

Studies of Hawaiian Neuroptera

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

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INTRODUCTION

This paper had its inception in my attempts to determine the unidentified Hawaiian Neuroptera in Bishop Museum. Early in my studies, I found that it was almost impossible to name most of the species from literature alone. No keys had been published to aid in the determination of our species, and I found it essential to prepare keys before I could work over our collections. I consider this paper only a preliminary contribution toward the knowledge of the Hawaiian Neuroptera; it is far from complete. This report should be used in conjunction with Perkins' excellent section on Neuroptera in *Fauna Hawaiiensis*, and his remarks in the introduction to that work will be found most useful.

Herein are presented keys to the families, genera and, with the exception of a key to the species of the hemerobiid genus *Nesomicromus*, keys to the species of all of the Hawaiian Neuroptera.

There are 60 species of Neuroptera in Hawaii, 54 of these are endemic products, the other six are either purposely or accidentally introduced species. The 60 species are distributed among four families as follows: Coniopterygidae, 1; Myrmeleonidae, 2; Chrysopidae, 28; Hemerobiidae, 29.

The following nomenclatorial changes are made herein: *Eidoleon wilsoni* (McLachlan), new combination for *Myrmeleon wilsoni* McLachlan; *Distoleon perjurus* (Walker) is not a synonym of *Eidoleon bistrigatus* (Rambur); *Anomalochrysa proteus* Perkins is a synonym of *A. hepatica* McLachlan; *Anomalochrysa deceptor* Perkins is a synonym of *A. maclachlani* Blackburn; *Anomalochrysa rhododora xerophylla* Perkins is a synonym of *A. rhododora* Perkins.

Many new locality data are presented herein, and the ranges of some species are shown to be somewhat greater than indicated by Perkins. More extensive collecting must be done to ascertain the limits of the ranges of many species. Dr. Perkins made the largest collection of Hawaiian Neuroptera yet assembled, and I doubt that there have been as many specimens of Hawaiian Neuroptera collected in all the years since Perkins' activity as were collected by that diligent worker.

I wish to thank Professor Nathan Banks of the Museum of Comparative Zoology, Boston, and Mr. D. E. Kimmins of the British Museum (Natural History) for helpful notes pertaining to the Myrmeleonidae and the Hemerobiidae.

KEY TO THE FAMILIES OF NEUROPTERA FOUND IN HAWAII

1. Small insects (less than 4 mm. long) with few wing veins and covered with a white powdery exudation **Coniopterygidae**
Without such an exudation; larger insects with many veins 2
- 2(1). Antennae enlarged distally to form a distinct club **Myrmeleonidae**
Antennae entirely moniliform or filiform and not enlarged distally .. 3
- 3(2). Radius of fore wings with but one sector; transverse veins between costa and subcosta not branched, at least in the basal half
Chrysopidae
Radius of forewings with two or more sectors, that, with their subsequent branches, reach the wing margin; the veins rarely indistinguishable and the wing coriaceous and areolated, but then the hind wings atrophied or absent; usually many branched cross veins between costa and subcosta **Hemerobiidae**

CONIOPTERYGIDAE

Genus **Coniocompsa** Enderlein

Coniocompsa Enderlein: Zool. Anz. 29: 225, 1905.

Coniocompsa vesiculigera Enderlein: loc. cit.

This is an adventitious species recorded thus far from Malacca and Hawaii. It has been swept from *Euphorbia* and *Gossypium tomentosum*; it occasionally comes to light. It has been found on Maui and Oahu, and most of the specimens in local collections have been taken in the dryer regions of Oahu.

MYRMELEONIDAE

Confusion exists in literature in regards to the identities of the Hawaiian ant lions. I hope that the following notes will help to clarify the situation.

Genus **Eidoleon** Esben-Petersen

Eidoleon Esben-Petersen: Arkiv för Zoologi 11(26): 15, 1918.

KEY TO THE SPECIES FOUND IN HAWAII

- Expanse of fore wings 70 to 90 mm.; most of the cells of the fore wings obviously infuscated along the cross veins **E. wilsoni** (McLachlan)
Expanse of fore wings less than 70 mm. to less than 60 mm.; only a few of the cells of the fore wings infuscated along the cross veins, most of the cells without any infuscation **E. bistrigatus** (Rambur)

Eidoleon wilsoni (McLachlan), new combination.

Formicaleo wilsoni McLachlan: Ann. Mag. Nat. Hist. (6) 10: 178, 1892.

Formicaleo ballievi Navas: Revista Real Acad. Madrid, p. 475, 1914; "Patria I. Sandwich, Honolulu, Ballieu, 1871 (Mus. de Paris)." Synonymy suggested by Esben-Petersen: Insects of Samoa, pt. 7, fasc. 3, p. 91, 1928.

This species has the cross vein of *Eidoleon* in the hind wing and belongs in the same genus as *bistrigatus*. The species has been found only in Hawaii and Lanai. It has been reported as common

at various places on Hawaii, including Pahala, Kau, Pokakuloa, Kawaihae, West Kohala, Kilauea, and Puuwaawaa. It is well represented in local collections.

Eidoleon bistrigatus (Rambur) Esben-Petersen.

Myrmeleon bistrigatus Rambur: Hist. Nat. Insects Névroptères, p. 391, 1842.

Distoleon bistrigatus (Rambur) Banks: Ann. Ent. Soc. Amer. 3(1): 43, 1910.

Eidoleon bistrigatus (Rambur) Esben-Petersen: Arkiv för Zoologi, 11: 15, 1918.

When Walker described *Myrmeleon perjurus* (Cat. Neuropt. Insects, British Mus., part 2, 1853), he gave the type locality as Hawaii. An error was made in the locality record, because *M. perjurus* has not been collected in Hawaii. I have seen specimens of *M. perjurus* collected in Guam, and it is probable that the type material came from the western Pacific. This confusion of locality data has resulted in the reduction of *M. perjurus*, apparently based upon misidentified Hawaiian specimens, as a synonym of *Eidoleon bistrigatus*, but it is distinct from that species. *M. perjurus* is now included in *Distoleon*. *Eidoleon* differs from *Distoleon* because it has a small cross vein from the second anal to the wing margin of the hind wing, but such a cross vein is absent in *Distoleon*. True *perjurus* lacks the cross vein and is generically distinct from *bistrigatus*.

Eidoleon bistrigatus is widespread from Australia to the Tuamotu Archipelago in southeastern Polynesia. It has been taken on Hawaii, Maui, Molokai, and Oahu in the Hawaiian Islands, but it is evidently rare. I have seen only four Hawaiian specimens.

CHRYSOPIDAE

KEY TO THE GENERA FOUND IN HAWAII

Fore wings with only two series of gradate cells **Chrysopa**
Fore wings with three or more series of gradate cells **Anomalochrysa**

Genus **Chrysopa** Leach

Chrysopa: Leach, in Brewster's Edin. Encyc. 9(1): 138, 1815.

Two species of *Chrysopa* are commonly found widespread in the islands. One of these (*C. microphya*) has been recorded only from Hawaii and doubtfully from the Tuamotu Archipelago; the other (*C. lanata*) is a South American species. The two species may be distinguished as follows:

Fore wings with the dividing nerve of the third cubital cell joining M before the first cross vein between M and Rs **C. lanata** Banks
Fore wings with the dividing nerve of the third cubital cell joining M beyond the first cross vein between M and Rs **C. microphya** McLachlan

Chrysopa lanata Banks: Proc. Ent. Soc. Wash. 12: 154, 1910.

This species is widespread in South America and has been found on Easter Island. It was first recorded here by Timberlake in 1919.

It often comes to light. Timberlake says that the adults do not eat aphids but feed freely upon honeydew. Swezey has found the larvae (which he states are not covered with debris) feeding upon the eggs of *Spodoprius mauritia*. The adults are more delicate than those of *C. microphyta* and have "weaker" veins. This species has been taken in numbers also on the leeward Hawaiian Islands: Pearl and Hermes Reef, Midway, Ocean Island.

Chrysopa microphyta McLachlan: Ann. Mag. Nat. Hist. (5) 12: 300, 1883.

The larvae of this species cover themselves with debris and feed upon leafhoppers, mealy bugs, scales, aphids, nymphs of *Siphanta acuta*, and other insects. The pupae of this species, as well as *C. lanata* and various *Anomalochrysa*, are heavily parasitized by the ichneumon wasp *Hemiteles tenellus* (Say). Miss Cheesman (1927) recorded this species from Faka-rava, Tuamotus, but was not positive that the insects she had collected belonged to this species. The wing veins on most examples are bold. Williams (Insects and Other Invertebrates of Hawaiian Sugar Cane Fields, pp. 130-131, 1931) gives additional data on the life history of the species.

In addition to these two species a third has been recorded from Hawaii, but there is now reason to believe that the record is erroneous. The other species is *C. oceanica* Walker, 1853 (*C. V-rubrum* Brauer, 1866) a species found widespread in Oceania from the New Hebrides to the Society Islands. However, the species might yet be found here, or it may live on some of our outlying islands. It would run to *C. microphyta* in the synoptic table and can be separated from that species as follows:

Fore wings with the cells in the anterior gradate series only about half as long as the cells in the posterior series; head without red maculae as in *C. oceanica*; expanse less than 25 mm. **C. microphyta** McLachlan
 Fore wings with the cells in the anterior gradate series about as long as the cells in the posterior series, with several cells continuing from Rs to M which are not broken by cross veins; head usually with a V-shaped red median mark just behind the antennae and a red macula in the middle of the face; expanse 30 or more mm. **C. oceanica** Walker

Genus *Anomalochrysa* McLachlan

Anomalochrysa McLachlan: Ann. Mag. Nat. His (5)12: 298, 1883.

Anomalochrysa is a species complex that does not lend itself to facile tabulation. Many of the species are variable. The number of series of gradate veins, for example, is often found to be subject to considerable variation in both fore and hind wings. I have not only given a general key to the species, but, to facilitate determination, I have prepared a separate key to the species of each main island. Considerable difficulty was had in preparing these keys, and they may be subject to some future modifications. However, I have found

them most useful and believe that other workers will be able to identify most specimens without great difficulty with the aid of the keys.

The eggs of *Anomalochrysa* are not stalked but are deposited directly on the plant surface, often in groups. Williams (1931, p. 130) says "Their elongate-oval, stemless eggs, frequently deposited one alongside the other, are provided at one extremity with a small button-like protuberance." The larvae are naked and do not cover themselves with debris as do most *Chrysopa*. The principal food of the larvae is Psocidae, but some of the species feed upon lepidopterous larvae, introduced aphids and others are known to eat homopterous insects, including the sugar cane leaf hopper. Williams, 1931, gives some notes on the biology of some of the species.

ANNOTATED LIST OF THE SPECIES OF ANOMALOCHRYSA

1. *Anomalochrysa angulicosta* Perkins: Fauna Haw. 2(2) : 50, 1899.
Molokai.
2. *Anomalochrysa cognata* Perkins: *loc. cit.*
Oahu: Mt. Tantalus; Kealakei.
3. *Anomalochrysa debilis* Perkins: *op. cit.*, p. 49.
Oahu: Koolau Mts.
Maui: Iao Valley.
Hawaii: Kohala Mts.; Kona, 3000 ft.
4. *Anomalochrysa frater* Perkins: *op. cit.*, p. 52, pl. 4, fig. 18.
Hawaii: Kona, 2000-4000 ft.; Kilauea; Kau, 4000 ft.; Upper Hamakua Ditch Trail, Kohala Mts.; Akaka.
5. *Anomalochrysa fulvescens* Perkins: *op. cit.*, p. 60, pl. 3, figs. 13, 14, 15, 16.
Maui: Haleakala, 5000 ft.
6. *Anomalochrysa gayi* Perkins: *op. cit.*, p. 56, pl. 3, fig. 7.
Kauai: Kumuwela; Waimea, 4000 ft.
Hawaii: Kau, 4000 ft.
7. *Anomalochrysa hepatica* McLachlan: Ann. Mag. Nat. Hist. (5)12: 299, 1883.
Anomalochrysa proteus Perkins: Fauna Haw. 2(2) : 59, pl. 3, figs. 11, 12, 13, **new synonym**.
I have been unable to find any differences on specimens in Perkins' paratype series of *proteus* to separate them from a series of specimens of *hepatica* in Fauna Hawaiiensis series determined by Perkins. I made cleared dissections of the male genitalia of specimens under each name and found them to be identical in structure.
Oahu: Koolau Mts., 2000 feet; Waialua; Mt. Tantalus; Manoa Valley; Mt. Kaala; Wailupe; Mt. Konahuanui.
Maui: Haleakala, 5000 ft.; Kula Pipe Line, 4500 ft.
Hawaii: 2000-8000 ft.; Kilauea; Kau, 4000 ft.; Kona, 4000-5000 ft.; Humuula; Hookomo; Hualalai; Mauna Loa, 4000 ft.
8. *Anomalochrysa haematura* Perkins: *op. cit.*, p. 58.

- Oahu: Koolau Mts., 2000 ft.; Castle Trail; Waianae Mts., 2000 ft.; Kipapa Gulch; Kawailoa Trail; Haleauau Valley.
9. *Anomalochrysa longipennis* Perkins: *op. cit.*, p. 53, pl. 3, fig. 5.
Hawaii: Kilauea.
10. *Anomalochrysa maclachlani* Blackburn: Ann. Mag. Nat. Hist. (5)14: 418, 1884.
Anomalochrysa deceptor Perkins: Fauna Haw. 2(2): 54, 1899, **new synonym**.
This synonymy is based upon a comparison of the type of *A. maclachlani* with paratypes of *A. deceptor* and a note on the type of *A. maclachlani* written by Perkins.
The holotype of *A. maclachlani* is now in Bishop Museum; the left wings are the only parts remaining on the card mount.
Oahu: Moanalua; Waialua, 1500 ft.; Koolau Mts., 2000 ft.; Wilhemina Rise, Honolulu.
Maui: Haleakala, 5000 ft.
Hawaii: Mauna Loa; Kealakekua, 3000 ft.; Kilauea; Kau, 4000 ft.; Kona, 3000 ft.; South Kona; Puna, 2000 ft.
11. *Anomalochrysa molokaiensis* Perkins: *op. cit.*, p. 48.
Molokai: 4000 ft.
12. *Anomalochrysa montana* Blackburn: Ann. Mag. Nat. Hist. (5)14: 419, 1884.
Hawaii: Mauna Loa, 7000 ft.; Kilauea, 4000 ft.; Kau, 4000 ft.
This species is very closely allied to *A. viridis*, but cleared dissections of the male genitalia show distinct differences in structure and chaetotaxy. In this species the aedeagus is somewhat more strongly arcuate; the ventral lobe is short and does not project much beyond the lateral lobes; the lateral lobes have the setae fine and hair-like, and not bristle-like.
13. *Anomalochrysa nana* Perkins: Fauna Haw. 2(2): 52, 1899.
Molokai: 3000 ft.
14. *Anomalochrysa ornatipennis* Blackburn: Ann. Mag. Nat. Hist. (5)14: 419, 1884.
Hawaii: Mauna Loa, 4000 ft.
The unique, badly damaged type is now in Bishop Museum; the body and most of the left hind wing are gone.
15. *Anomalochrysa paurostica* Perkins: Fauna Haw. 2(2): 53, 1899.
Hawaii: Oloa.
16. *Anomalochrysa peles* Perkins: *op. cit.*, p. 49.
Hawaii: Kilauea; north Kona, 4000 ft.
17. *Anomalochrysa princeps* Perkins: *op. cit.*, p. 47, pl. 3, fig. 1, pl. 4, figs. 20, 20a.
Hawaii: "dense damp forests," 2000-3000 ft.; Kealakekua, 3500 ft.; Puna, 2000 ft.; Kona, 2500 ft.
Esben-Petersen, in Insects of Samoa 7(3): 98, 1928, described

a new genus, for a new Samoan species and said that *A. princeps* "should probably be assigned to the new genus." Esben-Petersen separated his new Samoan genus (*Austrochrysa*) from *Anomalochrysa* because the genotype (*A. samoana*) had the third cubital cell rectangular instead of triangular, and his reason for suggesting transferring *A. princeps* to *Austrochrysa* was that the third cubital cell of *A. princeps* is usually quadrangular. However, the third cubital cell varies in shape not only among the species of *Anomalochrysa*, but also among individuals of one species. In our collection there is a specimen of *A. princeps* whose left side belongs to *Anomalochrysa*, but its right side belongs to *Austrochrysa*. *Austrochrysa* was described from a unique; I believe it best to await the discovery of additional material before transferring *A. princeps* to *Austrochrysa*. *A. princeps* is, however, one of the most distinct species of the Hawaiian Chrysopidae.

18. *Anomalochrysa raphidioides* Perkins: Fauna Haw. 2(2): 57, pl. 3, fig. 8, 1899.

Hawaii: Kona, 4000–5000 ft.; Mauna Loa; Hualalai; Kilauea; Kilauea Bird Park; Humuula; Hamakua, 1800 ft.; Kau, 1500 ft.

19. *Anomalochrysa reticulata* Perkins: *op. cit.*, p. 57.

Hawaii: Kilauea; Kona, 4000 ft.; Humuula; Kealakekua, 3500 ft.

20. *Anomalochrysa rhododora* Perkins: *op. cit.*, p. 60.

Anomalochrysa rhododora xerophylla Perkins: *loc. cit.*, new synonym.

Hawaii: Kilauea; 29 miles, Olaa.

This species and its "var." were described from uniques. The two holotypes are in Bishop Museum. Two additional specimens in our collection intergrade between the two forms described by Perkins. It appears probable to me that this species may be a geographical subspecies of *A. fulvescens* of Maui, but additional specimens are needed for careful study.

21. *Anomalochrysa rufescens* McLachlan: Ann. Mag. Nat. Hist. (5)7: 300, 1883.

Anomalochrysa biseriata Perkins: Fauna Haw. 2(2): 58, 1899.

Synonymy suggested by Perkins, *op. cit.*, part 6, p. 687, 1910.

22. *Anomalochrysa simillima* Perkins: *op. cit.*, part 2, p. 55, 1899.

Kauai: 3500 ft.; Kokee; Kaholuamano; Kalalau; Waimea, 4000 ft.

23. *Anomalochrysa soror* Perkins: *op. cit.*, p. 51.

Maui: Haleakala, 5000 ft.; Olinda 4200 ft.; northwest side Haleakala, 6000 ft.; Iao Valley; Ukulele Pipe Line, Haleakala.

24. *Anomalochrysa sylvicola* Perkins: *op. cit.*, p. 48, pl. 3, fig. 2. Kauai: Waimea, 4000 ft.

The female type is in Bishop Museum.

25. *Anomalochrysa viridis* Perkins: *op. cit.*, p. 51, pl. 3, fig. 4.

Kauai: Waimea, 4000 ft.; Waialeale; Alakai Swamp; Kalalau; Halemanu.

This species is closely allied to *A. montana*, but the male genitalia are different. The ventral lobe projects well beyond the lateral lobes which have numerous stiff bristles in addition to fine hair.

26. *Anomalochrysa zoe* Perkins: *op. cit.*, p. 56.

Oahu: Waianae Mts., 2000 ft.

Molokai: 2000-4000 ft.

Hawaii: Hilo, 1500 ft.; Kau, 1500 ft.; near Hilo, 2000 ft.

KEYS TO THE SPECIES OF ANOMALOCHRYSA

Hereafter are given six keys to *Anomalochrysa*: 1, a general key to the species; 2, key to the Kauai species; 3, key to the Oahu species; 4, key to the Molokai species; 5, key to the Maui species; 6, key to the Hawaii species.

I. GENERAL KEY TO THE SPECIES OF ANOMALOCHRYSA

NOTE: I have not seen *A. molokaiensis* Perkins nor *A. nana* Perkins and they are not included in this key. *A. molokaiensis* is allied to *A. princeps* and the type has an expanse of 43 mm.; *A. nana* has only 19 anteposterostigmatic cells and is 23 mm. in expanse. Both species were found on Molokai, and are separated in the key to the Molokai species.

1. Fore wings with the dividing vein of the third cubital cell normally joining the distal side of the cell at a distance from its junction with M, and not M, so that the proximal part of the cell has four sides instead of three; the third cross vein from Cu₁ beyond the origin of Cu₂ bifid; a large species, 33-43 mm.; Hawaii
 - A. *princeps* Perkins
 - Without some or any of these characters 2
- 2(1). Fore wings with the posterior side of the third cubital cell very long, as long or longer than the posterior (cubital) side of the second cell A. *gayi* Perkins
 - Fore wings with the posterior side of the third cubital cell shorter than the second, although elongated in some species 3
- 3(2). Fore wings with the dividing vein of the third cubital cell joining the distal side of the cell at M, or joining M with the distal side in a distinct swelling of M, and in many examples with the second cross vein from Cu₁ conspicuously swollen where it joins Cu₂ 4
 - Fore wings with the dividing vein of the third cubital cell not joining the distal side of the cell at M, but joining M normally at a distance from the distal side of the cell (occasionally, e.g., in *longipennis*, joining M close to the distal side, but without a distinct swelling of M) 7
- 4(3). Third cross vein from Cu₁ beyond the origin of Cu₂ joining Cu₂ far from its apex; Oahu A. *cognata* Perkins
 - Third cross vein from Cu₁ joining Cu₂ very close to its apex or joining the wing margin close to Cu₂ 5
- 5(4). Wings strongly fulvescent, especially the anterior pair which are often mottled with darker spots and areas; the veins always strongly colored; Maui A. *fulvescens* Perkins

- Wings not strongly fulvescent, variable in color, hyaline, whitish, brownish, or spotted 6
- 6(5). Fore wings subopaque or opaque, the cells with much coloring, whitish or brownish and maculate, with numerous cross veins in the Rs-M field so that there are as many as six to nine rows of cells in the gradate series; hind wings with four or five rows of gradate cells **A. rhododora** Perkins
- Fore wings hyaline or almost so, the membrane not extensively colored; fore wings with four rows of cells in the gradate series, hind wings with three **A. zoe** Perkins
- 7(3). Fore wings with the third cross vein from Cu_1 beyond the origin of Cu_2 joining the wing margin at a distance from Cu_2 , usually the distance between the apex of this cross vein and Cu_2 about equal to that between the third cross vein, never joining the margin very close to Cu_2 8
- Fore wings with the third cross vein from Cu_1 either joining Cu_2 before its apex, or joining it or almost joining it at the wing margin, but never distantly separated from it at the wing margin, always closer to Cu_2 than to the fourth cross vein from Cu_1 13
- 8(7). Fore wings with the distal side of the third cubital cell conspicuously oblique and fully one third longer than the dividing vein of the cell 9
- Fore wings with the distal side of the third cubital cell only moderately oblique and at most only one fourth longer than the dividing vein of the cell 11
- 9(8). Fore wings with the cell between 3A and the wing margin greatly narrowed or almost closed by a swelling of the wing margin near the branch from 2A; Hawaii **A. longipennis** Perkins
- Fore wings with the cell between 3A and the wing margin wide and not at all narrowed near the branch from 2A by a swelling of the wing margin 10
- 10(9). Molokai species; fore wing veins not spotted, but sometimes with some spots in the cells **A. zoe** Perkins
- Hawaii species; fore wings with a "few small black spots on the basal portion" on the veins **A. paurostica** Perkins
- 11(8). Hairs on the dorsum of the abdomen of the male coarse, dense, long, conspicuously erect and directed anteriorly; first series of cells behind Rs in both wings of both sexes not conspicuously high and narrow as compared to those between R and Rs
- A. hepatica** McLachlan
- Hairs on the dorsum of the abdomen of the male fine, not very long, usually comparatively sparse, mostly directed caudad; first series of cells behind Rs in both wings of both sexes conspicuously high and narrow as compared to the cells between R and Rs, usually three or four times as high as wide 12
- 12(11). Fore wing with the cell formed between 3A and the wing margin entirely open throughout its length, the wing margin not so thickened near to where the branch of 2A joins 3A as to close the cell
- A. maclachlani** Blackburn
- Fore wing with the cell between 3A and the wing margin not entirely open, but closed or almost closed by the arcuation of the hind margin at just before half the length of 3A from its base and again at a distinct swelling of the margin just before the point where the branch of 2A joins 3A; Kauai only **A. simillima** Perkins
- 13(7). Fore wings with only three rows of cells between Rs and M 14
- Fore wings with four rows of cells between Rs and M 21
- 14(13). Hind wings with only two rows of cells between Rs and M 15
- Hind wings with three or four rows of cells between Rs and M 16
- 15(14). The posterior series of cells between Rs and M in the fore wings con-

sisting of only four or five cells; the gradate nerves extending the line of M in fore wings assuming a conspicuous zigzag course beyond the first two or three basal cells of the posterior series of gradate cells; abdominal hairs, especially below, long and conspicuous; body often with considerable red coloration.

- A. haematura** Perkins
The posterior series of cells between Rs and M in fore wings consisting of more than five cells; the gradate nerves extending the line of M in the fore wings not assuming a strongly zigzag course after the first few cells of the posterior series of gradate cells; body usually yellowish or brownish and without conspicuous reddish coloration; costal margin of the fore wings of the male conspicuously lobed beyond the middle 17
- 16(14). Fore wings with the third cross vein from Cu_1 beyond the origin of Cu_2 joining the wing margin close to Cu_2 but not joining Cu_2 distinctly before its apex; fore wings normally conspicuously suffused with brown in the female and the veins very bold; Hawaii. (Note: Rarely an abnormal specimen of *A. viridis* Perkins from Kauai will run to here, but it may be distinguished by its small size and paler, greenish color) **A. rufescens** McLachlan
- 17(16). Fore wings with the third cross vein from Cu_1 obviously joining Cu_2 at a distance from the wing margin 17
- Anterior wing membrane whitish, with all the cells distinctly infusate along the veins; Oahu **A. cognata** Perkins
- Anterior wing membrane entirely hyaline, not whitish nor infusate along the veins 18
- 18(17). Fore wings with not more than 20 antepetostigmatic cells between C and Sc; Hawaii **A. ornatipennis** Blackburn
- Fore wings with more than 20, usually about 25 antepetostigmatic cells between C and Sc 19
- 19(18). Hair on abdomen conspicuously coarse, stiff, mostly dark, long; body usually with considerably red coloration . . . **A. haematura** Perkins
- Hair on abdominal tergites short and comparatively sparse or moderately long and fine, usually pale, never coarse and stiff 20
- 20(19). Kauai species **A. viridis** Perkins
- Hawaii species **A. montana** Blackburn
- 21(13). Fore wings with the third cross vein from Cu_1 beyond the origin of Cu_2 joining the wing margin close to the apex of Cu_2 , but not joining Cu_2 22
- Fore wings with the third cross vein from Cu_1 obviously joining Cu_2 before its apex 23
- 22(21). Hawaii species; wing veins bold, dark colored; expanse 35–36 mm. **A. reticulata** Perkins
- Kauai species; wing veins pale, greenish; expanse 28–32 mm. **A. viridis** Perkins
- 23(21). Hind wings with four series of cells at least in some places between Rs and M 24
- Hind wing with at most three series of cells between Rs and M . . . 27
- 24(23). Fore wings with the cells distinctly infusate along the veins; Hawaii **A. peles** Perkins
- Fore wings not infusate along the veins 25
- 25(24). Expanse 35–37 mm.; fore wings with 29–32 antepetostigmatic cells between C and Sc; without a dark spot in the cell between 3A and the wing margin; Kauai **A. silvicola** Perkins
- Expanse 26–32 mm.; fore wings usually with not more than 25 antepetostigmatic cells; with or without a dark spot in the cell between 3A and the wing margin 26
- 26(25). Fore wings with a dark macula near the apex of the cell between 3A

- and the wing margin; dorsal abdominal hair of the male coarse, dark, erect or directed anteriorly *A. frater* Perkins
- Fore wings without a dark macula in the cell between 3A and the wing margin; dorsal abdominal hair of the male fine, mostly pale, directed caudad *A. viridis* Perkins
- 27(23). Fore wings with the cells faintly infuscate along the gradate nerves; Hawaii *A. debilis* Perkins
- Fore wings without infuscation along the gradate veins, the cells entirely hyaline 28
- 28(27). Abdominal tergites of the male with coarse, anteriorly inclined, usually dark hair; apices of the wings angulate *A. frater* Perkins
- Abdominal tergites of the male with fine, posteriorly directed hairs; apices of the wings angulate or rounded 29
- 29(28). Fore wings more rounded than angulate at their apices, not distinctly angulate the apical side of the third cubital cell usually but not always forming nearly a right angle with Cu_1 ... *A. soror* Perkins
- Fore wings distinctly angulate at their apices, the apical side of the third cubital cell always distinctly oblique and forming less than a right angle with Cu_1 ; Kauai *A. viridis* Perkins

II. KEY TO THE ANOMALOCHRYSA OF KAUAI

1. Fore wings with the posterior (cubital) side of the third cubital cell as long or longer than the posterior side of the second cell.
 - A. gayi* Perkins
 - Fore wings with the posterior side of the third cubital cell obviously shorter than the posterior side of the second cell 2
- 2(1). Hind wings with only two rows of cells between Rs and M; costal margin of the fore wings of the male conspicuously lobed beyond the middle *A. rufescens* McLachlan
- 3(2). Hind wings with three or more rows of cells between Rs and M ... 3
- Fore wings with the third cross vein from Cu_1 beyond the origin of Cu_2 not joining Cu_2 but reaching the wing margin at a distance from the apex of Cu_2 ; the cell between 3A and the wing margin closed or nearly closed by a distinct swelling of the wing margin near the branch from 2A *A. simillima* Perkins
- Fore wings with the third cross vein from Cu_2 not reaching the wing margin but joining Cu_2 or joining the wing margin very close to the apex of Cu_2 ; the cell between 3A and the wing margin not closed by a swelling of the wing margin 4
- 4(3) Expanse 35-37 mm.; fore wings with 29-30 anteposterostigmatic cells between C and Sc *A. sylvicola* Perkins
- Expanse 28-32 mm.; fore wings usually without more than 25 anteposterostigmatic cells *A. viridis* Perkins

III. KEY TO THE ANOMALOCHRYSA OF OAHU

1. Hind wings with at most two series of cells between Rs and M ... 2
- Hind wings with at least three series of cells between Rs and M ... 3
- 2(1). The posterior series of cells between Rs and M in fore wings consisting of only four or five cells; the gradate nerves extending the line of M in the fore wings assuming a conspicuous zigzag course beyond the first two or three basal cells of the posterior series of cells between Rs and M; abdominal hairs, especially below, long and conspicuous; body often with considerable red coloration.
 - A. haematura* Perkins
 - The posterior series of cells between Rs and M in fore wings consisting of more than five cells; the gradate nerves extending the line of M in the fore wings not assuming a strongly zigzag course after

- the first few basal cells in the posterior series of cells between Rs and M; body usually yellowish or brownish without conspicuous reddish coloration; costal margin of fore wings of male conspicuously lobed beyond the middle **A. rufescens** McLachlan
- 3(2). Fore wings with all cells infusate along their veins; the dividing vein of the third cubital cell usually joining M at or near to the distal side of the cell so that the distal part of the cell often has but four sides **A. cognata** Perkins
Fore wings without distinct infuscation along the veins; at most faintly infusate along the gradate veins only in *A. viridis*; the distal part of the third cubital cell always with five sides 4
- 4(3). Fore wings with the third cross vein given off from the lower side of Cu_1 beyond the origin of Cu_2 not reaching the wing margin, but joining Cu_2 , the cells faintly infusate along the gradate veins. **A. debilis** Perkins
Fore wings with the third cross vein from Cu_1 reaching the wing margin and not joining Cu_2 5
- 5(4). Fore wings with the dividing vein of the third cubital cell either joining M at the base of the distal side of the cells or the distal side conspicuously oblique, much longer than the dividing nerve, or both characters present **A. zoe** Perkins
Fore wings with the third cubital cell not so formed 6
- 6(5). Hairs on the abdominal tergites of the male coarse, dense, long, conspicuously erect, directed cephalad, usually dark colored; first series of cells behind Rs in both wings of both sexes not unusually high and narrow **A. hepatica** McLachlan
Hairs on the abdominal tergites of the male fine, not long, pale, mostly directed caudad; first series of cells behind Rs in both wings of both sexes conspicuously high and narrow as compared to those between R and Rs **A. maclachlani** Blackburn

IV. KEY TO THE ANOMALOCHRYSA OF MOLOKAI

I have not seen the first two species listed.

1. Posterior wings with more than three rows of cells between Rs and M **A. molokaiensis** Perkins
Posterior wings with only three rows of cells between Rs and M .. 2
- 2(1). Fore wings "with only about 19" antepetrostigmatic cells; expanse 23 mm. **A. nana** Perkins
Fore wings with more than 25 antepetrostigmatic cells; expanse more than 30 mm. 3
- 3(2). Fore wings with the third cross vein given off from the lower side of Cu_1 beyond the origin of Cu_2 joining Cu_2 ; the fourth cubital cell with its anterior and posterior sides subequal in length **A. angulicosta** Perkins
Fore wings with the third cross vein from Cu_1 joining the posterior wing margin; the fourth cubital cell obviously narrower posteriorly **A. zoe** Perkins

V. KEY TO THE ANOMALOCHRYSA OF MAUI

1. Fore wings with the dividing vein of the third cubital cell apparently joining the base of the distal side of the cell in a swelling of M; fore wings, especially, conspicuously brownish, often maculate. **A. fulvescens** Perkins
Fore wings with the dividing vein of the third cubital cell distant from the base of the distal side of the cell; wings not so colored 2
- 2(1). Fore wings with the third cross vein given off from the lower side of

- Cu₁ beyond the origin of Cu₂ joining Cu₂ 3
 Fore wings with the third cross vein from Cu₁ not joining Cu₂ but reaching the wing margin 4
- 3(2). Fore wings with the cells faintly infusate along the gradate veins
A. debilis Perkins
 Fore wings without infuscation along the gradate veins, the cells entirely hyaline *A. soror* Perkins
- 4(2). Hind wings with the first series of cells behind Rs high and narrow, obviously much higher and narrower than those between R and Rs, often four times as high as wide; hairs on the abdominal tergites of the male fine, not long, pale, mostly directed caudad
A. maclachlani Blackburn
 Hind wings with the first series of cells behind Rs not conspicuously high and narrow but rather similar in shape to those between R and Rs, although mostly higher than those cells, but not usually more than twice as high as wide, never approaching four times as high as wide; hair on the abdominal tergites of the male coarse, dense, long, conspicuously erect, directed forward, usually dark in color
A. hepatica McLachlan

VI. KEY TO THE ANOMALOCHRYSA OF HAWAII

1. Fore wings with only three series of cells between Rs and M 2
 Fore wings with more than three series of cells between Rs and M . . . 6
- 2(1). Fore wings with the distal side of the third cubital cell greatly elongated so that the posterior (cubital) side of that cell is as long or longer than the posterior side of the second cell . . . *A. gayi* Perkins
 Fore wings with the third cell not so formed 3
- 3(2). Fore wings with the third cross vein from Cu₁ beyond the origin of Cu₂ reaching the wing margin close to the apex of Cu₂, but not joining Cu₂; fore wings normally conspicuously suffused with brown in the female *A. raphidioides* Perkins
 Fore wings with the third cross vein from Cu₁ beyond the origin of Cu₂ joining Cu₂ before its apex; fore wings not conspicuously colored 4
- 4(3). Fore wings with not more than 20 anteposterostigmatic cells between C and Sc *A. ornatipennis* Blackburn
 Fore wings with more than 20, usually about 25, anteposterostigmatic cells between C and Sc 5
- 5(4). Fore wings with the third cross vein from C₁ beyond the origin of Cu₂ close to its apex *A. frater* Perkins
 Fore wings with the third cross vein from Cu₁ joining Cu₂ at a distance from the apex, not much beyond the middle of the segment of Cu₂ beyond the second cross vein from Cu₁
A. montana Blackburn
- 6(1). Fore wings with the third cross vein from Cu₁ beyond the origin of Cu₂ not joining Cu₂ but reaching the wing margin at a distance from Cu₂, as close to the fourth cross vein as to the third 7
 Fore wings with the third cross vein from Cu₁ either joining Cu₂ and not reaching the wing margin, or reaching the margin joining to Cu₂ or very close to Cu₂, never distantly separated from the apex of Cu₂ 11
- 7(6). Hind wings with only three series of cells between Rs and M 8
 Hind wings with four series of cells between Rs and M 10
- 8(7). Fore wings with the distal side of the third cubital cell at most very slightly longer than the dividing nerve of the cell
A. hepatica McLachlan
 Fore wings with the distal side of the third cubital cell very oblique,

- about one third longer than the dividing nerve of the cell 9
- 9(8). Fore wings with the cell between 3A and the wing margin greatly narrowed or almost closed by a swelling of the wing margin near the branch of 2A *A. longipennis* Perkins
- Fore wings with the cell between 3A and the wing margin wide and not at all narrowed near the branch from 2A by a swelling of the wing margin *A. paurostica* Perkins
- 10(7). Hind wings with the first series of cells behind Rs high and narrow, obviously much higher and narrower than those between R and Rs, often four times as high as broad; hair on the abdominal tergites of the male fine, usually pale and comparatively sparse, mostly directed caudad *A. maclachlani* Blackburn
- Hind wings with the first series of cells behind Rs not conspicuously high and narrow, but rather similar in shape to those between R and Rs, although mostly higher than those cells, but usually not more than twice as high as wide, never approaching four times as high as wide; hairs on the abdominal tergites of the male coarse, dense, long, mostly dark, conspicuously erect and directed forward *A. hepatica* McLachlan
- 11(6). Fore wings with the dividing nerve of the third cubital cell normally joining the distal side of the cell at a distance from M; the third cross vein from Cu_1 beyond the origin of Cu_2 bifid; a large species, 33-43 mm. in expanse *A. princeps* Perkins
- Fore wings with the dividing nerve of the third cubital cell joining M, and not the distal side of the cell, at the base or at a distance from the base of the distal side of the cell; the third cross vein from Cu_1 not bifid 12
- 12(11). Fore wings with the dividing nerve of the third cubital cell joining M at the base of the distal side of the third cell so that the cell has only three or four sides; fore wings whitish, brownish or maculate, with numerous cross veins in the Rs-M field so that there are as many as six to nine rows of cells in the gradate series *A. rhododora* Perkins
- Fore wings with the dividing nerve of the third cubital cell joining M at a distance from the base of the distal side of the third cell so that the cell has five sides 13
- 13(12). Fore wings with the distal side of the third cubital cell conspicuously obliquely produced so that it is fully one third longer than the dividing nerve, and the posterior side of the cell is almost as long as the anterior side of the entire cell *A. zoe* Perkins
- Fore wings with the distal side of the third cubital cell not so produced 14
- 14(13). Hind wings with four series of cells between Rs and M; fore wings with the cells narrowly infusate along the veins .. *A. peles* Perkins
- Hind wings with only three series of cells between Rs and M; fore wings either entirely hyaline or only infusate along the gradate nerves 15
- 15(14). Fore wings with the third cross vein from Cu_1 joining the wing margin close to Cu_2 but not joining Cu_2 ; expanse 35-36 mm. *A. reticulata* Perkins
- Fore wings with the third cross vein from Cu_1 joining Cu_2 before its apex; expanse 24-32 mm. 16
- 16(15). Fore wings with the cells faintly infusate along the gradate nerves; dorsal abdominal hair of the male pale, directed caudad *A. debilis* Perkins
- Fore wings without any infuscation along the gradate nerves; dorsal abdominal hair of the male dark, anteriorly inclined *A. frater* Perkins

HEMEROBIIDAE

My rather brief studies of Oceanic Hemerobiidae have convinced me that many of the genera in the family are apparently founded on poor characters. Some species have so much variation in the wing veins that various individuals could be placed in two or more genera. In fact, there may be enough difference between the right and left wings to place a specimen in one genus or another, depending upon which side of the individual is examined. It appears to me that the endemic Hawaiian Hemerobiidae are polyphyletic. However, there is much variation and many connecting forms among the species and much careful study must be done before they can be split up into different genera.

Williams (The Insects and Other Invertebrates of Hawaiian Sugar Cane Fields, pp. 128-130, 1931) gives some good notes on the biology of several species.

KEY TO THE GENERA OF HEMEROBIIDAE FOUND IN HAWAII

1. Hind wings fully developed 2
Hind wings atrophied and minute or absent; flightless species with coriaceous fore wings 5
- 2(1). Fore wings with a recurrent vein given off from near the base of the subcosta in the costal area 3
Fore wings without a subbasal recurrent vein in the costal area ... 4
- 3(2). Fore wings with only two radial sectors, the cell formed by the recurrent vein in the costal area three times as long as high; prothorax narrower than the head; antennae in our species conspicuously bicolored, the basal third or more mostly black
Symphorobius Banks
Fore wings with three radial sectors, the cell formed by the recurrent vein in the costal area only twice as long as high; prothorax broader than the head; antennae in our species entirely yellowish
Nesobiella Kimmins
- 4(2). Fore wing with medius closely approaching Cu_1 , not separated from Cu_1 by much more than the diameter of the vein near to where M branches; hind wings with the distal branch of 1A with only a few small simple marginal branches near the apex, but without a distinct fork; apices of fore wings always rounded; one common, pale brown species **Eumicromus** Nakahara
Fore wing with medius usually, but not always, well separated from Cu_1 , usually separated by almost twice or more than twice the diameter of a vein where it most closely approaches Cu_1 ; hind wings usually with the distal branch of 1A with a distinct fork that arises well before the apex of the distal branch, in some species from near the middle of the distal branch, and which usually has some small marginal branches; fore wings either distally rounded or concave, often conspicuously angular **Nesomicromus** Perkins
- 5(1). Hind wings present, but reduced to small or minute, fleshy flaps; antennae longer than a fore wing **Pseudopsectra** Perkins
Hind wings absent; antennae shorter than a fore wing
Nesothauma Perkins

Genus **Symphorobius** Banks

Symphorobius Banks: Trans. Amer. Ent. Soc. 32(1): 40, 1905.

We have one introduced representative of this genus in Hawaii; it is:

Symphorobius barberi Banks: Proc. Ent. Soc. Wash. 5(4): 241, 1903.

This rather small (expanse about 10 mm.) brown lace wing can easily be recognized. It might be confused with *Nesobiella hospes* (Perkins) because of the presence of a recurrent vein in the basal costal area, but, in addition to the generic characters mentioned in the key, this species differs from our *Nesobiella* in having the antennae conspicuously bicolored (the basal third or more is mostly black); the cell formed by the recurrent vein in the costal area is three times as long as high and the head is broader than the prothorax.

This species was described from Arizona and was introduced to Honolulu by Rust in 1929. I have seen specimens from Oahu only. Swezey, in 1928, found what he considered to be the larvae of this species feeding on *Pseudococcus longispinus* (Targ.). It was taken in some numbers by W. C. Look in fields of potatoes at Poamoho, Oahu, in December, 1939. Essig (1929) records the species from California, Nevada, Arizona, and New Mexico where it feeds upon mealybugs.

Genus *Nesobiella* Kimmins

Nesobiella Kimmins: Ann. Mag. Nat. Hist. (10)16: 618, fig., 1935.

This is a monotypic genus; its genotype is:

Nesobiella hospes (Perkins) Kimmins.

Megalomus hospes Perkins: Fauna Haw. 2(2): 36, pl. 4, figs. 1, 2, 16, 16a, 1899.

Nesobiella hospes (Perkins) Kimmins: Ann. Mag. Nat. Hist. (10)16: 618, figs. 10, 11, 1935.

This species is found on all of the main islands, usually in the mountains. Perkins and Kimmins give good figures that will enable the species to be easily identified.

Although this species has been found only in Hawaii, Perkins thought that it would ultimately be found to be introduced. Perkins (Fauna Haw. Introduction, p. clxxi) says "It flies at dusk and sometimes is attracted by lights in the nighttime, hiding by day amongst dead leaves attached to trees, and amongst dead fern fronds. When beaten from these it feigns death like others of the group."

Genus *Eumicromus* Nakahara

Eumicromus Nakahara: Annot. zool. Jap. 9: 11, 1915.

Archaeomicromus Kruger: Stettin Ent. Ztg. 83: 171, 1922. Synonymy by Kimmins: Ann. Mag. Nat. Hist. (10)18: 87, 1936.

Eumicromus navigatorum (Brauer) Kimmins.

Micromus navigatorum Brauer: Zool.-Bot. Gesells., Vien, 17: 508, 1867.

Micromus vinaceus Gerstaecker: Jahrg. Mitth. naturw. Verein Neuperpom. und Rügen, 16: 111, 1885.

Archaeomicromus navigatorum (Brauer) Esben-Petersen: Insects of Samoa 7(3): 93, 1928.

Eumicromus navigatorum (Brauer) Kimmins: Ann. Mag. Nat. Hist. (10)18: 87, 1936.

This species was introduced from Queensland, Australia, by F. X. Williams and released at Hilo, Hawaii in 1920. It was reported established and feeding on aphids in 1921. It can be distinguished from most of the *Nesomicromus* whose fore wings are rounded at their apices because of its pale brown coloration. I have seen specimens from all of the main islands except Lanai, but it probably occurs there. This species is wide spread from eastern Australia to the New Hebrides, through Fiji and into Samoa.

Genus *Nesomicromus* Perkins

Nesomicromus Perkins: Fauna Haw. 2(2): 37, 1899.

I have, unfortunately, seen authentically named specimens of only about one half of the described species of this Hawaiian genus. It is, therefore, impossible for me to present keys to the species here, but I hope to prepare identification tables when future conditions render such an undertaking possible. Many of the species are known from unique types.

The holotypes of the species described by Perkins in his "Supplement to the Neuroptera," Fauna Haw. 2(6): 691-696, 1910, *N. angularis*, *N. phaeostictus* and *N. ombrias* are in Bishop Museum; the other holotypes are in the British Museum.

Prof. Banks has called my attention to the fact that, because *medius* in the fore wing of *Nesomicromus minimus* Perkins forks opposite to the second cross vein between Cu_1 and Cu_2 instead of before that cross vein, the species should be transferred to the oriental genus *Nenus* Navas (Mem. Ac. Barcelona (3)10(9): 67, 1912). This character appears to be satisfactory for separating *N. minimus* from most of the species of *Nesomicromus* I have examined, but it cannot be used to generically separate *N. minimus* from *Eumicromus navigatorum*. I have examined a large series of *Eumicromus navigatorum* and have found that there is much variation to the point of forking of *medius* in the fore wing. On some specimens *medius* forks far behind the second cross vein between Cu_1 and Cu_2 , on others it forks near or opposite that cross vein, and on other specimens it forks beyond the cross vein.

Segregation of the species of *Nesomicromus* into groups must be based upon careful study of series of specimens and an examination of all of the types.

LIST OF THE SPECIES OF NESOMICROMUS

1. *Nesomicromus angularis* Perkins: Fauna Haw. 2(6): 691, 1910.
Molokai, 4500 ft.

2. *Nesomicromus angustipennis* Perkins: Fauna Haw. 2(2): 38, pl. 4, fig. 5; 1899.
Kauai: Waimea, 4000 ft.
3. *Nesomicromus bellulus* Perkins: *op. cit.*, p. 40, pl. 4, fig. 8.
Maui: Haleakala, 5000 ft.
4. *Nesomicromus brunescens* Perkins: *op. cit.*, p. 43, pl. 4, fig. 9.
Molokai: 5000-6000 ft.
Lanai: Halepaakai, 3000 ft.
Maui: Haleakala, 5000 ft.
5. *Nesomicromus drepanoides* Perkins: *op. cit.*, p. 39, pl. 4, fig. 6.
Kauai: Waimea, 4000 ft.; Halemanu, 4000 ft.
6. *Nesomicromus distinctus* Perkins: *op. cit.*, p. 44.
Molokai.
7. *Nesomicromus forcipatus* Perkins: *op. cit.*, p. 44, pl. 4, figs. 14, 14a.
Kauai: Makaweli, over 2000 ft.
Oahu: Waianae Mts., 1500 ft.
8. *Nesomicromus fulvescens* Perkins: *op. cit.*, p. 39.
Oahu: Waianae Mts., 3000 ft.
9. *Nesomicromus haleakalae* Perkins: *op. cit.*, p. 42.
Maui: Haleakala, 4000 ft.
10. *Nesomicromus infumatus* Perkins: *op. cit.*, p. 41.
Maui: Haleakala, 5000 ft.
11. *Nesomicromus latipennis* Perkins: *op. cit.*, p. 38, pl. 4, fig. 4.
Hawaii: Kona, 3500 ft.
12. *Nesomicromus longispinosus* Perkins: *op. cit.*, p. 42, pl. 4, fig. 15.
Hawaii: Kilauea.
13. *Nesomicromus minimus* Perkins: *op. cit.*, p. 45, pl. 4, fig. 11.
Molokai: 2000-4000 ft.
Hawaii: Kona, 4000 ft.; Kilauea; Kau, 4000 ft.
14. *Nesomicromus minor* Perkins: *op. cit.*, p. 41.
Oahu: Waianae Mts., 3000 ft.
15. *Nesomicromus molokaiensis* Perkins: *op. cit.*, p. 41.
Molokai: above 4000 ft.
16. *Nesomicromus ombrias* Perkins: Fauna Haw. 2(6): 692, 1910.
Oahu: Koolau Mts., 1500 ft., near Honolulu.
17. *Nesomicromus paradoxus* Perkins: Fauna Haw. 2(2): 39, pl. 4, fig. 7, 1899.
Hawaii: Kilauea, 4000 ft.
18. *Nesomicromus phaeostictus* Perkins: Fauna Haw. 2(6): 692, 1910.
Oahu: Koolau Mts., 1500 ft.
19. *Nesomicromus rubrinervis* Perkins: Fauna Haw. 2(2): 43, 1899.
Hawaii: Kilauea; Kau, 4000 ft.

20. *Nesomicromus stenopteryx* Perkins: *op. cit.*, p. 45.
Maui: Haleakala, 5000 ft.
21. *Nesomicromus subochraceus* Perkins: *op. cit.*, p. 44, pl. 4,
fig. 10.
Oahu: Mt. Tantalus.
Molokai: 3000 ft.
Maui: Haleakala, 5000 ft.
Hawaii: Kau, 4000 ft.; Kilauea.
22. *Nesomicromus vagus* Perkins: *op. cit.*, p. 37.
Widespread and common on all of the main islands; genotype.

Genus *Pseudopsectra* Perkins

Pseudopsectra Perkins: Fauna Haw. 2(2): 46, 1899.

This genus is not only one of the most aberrant genera of Hawaiian Insecta, but it is one of the most unusual genera of the Neuroptera. Dr. Perkins erected the genus to receive the rare *Pseudopsectra lobipennis* from Mt. Haleakala, Maui. Until now, we have considered the genus to be a peculiar development of Maui only, but Mr. O. H. Swezey found another in the highlands of Kauai in 1921, and Dr. R. L. Usinger found a distinct new species in the saddle between the great mountains of Mauna Kea and Mauna Loa on the island of Hawaii in 1935. I consider these discoveries among the most important made since Dr. Perkins' extensive work. We must now recognize the fact that the Mauian *P. lobipennis* is not a unique, localized, mutant form isolated on Haleakala, but that there are more species that share its peculiar characters. Messrs. Swezey and Williams tell me that Bridwell, in their company, found a specimen evidently belonging to the genus on Mt. Kaala, Oahu, many years ago, but that he lost the vial containing the specimen while descending the precipitous slopes of the mountain, and that the specimen never reached the laboratory.

These data recall the history of the flightless dolichopodid genus *Emperoptera* which was erected by Grimshaw in 1902 for an Oahuan fly and remained monotypic until 1938 when a second species was described from Maui (see these "Proceedings" 10(1): 145, 1938).

The genus *Pseudopsectra* is an offshoot of the extensively developed Hawaiian genus *Nesomicromus*. It differs from *Nesomicromus* because it is flightless and has the hind wings reduced to minute, fleshy lobes and the fore wings much reduced in size, coriaceous and convex or angulate. In the original generic description Perkins said "Nervuration without hairs," but this statement must now be amended, for the new species from Hawaii has the veins all densely set with long hairs. On the genotype the veins are set with minute setae that cannot easily be seen with a hand lens but are discernible under the microscope. The species of *Nesomicromus* vary as to the hairyness of the wings, on some the hairs are conspicuous, but on others they are minute and hardly discernible.

The discovery of the two new species of *Pseudopsectra* greatly reduces the morphological gap between that genus and *Nesothauma*. I believe that the two genera have been similarly derived, and if it were not for the short antennae of *Nesothauma*, I would merge them. The hind wings on the genotype of *Pseudopsectra* are small cordate lobes, those of the new species from Kauai are much smaller and minute, and on the genotype of *Nesothauma* there are no traces of hind wings. We might expect a similar variation and gradation in the length of the antennae, but on all three species now assigned to *Pseudopsectra* the antennae are distinctly longer than the fore wings, but on *Nesothauma* the antennae are shorter than the fore wings. The fore wings of the new species are intermediate in texture and venation between those of the genotypes of the two genera; the wings of the Hawaii species are closer to those of *Pseudopsectra*; and the Kauai species resemble those of *Nesothauma*. The new Kauai species has the fore wings peculiarly transversely angulate in the basal costal area as does *Nesothauma haleakalae*. The crown of the head, pronotum and mesonotum of the Kauai species are set with large conspicuous tubercles, and on *Nesothauma haleakalae* these areas are minutely tuberculate. The Maui and Hawaii species of *Pseudopsectra* have those areas hairy but not tuberculate.

The species of *Nesomicromus* can be divided into two groups according to the shape of the wings. In one group the species have the apices of the fore wings rounded; in the other group they are concave at least at the apex, and some of those with the concave apices also have the posterior margins sinuous. It appears to me that the *Pseudopsectra* from Maui and Hawaii and *Nesothauma* have all been derived from species of *Nesomicromus* falling in the group with apically rounded wings and that the Kauai species has been derived from an angulate winged species resembling *Nesomicromus paradoxus* Perkins.

I take pleasure in dedicating the following species to their diligent collectors and my close friends Mr. O. H. Swezey and Dr. R. L. Usinger.

Pseudopsectra usingeri, new species (fig. 1)

Male.—Brown, fuscous to piceous; antennae brownish testaceous at the base but becoming darker distally; legs testaceous with the fore and mid tibiae slightly infuscated; head with the face brown, the crown brown in the middle to the vertex; but piceous on either side near the pronotum; pronotum predominantly piceous, almost black and with a yellowish brown macula or maculae on either side; mesonotum similarly colored; abdomen basically piceous but with about the apical half of the dorsum brownish yellow; wings basically brownish yellow but with numerous, variable dark markings mostly on the veins but also some on the membrane, the most conspicuous marks, under magnification, consisting of a series of dark maculae subequally spaced around the entire wing margin, those on the posterior margin most conspicuous.

Head with the face bare, smooth and conspicuously shiny; crown dull, coarsely, densely punctate, coarsely reticulate, with numerous long hairs;

terminal segment of the maxillary palpi flattened, lanceolate-acuminate; the distance across the eyes one-fourth greater than the distance from the base of the pronotum to the apex of the crown. *Thorax* with the pronotum fully one-third broader than long (3.4:2.2), coarsely, densely, confusedly punctate, coarsely reticulate and bearing numerous long, erect hairs; mesonotum one-sixth broader than long, sculpture and clothing similar to that of the pronotum; metanotum coarsely reticulate, bare. *Abdomen* coarsely reticulate, clothed with long, erect conspicuous hair, especially toward the apex; terminalia with the lateral appendices nipple-like in lateral view, deeply concave on the inner side, with numerous small tubercles bearing long hairs, the apical

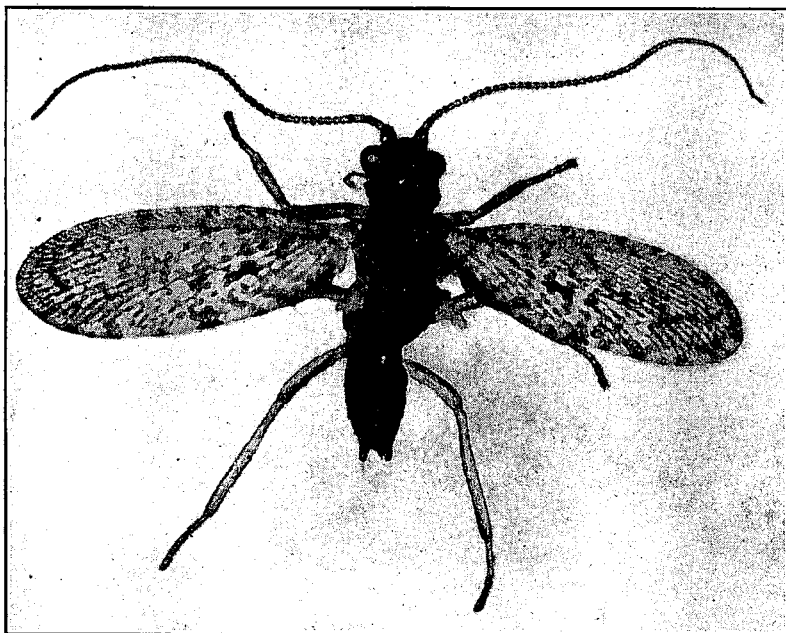


FIG. 1. *Pseudopsectra usingeri* Zimmerman, new species; holotype. Photograph by W. Twigg-Smith.

hairs longest and tending to form a slender fascicle; the inner, or lower "spines" erect, capable of extending to the apices of the lateral lobes, not decussate, lacina-like. *Wings* with the fore pair two and one-half times as long as broad; all of the veins and margins closely set with very long, erect, conspicuous hairs; all of the veins are very heavy and with an excessive number of similarly developed cross veins that give the wing a coarse, close reticulate pattern, radius with seven sectors; hind wings 0.5 mm. long, 0.5 mm. wide, subcordate in shape, with an anterior basal tooth-like lobe bearing a cluster of long hairs (frenulum), with one prominent longitudinal vein that runs obliquely from near the base of the prominent veins to about the middle of the hind margin and one cross vein from about the middle of the longitudinal vein to the anterior margin. Expanse: 8.25 mm.

Island of Hawaii, T. H. Holotype male taken one mile north of Humuula, July 30, 1935, and one female paratype from *Sophora* at Humuula, August 2, 1935; both specimens were collected by Dr. R. L. Usinger and are in Bishop Museum. The paratype was attacked by mold and the right wing and abdomen became detached from the specimen when it was remounted; all of the parts have, however, been preserved on the card holding the specimen.

This species may easily be distinguished from *Pseudopsectra lobipennis* Perkins because of its densely hairy wings alone. There are numerous other characters that may be used for differentiation, however. The wings on *P. usingeri* are proportionately narrower than those of *P. lobipennis* and their venation is greatly complicated by the excessive number of cross veins. On *P. lobipennis* there are a few cross veins between R and Sc and none between Sc and C, whereas these areas contain numerous cross veins on *P. usingeri*. Because of the hairs and denseness of the wings, it is much easier to trace the venation of *P. usingeri* with transmitted light than reflected light. On *P. lobipennis* the most prominent vein in the hind wing is branched near the apex and the posterior branch continues to the hind margin of the wing; such a branch is evidently lacking on *P. usingeri*. There are apparent differences in the terminalia, but to accurately discuss them, cleared dissections must be made; the mutilation of the holotype of *P. usingeri* and one male paratype of *P. lobipennis* before me is inadvisable.

Pseudopsectra swezeyi, new species (fig. 2)

Female.—Brown, fuscous and black; antennae yellowish brown, the basal segment with a dark transverse cloud; head with the face brown with some obscure dark areas, yellowish brown behind the antennae; pronotum yellowish brown, mesonotum with some darker areas, metanotum mostly yellowish brown, the pleurae fuscous; abdomen basically fuscous with the tergites mostly yellowish brown; legs basically yellowish to yellowish brown, all the coxae with a dark transverse cloud, fore and mid femora with a dark, broad median band, fore and mid tibiae with a rather similar mark but which is divided into two bands, hind femora and tibiae without such dark marks; fore wings basically yellow with the veins varying in color from yellow to brown through fuscous to black, the wing margin with yellow, dark brown or black marks alternating.

Head with the front reticulate, sparsely setose, the sutures marked by more polished, slightly elevated lines, the median line most conspicuous, crown protuberant and conspicuously multituberculate; terminal segment of the maxillary palpus about twice as long as the penultimate, flattened, lanceolate-acuminate; the distance across the eyes almost equal to the median length of the pronotum and crown; antennae distinctly longer than the fore wings. *Thorax* with the pronotum about one-sixth broader than long, set with numerous, long, very conspicuous, sharply pointed, cone-like tubercles, set in three transverse zones, the first zone consisting of a single tubercle on either side of the median line at the base, the second zone containing six or seven tubercles on either side of the median line just behind the middle, this median zone connected to the anterior zone by two tubercles along either side of the median line, the anterior zone consisting of ten or twelve tubercles near the anterior margin, the median line is free from tubercles and appears as a

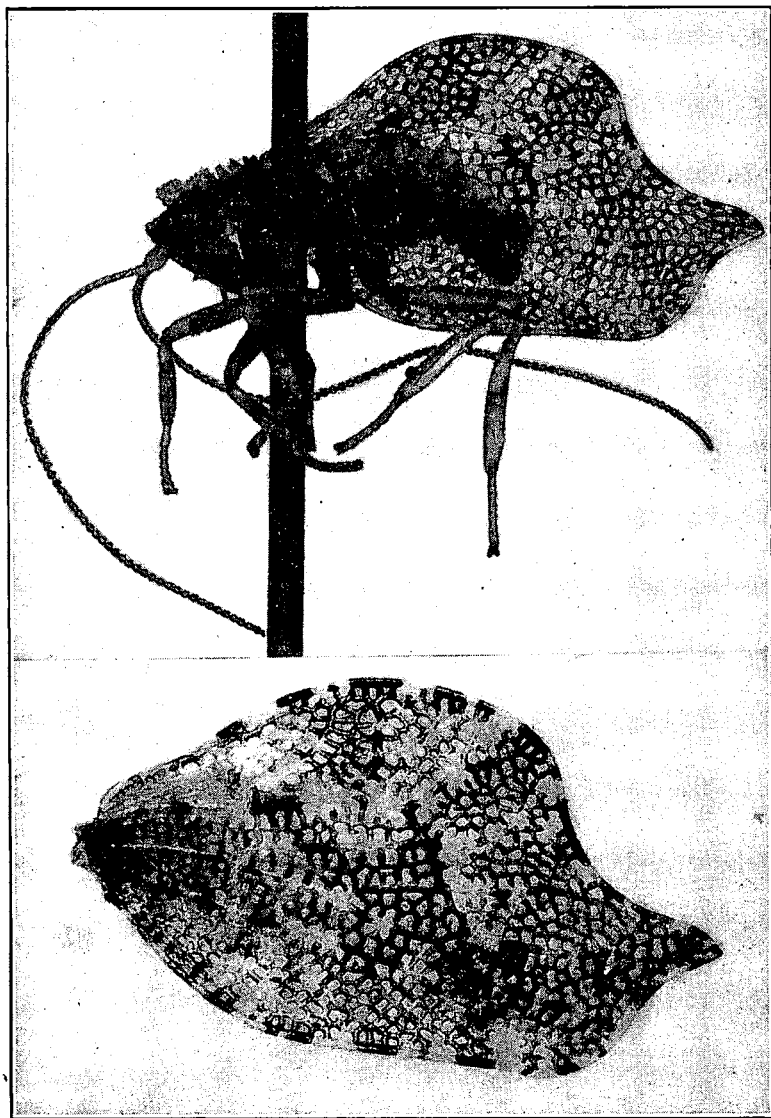


FIG. 2. *Pseudopsectra swezeyi* Zimmerman, new species; holotype. The lower figure is the left wing. Photographs by W. Twigg-Smith.

rather broad, shallow longitudinal depression; mesonotum with several tubercles on either side of the median line; metanotum not tuberculate. *Abdomen* reticulate but comparatively shiny; with two types of hair, one short and minute, the other long and conspicuous, the long hairs more numerous on the lower side and terminal segment and arising from small tubercles on those areas. *Legs* with the fore and mid femora conspicuously multidenticulate on the lower sides, the hind femora with minute denticles. *Wings* with the fore pair shaped as illustrated, not quite twice as long as wide (9:5), strongly transversely angulate toward the base from the costa to the radius, with microscopical setae only and no hairs; with some conspicuous tubercles near the base of the radius, all of the veins very heavy and the entire wing set with an excessive number of similar developed cross veins, the veins rather difficult to trace and abnormally placed, apparently as follows: Sc inconspicuous, traceable for only a short distance from the base, R continued to near the middle and then curved downward to join Rs (?) beyond the middle, with four superior sectors, Rs (?) with two superior sectors directed with the longitudinal axis that join R in its downward curve, forked just before R joins its upper branch, Cu (?) traceable to the apex; hind wings minute, halter-like, 0.15 mm. long. Expanse about 10 mm.

Island of Kauai, T. H. Holotype female, in Bishop Museum, collected by Mr. O. H. Swezey at Nualolo, September 1, 1921.

This is an aberrant insect. The tuberculate head and thorax are unique, and together with the peculiarly shaped fore wings will enable one to recognize the species at a glance.

The wings are apparently rigidly fixed, because they could not be spread forward; the left wing was removed to expose the side of the body. The angulation of the wings near the base (thus making the costal area fit more or less horizontally over the back) is very similar to that of *Nesothauma haleakalae* Perkins and their texture is like that of that species rather than the genotype of *Pseudopspectra*.

Genus *Nesothauma* Perkins

Nesothauma Perkins: Fauna Haw. 2(2): 46, 1899.

This genus contains one species on which there are no traces of hind wings. The fore wings are greatly modified.

Nesothauma haleakalae Perkins: *loc. cit.*, p. 47, pl. 4, figs. 13, 13a, 13b.

There is considerable variation in the color of the wings of this species, some examples have more black than others, but in most specimens the wings are tessellated. The wings are strongly and conspicuously transversely angulate in the basal fourth and overlap over the abdomen for about one-half of their lengths. It is difficult to trace the veins, because of the heavy texture and supernumerary cross veins. The entire wing has a coarsely reticulate appearance and recalls those of some tingitid bugs. In the natural position, this species greatly resembles a large psychodid fly.

This insect is rare. It has been found only high on the slopes of Mt. Haleakala, Maui. Perkins collected it at 5,000 feet in March 1894 and October 1896.