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 *elaecocarpi*, 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* sub-genus.

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 thie 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

*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, pro-

notum 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.).

Nesoplcias 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.

*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

*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 world-wide. 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.

*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

*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 corresponding change to take place in the females of the same family, due to the alteration of the germ-plasm of the parent.*

*Pearl and Surface, Science 1915, No. 1060, p. 616.

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

*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
kalia	....	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.

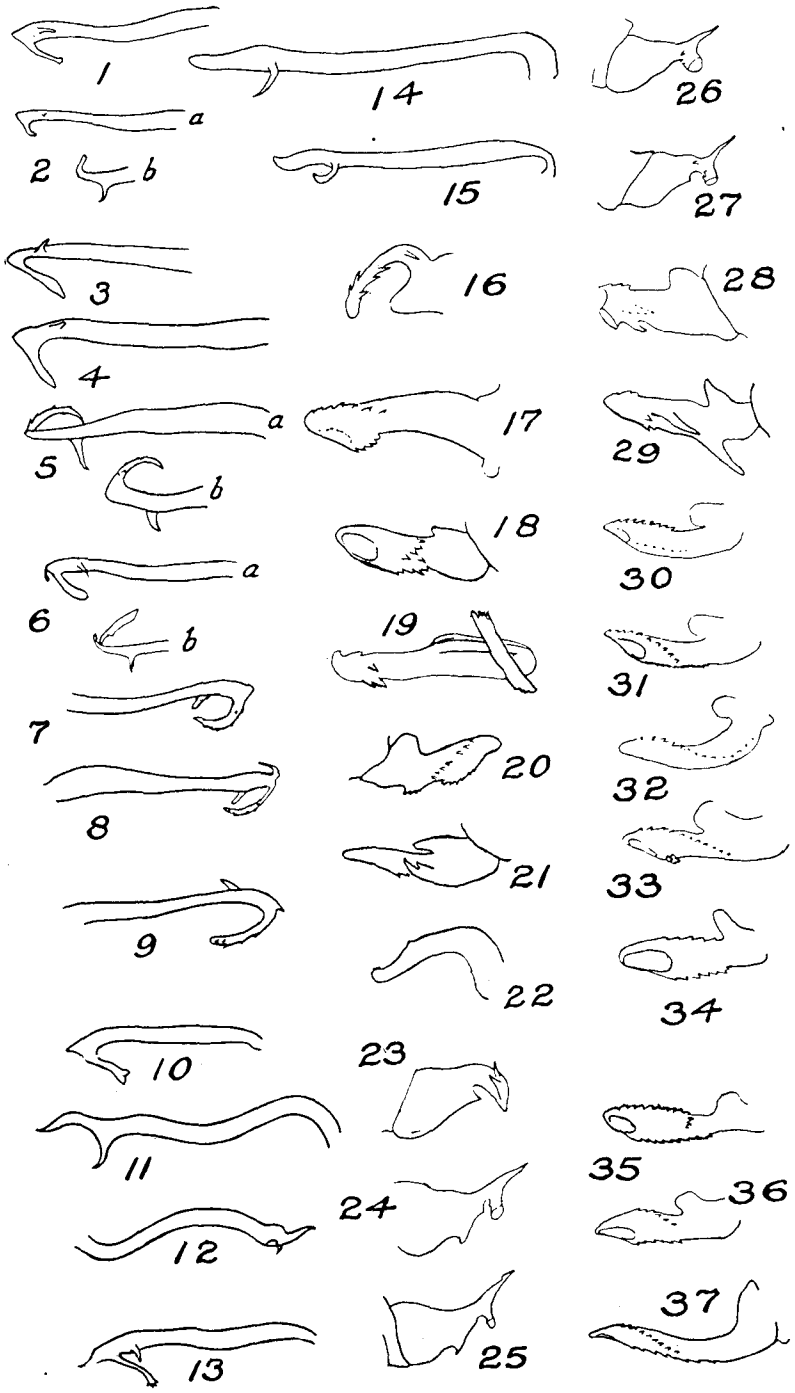

PLATE 3.

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.

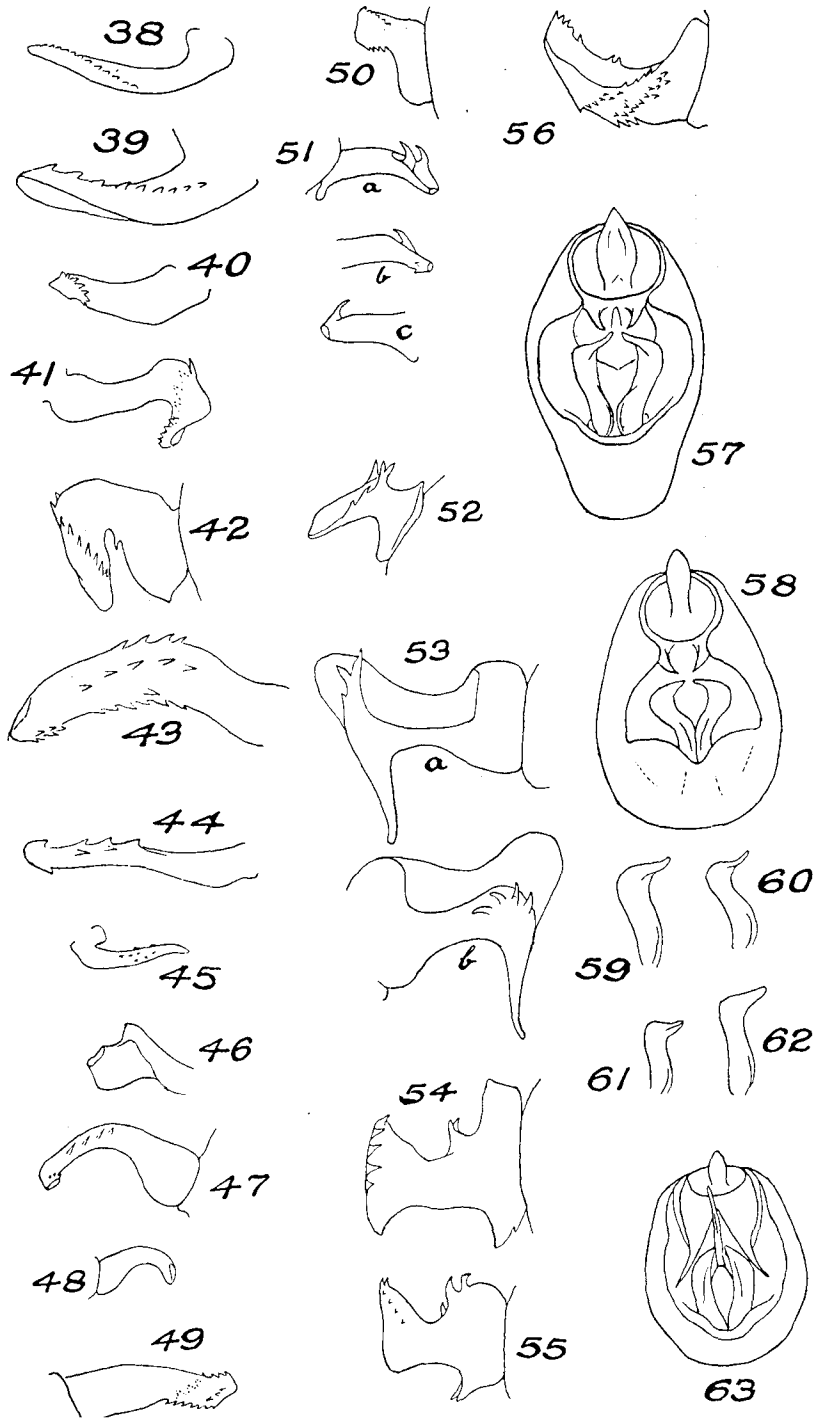

PLATE 4.

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.