of *Verbascum officinale* widely separated in botanical relationship and in other ways.

In considering evolutionary matters too often attention has been centered upon obvious structures, especially those used for the distinction of species in systemic botany and zoology. Food habits, reflexes, tropisms, and transformations are no less characters of species and have played a large part in the development of the species and require consideration when we are making out our explanations.

Leguminous Pods and Seeds with Reference to Their Infestation by *Bruchidae*.

The *Bruchidae* were without doubt descended from a Chrysomelid group in which the larvae attacked the green pods of legumes and the oviposition of such species as *Bruchus obtectus* in which the eggs are laid in crevices in the pods of the host plant may perhaps represent the primitive method of egglaying from which later forms developed in which the eggs were cemented to the larval food. There can be but little doubt that the evolution of the *Bruchidae* has proceeded in directions limited by the peculiarities of the *Leguminosae* and there is an interesting field for work in the investigation of the factors which limit the attacks of the different species of *Bruchidae.* In some experiments summarized further on I have attempted to make a beginning on such investigation. Some of these factors are readily discerned while others remain elusive. The following notes and inferences in regard to the limitation of Bruchid attacks have seemed worth recording.

When a species of *Bruchidae* oviposits in crevices in the pods or in openings made by the female into the pod or if the eggs are cemented to the seed but not to the pod the structure of the pod and its behavior upon ripening are important factors in reference to Bruchid injury. Thus *Prosopis juliflora* is not naturally attacked by *Bruchus pruininus* because of its indehiscent pods yet it readily breeds in the seeds when the coverings are artificially removed and this is also true of the peanut and the beggar's tick (*Desmodium uncinatum*).

In the species of *Bruchidae* cementing their eggs to the larval food they may be attached either to the pods or to the seeds, or in many species either to the pods or to the seeds.

Bruchus pisorum apparently always oviposits upon the pods; *Bruchus pruininus* apparently always upon the seed; while the dolichos bruchus, *Bruchus chinensis,* and *Caryoborus gonagra* may place their eggs either upon the seeds or the pods of their host plants. In any case the larva of the Bruchid finds confronting it on hatching the work of penetrating into the cotyledons of the seed which forms its principal or perhaps its exclusive food. If the egg should have been placed upon a dry, hard, woody pod such as that of *Delonix regia* we may suppose such a barrier might serve to exhaust the reserve energy of the larva so that it would perish before it could have opportunity for feeding. I have no record of finding the seeds of this species attacked by *Caryoborus gonagra* but there are other mechanical difficulties in the way of a Bruchid larva penetrating this seed. We may conceive of a Bruchid larva overcoming such a difficulty as this, however, and that presented by similar difficulties in the hardness of seed coats and tough albumen by timing its attempt at entering so that it would have to encounter them in an immature condition before they have hardened. Whether to serve such a purpose or not, though probably for some other reason, the pea bruchus oviposits only upon the green pods of its host plants. Now in the Islands the host plants of this *Bruchus* are but rarely cultivated and if the species should be brought in through the importation of peas, as we know has been frequently, it would rarely be able to find conditions under which it could breed. This seems to me the probable reason that this species has not as yet been able to establish itself in the Islands.

In the case of *Cassia grandis* there is within the pod in the little compartment about each seed a considerable amount of a pitchy material surrounding the seed which would serve to retard a Bruchid larva and, perhaps, to cause its death. A similar substance but much less copious in quantity is found in the pods of *Cassia fistula* but it does not in either case wholly serve to prevent the entrance of the *Caryoborus* larva.

On the outer surface of the seeds of *Bauhinia tomentosa* and *Bauhinia monandra* is a layer of material which swells up with moisture and shreds away and would serve to detach any bruchus egg attached to it. This does not serve to prevent the entrance of the *Caryoborus* larva since the eggs of that species are usually attached to the pod and the entrance of the larva is affected before the pod is opened and the seed exposed to moisture. Eggs of *Bruchus pruininus* deposited on these seeds in captivity were detached when added moisture caused the swelling and shredding away of this layer.

The surface of some seeds such as those of different species of *Crotalaria* seem to be of such a nature as to prevent the attachment of bruchus eggs. It may be, however, that there is some other reason such as odor or size which prevented oviposition upon them by *Bruchus pruininus* which has otherwise been quite ready to oviposit upon very diverse seeds.

The seeds of *Delonix regia, Acacia grandis,* and of *Peltophorum inerme* among others are covered with a very dense and hard covering and it is doubtful if any *Bruchid* larva could pierce them. Eggs of *Bruchus pruininus* laid on the seeds of the latter species hatched properly but could not penetrate into the cotyledon, perishing before they had pierced the seed coat. They could not, likewise, penetrate the tough seed coat of *Acacia farnesiana.*

Within the seed coat of many leguminous seeds is an albumen which is very hard and tough when dry and this may serve as a sufficient barrier to prevent the further entrance of the larva. The seeds of *Cassia glauca* resemble the seeds of *Leucaena glauca* and *Bruchus pruininus* deposits its eggs upon them freely both in the field and in captivity. The seed coat is, however, harder and there is a layer of albumen within that. The bruchus larva is able to pierce the seed coat but perishes on its way through the albumen.

Seeds, not otherwise defended from bruchus attack, may be unfit for the food of the bruchus attacking it and the larva may perish as the result of feeding on the substance of the cotyledons.

Leguminous seeds vary greatly in their composition but appear to agree in having similar proteids which, as a group, differ from the proteids of other seeds, being said to resemble animal proteids more than those of grains or oil seeds. Their proteids are mostly globulins and the globulins of different species of edible legumes are by no means identical. Thus the phaseolin of the common bean is distinctly different from the legumin and vicilin of vetches, broad beans, lentils, and peas and it is not improbable that the inability of bruchids to breed in legumes otherwise similar in composition to their host seeds may be due to the diversity of ther proteids. The seeds of many legumes, particularly the greater part of the edible legumes, contain more than half their dry weight of starch, while others contain none at all.

In general Bruchids which breed in starchy seeds cannot breed in those without starch and *vice versa.* The soy bean in which the carbohydrate is reduced and not in the form of starch, however, serves for the development of *Bruchus chinensis, B. quadrimaculatus,* the dolichos weevil, and *Zabrotes,* species ordinarily breeding in the other starchy food legumes. Its carbohydrate is, however, of a form similar to starch and is present to about .12 of the dry weight of the seed.

In general the food legumes contain but little oil while in the peanut it may be present to .28–.45 of the weight of oil, largely replacing the starch. While the eggs of *B. chinensis, B. quadrimaculatus,* the dolichos weevil, and *Zabrotes* are readily laid upon peanuts from which the shells have been removed and their larvae enter the cotyledons and the larvae of *B. obtectus* will, likewise, enter them, none of these species can develop and I have supposed their death to be due to the oil. I was, therefore, greatly surprised to find *B. pruininus,* under similar conditions, was able to breed in peanuts, although its other host seeds contain no starch and but little oil.

Many legumes contain poisonous principles, particularly alkaloids and glucosides, and we should expect Bruchids to be affected by some of these. Probably the inability of *Caryoborus gonagra* to breed in the seeds of *Abrus precatorius,* and *Pithecolobium dulce,* upon which it oviposits, and into which the larva can penetrate, is due to poisonous principles in them.

Some seeds are so small as to prevent the oviposition of *Bruchidae* on their surface, since the insect would not be able to reach conveniently any part of the surface of the seed with its ovipositor while resting on its surface and the weight of the insect also tends to dislodge the seed and its precarious position on a small seed seem to disturb the Bruchid so as to prevent egg-laying. Thus *Bruchus pruininus,* which is very catholic in its taste in regard to oviposition, is usually unable to deposit its eggs on such small seeds as those of *Indigifera anil, Desmodium uncinatum,* the smaller-seeded *Crotalarias, Phaseolus* *semierectus,* and *Medicago lupulina,* while it will readily lay them on the larger-seeded *Crotalaria,* and on indigo seeds in the pod.

The seeds of *Cassia siamea* are almost paper-thin and their form alone would seem to forbid them being utilized by any Bruchid.

Entrance of the *Bruchidae* into the Seed.

Those species which cement the egg solidly to the seed itself have the advantage of the support of the egg in penetrating into the seed and need not wander about to find a favorable point for entrance. The species which attach the seeds to the pod at times and those which place them in crevices of the pod or loose among seeds in storage have to meet the problem of placing themselves as larvae in some position where they may secure some other support for the boring operation. If the egg is cemented on the pod directly over the seed the larva will frequently find the surface of the seed lying close against the pod where it has entered and the hole made in entering the pod will serve its purpose. In any case if it misses this point in entering the pod it can easily wedge itself between the seed and pod and get its purchase in that way and the larvae from eggs laid within the pod can do the same. Larvae from eggs of *Bruchus obtectus* laid among beans in storage have been seen to enter where two seeds touch or where seed touched the glass of the tube in which they were under observation.

Emergence of *Bruchidae* from Seeds.

Considerable difference of interpretation has existed as to the emergence of *Bruchidae*, some considering that the larva makes complete preparation for the emergence of the adult while others have supposed that the adult gnaws its way out of the seed. In the case of all *Bruchidae* which I have studied the adult pushes loose from the seed a circular bit of the seed coat which has been gnawed around and loosened from the rest of the seed coat. Upon a careful study of the emergence of *Bruchus pruininus* it was found that in this species the procedure is as follows, the observations being made on it breeding in the seeds of *Leucaena glauca.* In this plant the seeds have a thin, albuminous endosperm which the larva gnaws away more or less on either side of the seed in the latter part of its feeding period, and this is particularly the case just opposite the place where it finally places its head and which will be in contact with the future mandibles of the adult. Here appears a definite circular patch where the albumen is entirely eaten away but if this be examined during the pupal period it will be seen that the circular cut has not yet been made which permits the separation of the bit covering the emergence hole. This is undoubtedly made by the adult just before emergence by revolving in its pupal cell.

TABLE OF EXPERIMENTS WITH VARIOUS SEEDS RELATING TO THE OVIPOSITION AND BREEDING OF HAWAIIAN BRUCHIDAE.

EXPLANATION OF CHARACTERS USED.

a—oviposits but cannot develop.
b—adults have been bred.
n—no oviposition observed.
o—no experiments made, but no oviposition or infestation observed.
1—Recorded by Fullaway but not observed by me.
2—My experiments not yet conclusive, but results so far negative.
3—Apparently can breed but my results not yet conclusive.
4—Reported by Van Dine as breeding but probably erroneously.
5—Very extensive oviposition but apparently but little breeding.

Name and Origin of Seed, Etc.	Bruchus chinensis	Bruchus quadrimaculatus	Dolichos weevil	Bruchus pruininus	Bruchus obtectus	Bruchus prosopis	Spermophagus (Zabrotes) sp.	Caryoborus gonagra
Phaseolus vulgaris, common bean, cultivated locally in many varieties, supposedly of American origin; starchy	a	a	a	a	b	o	b	o
Phaseolus lunatus, lima bean, cultivated locally in several varieties, supposedly of American origin; starchy	a	b	b	a	b	o	b	o
Phaseolus articulatus, adsuki bean, red variety, imported from Japan, of Oriental origin; starchy	b	b	b	a	o	o	b	o
Phaseolus aureus, mung or mundo bean, probably imported from Japan, a greenish yellow variety, also cultivated locally to some extent, of Oriental origin; starchy	b	b	b	a	o	o	a?	o
Phaseolus acutifolius, tepary bean, recently introduced into cultivation locally, of North American origin; starchy	a	b	?	a	b	o	b	o
Phaseolus semierectus, an introduced weed, generally distributed, of American origin; starchy	n	a	n	n	o	o	a	o
Vigna chinensis and *catjang,* cowpeas, locally cultivated mainly for green manure, elsewhere an important food crop, Oriental in origin; starchy	b	b	b	a	o	o	b	o
Vigna lutea, a native beach plant, probably of native introduction; starchy	a	b	a	o	o	o	o	o
Cajanus indicus, the pigeon pea, locally cultivated in several varieties, of African origin; starchy	b	b	b	a	2	1	b	o

TABLE OF EXPERIMENTS—Continued.

Name and Origin of Seed, Etc.	Bruchus chinensis	Bruchus quadrimaculatus	Dolichos weevil	Bruchus pruininus	Bruchus obtectus	Bruchus prosopis	Spermophagus (Zabrotes) sp.	Caryoborus gonagra
Dolichos lablab, the bonavist locally called the papapa bean, of limited use for food, also escaped from cultivation, of African origin; starchy	a	b	b	a	2	o	a	o
Glycine hispida, the soy bean, imported from Japan, a yellowish and a black variety in the Oriental stores, of Oriental origin	b	b	b	b	3	o	b	o
Cicer arietinum, the chick pea, of Mediterranean or West Asiatic origin, imported for food; starchy	b	b	b	n	2	o	b	o
Vicia faba, the broad, Windsor, or horsebean, imported in two or three varieties from California and Japan, also cultivated to a limited extent on Maui and Hawaii at the higher elevations, of Mediterranean origin; starchy	b	b	b	a	2	o	n?	o
Pisum sativum, the common pea, introduced for food, grown to a limited extent on Maui and Hawaii at the higher elevations; starchy	b	b	b	a	2	o	b	o
Arachis hypogaea, the peanut, grown locally only to a limited extent, imported for food, of American origin; starchy and oily	a	a	a	b	2	o	a	o
Lupinus hirsutus, blue lupine, grown to a slight extent at higher elevations for green manure, of European origin; starchy	a	a	o	o	o	o	o	o
Lupinus angustifolius, Italian lupine, grown to a limited extent at the higher elevations on Hawaii for food and green manure, of South European origin; starchy	a	o	a	o	o	o	o	o
Canavalia ensiformis, jack bean, locally grown for green manure, tropical	a	a	a	o	o	o	a	o
Stizolobium pachylobium, velvet bean, grown locally for green manure	a	a	a	a	o	o	a	o
Erythrina monosperma, wiliwili, a native lowland tree, with large bean-like dull scarlet seeds, unknown elsewhere; starchy	o	o	a	o	o	o	o	a
Erythrina indica, Indian coral tree, planted as an oddity, with large dull dark carmine seeds, of Indian origin; starchy	a	a	a	a	o	o	a	a

TABLE OF EXPERIMENTS—Continued.

Name and Origin of Seed, Etc.	Bruchus chinensis	Bruchus quadrimaculatus	Dolichos weevil	Bruchus pruininus	Bruchus obtectus	Bruchus prosopis	Spermophagus (Zabrotes) sp.	Caryoborus gonagra
Abrus precatorius, the praying bean, an herbaceous vine planted for its small bead-like scarlet and black seeds, Indian origin	a	o	o	a	o	o	a	a
Crotalaria spp., rattle pods, weeds, small-seeded species, Indian origin	o	o	o	n	o	o	o	o
Crotalaria juncea, sunn hemp, a fiber plant, but grown locally for green manure, with seeds much larger than the other species, Indian origin	o	o	o	a	o	o	o	o
Indigifera anil, indigo, locally escaped from cultivation and now a weed, American origin	o	o	o	b	o	o	o	o
Sesbania coccinea, a small tree with large ornamental flowers, said to be sparingly escaped from cultivation, Indian and Malayan	a	a	a	o	o	o	o	o
Sesbania sesban, sesban, a shrub or small tree, with small sub-cylindrical seeds, a fiber plant now growing naturally, of American origin	o	o	o	b	o	o	o	o
Leucaena glauca, locally called false koa or koa haole, a small tree or shrub, extensively naturalized, of American origin	a	a	o	b	o	o	o	o
Prosopis juliflora, algaroba or kiawe, a widely distributed tree in the lowlands, the pods forming an important cattle feed, of American origin	a	o	o	b	4	b	o	b
Piscidia erythrina, fish poison tree planted in Thomas Square, of American origin	o	o	o	a	o	o	o	o
Cassia grandis, pink shower, a flowering tree extensively planted, of American origin	a	o	o	a	o	o	o	b
Cassia fistula, golden shower, a flowering tree extensively planted, of Indian origin	a	o	o	b	o	o	o	b
Cassia nodosa, pink and white shower, an extensively planted flowering tree, of Indian origin	a	n	n	b	o	o	o	b
Cassia glauca, a small flowering tree, not very much planted, seeds almost exactly like those of *Leucaena glauca* but the seed coats harder, of Asiatic origin	a	o	o	a	o	o	o	o

TABLE OF EXPERIMENTS—Continued.

Name and Origin of Seed, Etc.	Bruchus chinensis	Bruchus quadrimaculatus	Dolichos weevil	Bruchus pruininus	Bruchus obtectus	Bruchus prosopis	Spermophagus (Zabrotes) sp.	Caryoborus gonagra
Cassia mimosoides, a low slender herbaceous weed, origin tropics in Old World	o	o	o	a	o	o	o	o
Cassia bicapsularis, a spreading semiscandent weedy shrub, of American origin	o	o	o	a	o	o	o	o
Cassia siamea, a flowering tree, extensively planted, of Indian origin	o	o	o	a	o	o	o	o
Cassia occidentalis, a coarse erect weed, of American origin	o	o	o	a	o	o	o	o
Cassia alata, a shrub or small tree, planted for its flowers, of American origin	a	o	o	a	o	o	o	o
Clitoria, sp., an herbaceous flowering vine, planted for ornamental purposes	a	a	n	o	o	o	o	o
Pterocarpus indicus, a large tree with the aspect of an elm and its fruit resembling that of the elm, of Oriental origin	o	o	o	a	o	o	o	o
Desmodium uncinatum, beggar's tick, an herbaceous weed, of American origin	o	o	o	b	o	o	o	o
Delonix regia, "Poinciana regia", a rather small tree extensively planted for its brilliant red flowers, native of Madagascar	a	o	o	a	o	o	o	o
Pithecolobium dulce, a large tree called opiuma by the Hawaiians, often escaped from cultivation, of American origin	a	o	o	o	o	o	o	a
Samanea saman, monkeypod, extensively planted as a shade tree, of American origin	o	o	o	o	o	o	o	o
Albizzia lebbek, a shade tree not very widely planted, of Indian origin	a	o	o	a	o	o	o	o
Albizzia saponaria, a shade tree, only a few trees in Honolulu, of Malay(?) origin	a	o	o	b	o	o	o	o
Adenanthera pavonina, a tree planted for its scarlet seeds, of Indian origin	a	o	o	a	o	o	o	5
Tamarindus indicus, tamarind, a tree planted for its acid pods, of Indian origin	a	o	o	a	o	o	o	b
Bauhinia tomentosa, a flowering shrub, not very generally planted, of Indian origin	a	o	o	a	o	o	o	b

TABLE OF EXPERIMENTS—Continued.

NAME AND ORIGIN OF SEED, ETC.	Bruchus chinensis	Bruchus quadrimaculatus	Dolichos weevil	Bruchus pruininus	Bruchus obtectus	Bruchus prosopis	Spermophagus (Zabrotes) sp.	Caryoborus gonagra
Bauhinia monandra, a small flowering tree rather generally planted, of American origin	a	o	o	a	o	o	o	b
Desmanthus virgatus, a weedy shrub, of West Indian origin	o	o	o	b	o	o	o	o
Acacia koa, koa, a native Hawaiian timber tree, planted to some extent in the cooler parts of Honolulu	a	o	o	b	o	o	o	o
Acacia farnesiana, klu, a spinose shrub or small tree of American origin occupying large areas of the drier lowlands	a	o	o	a	o	o	o	b
Caesalpinia pulcherrima, pride of Barbadoes, an ornamental prickly shrub formerly grown in hedges and sparingly escaped, of American origin	a	o	o	b	o	o	o	b
Peltophorum inerme, a beautiful tree extensively planted, of Malayan origin	o	o	o	a	o	o	o	o

Insects in Relation to Problems of Storage of Food in Hawaii.

BY JOHN COLBURN BRIDWELL.

[Read at November meeting.]

The problem of food storage and food conservation in Hawaii is affected by the destructive action of insects. A considerable number of species of stored-food insects are present but the different ones need not be considered separately since several species may be present in the same food and in general all these attacks are to be combatted in much the same way. There are differences in the resistance among these insects to the action of the instruments of sterilization and the measures resorted to must be adjusted to the most resistant.

Certain general facts in regard to stored-food insects are to be borne in mind. All stored-food insects are developed from eggs and in all of any great importance there is a larval, or grub, or caterpillar stage, followed by an inactive pupal stage before the insect emerges as an adult. In these different stages there is considerable difference in the insect's resistance to fumigation or other means of killing them and the character of the foot product and the way in which it is attacked causes variation in our methods of attack. Compact substances are but slowly penetrated by fumigants and aromatic and fatty substances cannot be subjected to heat.

Generally speaking, food is more likely to become infested in the mill or factory than in the store and in the store than in the home. If the mills and factories can be kept free of infestation there will be but little loss in stored foods consumed in the Islands within a short time after their importation. There is an encouraging increase in the number of mills and factories which sterilize their products before they are placed on the market. No doubt the number could be materially increased if there were concerted demands for such sterilization made by the importers. In many cases the food may become infested either by the adult insect entering loose masses of the food and laying their eggs or by the small larvae entering through the crevices in the containers.

The prevention of injury to food by insects requires that two things must be done, (1) all insects in their different stages must be destroyed, and (2) insects from without must be prevented from gaining access and reinfesting the food or if this is impossible any insects present must be prevented from further development.

The destruction of insects in foods may be secured more or less completely in a variety of ways of which three are of sufficient importance for discussion here. These are: (1) sterilization by dry heat, (2) fumigation by carbon disulfid, or bisulphide, and (3) fumigation by hydrocyanic acid gas.

If any insect is subjected to a temperature of 110° F. long enough for the heat to penetrate its tissues they will be cooked and the insect in any of its stages will consequently be destroyed. In practise it has been found desirable to use somewhat higher temperatures so as to secure quicker penetration of the food material by the heat. It has been found, for instance, that a satisfactory sterilization of peanuts in loose piles may be obtained without injury to their powers of germination if they are subjected to a temperature of 125° F. sustained for six hours. The heat desired may be obtained by piping a room for steam heat with radiators calculated for securing the temperature needed and sustained for the time found necessary by experiment to secure sterilization. The application of dry heat is one of the most generally applicable methods of food sterilization and is rapidly coming into wider use. In the home, cereals and flour may be sterilized in the oven if care is taken to secure a low heat so as not to cause scorching. There can be no doubt that if the dried foods imported into the islands could be treated in a properly constructed steam sterilizing plant before being distributed to the stores that much of the present loss in these products now being suffered would be obviated. Occasionally foods can be sterilized in the sunshine, the direct rays of the sun, especially when shining upon a dark background, serving to produce sufficient heat for the purpose. This method of application of dry heat has been used with some success with weevilly beans. Moist heat on account of its tendency to promote the development of molds is rarely available for foods which are to be stored.

All fumigation methods have the disadvantage of uncertainty and while of very great use where the food is soon consumed are not advisable where long continued storage is planned.

It has been found that carbon bisulphide in the proportion of 2 pounds to 1000 cubic feet, kept in tight receptacles for not less than 48 hours will ordinarily sterilize bags of grain, destroying even the most resistant. More satisfactory results can be obtained where the receptacle is so tight as to permit the air to be exhausted.

One serious objection to the use of carbon bisulphide is the vile odor of many of the commercial grades which would utterly prevent its use in the home except in some outbuilding used for the purpose. Its fumes are also extremely inflammable and explosive when mixed with air. This is, however, a method widely used and with a high degree of success where absolute sterilization is not required.

Another exceedingly important method of fumigation employs hydrocyanic acid gas liberated by the action of sulphuric acid on potassium or sodium cyanide in an excess of water. This gas has higher penetrating power and is enormously more poisonous than the carbon bisulphide gas. Even in relatively loosely constructed mills fumigation with the gas produced by 1 oz. potassium cyanide and 1 oz. of sulphuric acid in 3 ozs. of water for each thousand cubic feet has given satisfactory results. In closer quarters the dose could be considerably reduced. This method of fumigation requires to be handled with great care and is not generally available in the home on account of the deadly poisonous nature of the potassium cyanide and the resulting gas and the caustic and corrosive nature of the sulphuric acid.

Both methods of fumigation may be employed without affecting the germinating properties of seeds. In neither case is there any injury to the food value of ordinary cereals or dry foods. However a food product is sterilized it will become reinfested in these Islands within a few months unless protected in some manner. Even paper and cloth bags give a certain degree of protection and many efforts have been set forth to secure a vermin-proof paper or pasteboard cartons, and some of them have proved quite successful. However, any dry food product intended to be stored for long periods under present conditions should be sterilized in hermetically sealed tin containers. This is the method generally used in tropical countries. In case it is desirable to concentrate on this Island, flour, beans, and other such products for a year, two, or three years' rations there is no reason why it cannot be done in this way. The better mills are now practicing sterilization of their products and without doubt such products could be contracted for on this scale ready for indefinite storage in tins.

Even under present conditions considerable losses in the home may be avoided by sifting all flour and meal as soon as it is brought into the house and enclosing it in tight tins. Cereals in these tins or in packages placed in the oven and heated dry to any temperature not above the boiling point will be sterilized and not injured in any way for storage.

There are certain products which are not readily sterilized and protected in tin containers but are subject to insect attack. Many of these can be kept in ordinary cold storage while in other cases precautions must be taken to reduce the humidity of the air in order that the materials may not become waterlogged.

It is extremely desirable that the problems here discussed with reference to the food supply should be taken up by an entomologist who could devote his entire time to the subject. Our present knowledge of this subject is confined to the incidental observations of men whose other work has commanded the greater part of their attention.

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