

INSECTS OF MICRONESIA

Neuroptera: Myrmeleontidae and Chrysopidae¹

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INTRODUCTION

This report covers material from all the principal island groups of Micronesia. About 383 specimens of these families from Micronesia were studied.

I wish to express my appreciation to Dr. J. L. Gressitt and Miss Setsuko Nakata for making this material available to me. The United States Office of Naval Research, the Pacific Science Board (National Research Council), the National Science Foundation, and Bernice P. Bishop Museum have made this survey and publication of the results possible. Field research was aided by a contract between the Office of Naval Research, Department of the Navy, and the National Academy of Sciences, NR 160-175.

The following institutions have generously lent specimens for this study: Bernice P. Bishop Museum, United States National Museum, California Academy of Sciences, Museum of Comparative Zoölogy at Harvard University, Chicago Natural History Museum, Hawaiian Sugar Planters' Association, Kyushu University, the Government of Guam, and the Trust Territory of the Pacific Islands. I am indebted to Dr. Waro Nakahara, Dr. Satoru Kuwayama, and M. Jacques Auber for their kindness in examining type material and lending specimens.

The following symbols indicate the museums in which specimens are stored: US (United States National Museum), BISHOP (Bishop Museum), and MCZ (Museum of Comparative Zoölogy).

Abbreviations for wing veins used throughout this report are as follows: A₁, first anal vein; C, costa; CuA, cubitus anterior; CuA₂, second branch of cubitus anterior; CuP, cubitus posterior; MA, media anterior; MP₁₊₂, first main branch of media posterior; MP₃₊₄, second main branch of media posterior; Psc, pseudocubitus; Psm, pseudomedia; R, radius; R₂, second radius; Rs, radial sector; and Sc, subcosta.

¹ This represents, in part, Results of Professor T. Esaki's Micronesian Expeditions (1936-1940), No. 99.

Fifteen species are represented in the material studied; two appear to be endemic to Micronesia, and eight are more or less widely distributed. One species is described as new. The neuropterous fauna is made up of two elements: the great majority with Indo-Malayan origin and a few that appear to have northeastern Asian affinities (*Chrysopa boninensis* and *C. furcifera*). However, the taxonomy of these families is still in too rudimentary a state for zoogeographic analysis.

The most widespread species, *Distoleon bistrigatus*, *Chrysopa oceanica*, *C. basalis*, and *Myrmeleon acer*, show considerable geographic variation.

DISTRIBUTION OF MICRONESIAN MYRMELEONTIDAE AND CHRYSOPIDAE

	MICRONESIAN ISLAND GROUPS										Other Localities	
	Bonin	N. Mariana	S. Mariana	Caroline						Marshall		Gilbert
				Palau	Yap	Caroline A.	Truk	Ponape	Kusaie			
Myrmeleontidae												
1. <i>Pseudoformicaleo jacobsoni</i>				×								Ceylon, Java, Malaya, Formosa
2. <i>Distoleon bistrigatus</i>		×	×	×	×							India to Tuamotus
3. <i>D. boninensis</i> *	×											Pacific region
4. <i>Myrmeleon acer</i>			×	×	×							
5. <i>Hagenomyia bicarunculata</i>				×								
Chrysopidae												
1. <i>Chrysopa oceanica</i>	×	×	×	×	×	×		×				Oceania
2. <i>C. ramburi</i>		×	×	×	×	×				×	×	Malaya, Timor, Australia, Tonga, Society Is., Samoa
3. <i>C. basalis</i>		×	×	×				×		×	×	Australia, Philippines, Formosa, Ryukyus, Ellice Is., Society Is., Austral Is., Marquesas, Tuamotus, Easter I., Hawaiian Is.
4. <i>C. jolyana?</i>			×									New Hebrides
5. <i>C. boninensis</i>	×											Formosa, Honshu, Shikoku
6. <i>C. scelestes</i>			×	×	×		×	×				India
7. <i>C. satilota</i>			×	×								Australia
8. <i>C. furcifera</i>	×											Japan, Ryukyus, Formosa, Philippines
9. <i>C. astur</i>				×	×							Ryukyus
10. <i>C. alcestes</i>	×											Bengal

* Described as new.

Chrysopa ramburi, although distributed throughout the Pacific, shows little geographic variation. The other species have more restricted or spotty distributions.

SYSTEMATICS

FAMILY MYRMELEONTIDAE

Five species are represented in the collections studied by me; two are endemic to Micronesia.

KEY TO MICRONESIAN SPECIES OF MYRMELEONTIDAE

1. In hind wing one crossvein basal to origin of Rs+MA..... 2
In hind wing at least three crossveins basal to origin of Rs+MA..... 4
2. In fore wing, CuA₂ and A₁ run parallel to hind margin, and unite at middle of wing; no apical fuscous stripe in hind wing..... **Pseudoformicaleo jacobsoni**
In fore wing, CuA₂ and A₁ run at angle to hind margin, and unite much basad of middle of wing; usually apical fuscous stripe on hind wing..... 3
3. Three rows of crossveins in basal portion of cubital field in hind wing; hind margin of ninth abdominal tergite of female angulate..... **Distoleon boninensis**
Two rows of crossveins in basal portion of cubital field in hind wing; hind margin of ninth abdominal tergite of female nearly straight.... **Distoleon bistrigatus**
4. Vertex and frons black; in fore wing basad of stigma, no costal veinlets connected by crossveins; basad of origin of RS+MA in fore wing, no crossveins connected..... **Myrmeleon acer**
Vertex brown, with two conspicuous black spots; in fore wing basad of stigma, short series of veinlets connected by row of crossveins; several crossveins basad of origin of Rs+MA connected..... **Hagenomyia bicarunculata**

1. **Pseudoformicaleo jacobsoni** Weele.

Pseudoformicaleo jacobsoni Weele, 1909, Leyden Mus., Notes 31: 25, fig. 11, pl. 2, fig. 8 (central Java; type in Leyden Mus.); 1912, Leyden Mus., Notes 35: 229.

Creagris matsuokae Okamoto, 1910, Wiener Ent. Zeitung 29: 282, fig. 3, (Formosa; n. syn.).

Gama matsuokae Banks, 1937, Philippine Jour. Sci. 62: 287.—Kuwayama, 1956, Ent. Soc. Shikoku, Trans. 5: 30.

DISTRIBUTION: Ceylon, Java, Malaya, Formosa, western Caroline Is.; two Micronesian specimens examined.

PALAU. BABELTHUAP: Ngerehelong, Apr. 1957, Sabrosky; Melekeiok, Apr. 1936, Ono.

I have compared several examples from Formosa with Malayan and Micronesian material; they appear to be identical.

2. **Distoleon bistrigatus** (Rambur). (Figure 1, b.)

Myrmeleon bistrigatus Rambur, 1842, Hist. Nat. Insectes, Neuropt., 391 (Tahiti; type in Paris Mus.).—Walker, 1853, Cat. Neuropt. Brit. Mus. 2: 335.

Myrmeleon striola Walker, 1853, Cat. Neuropt. Brit. Mus. 2: 340.

Myrmeleon torvus Walker, 1853, Cat. Neuropt. Brit. Mus. 2: 341.

Distoleon bistrigatus, Banks, 1910, Ent. Soc. Am., Ann. 3 (1): 43.—Kimmins IN Cheesman, 1927, Ent. Soc. London, Trans. 75: 14.

Formicaleo acuminatus Okamoto, 1910, Wiener Ent. Zeitung 29: 290 (n. syn.).

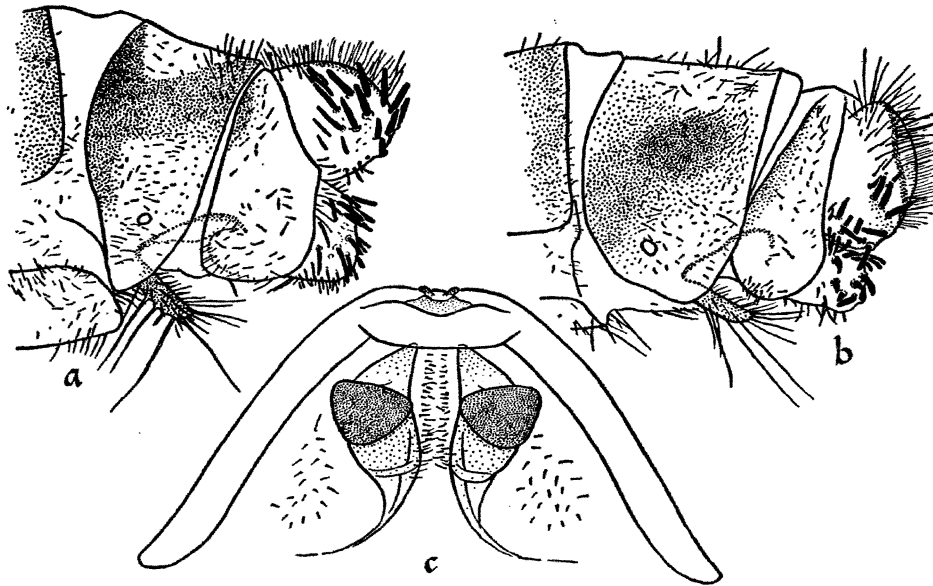


FIGURE 1.—Genitalia: a, *Distoleon boninensis*, holotype, female; b, *D. bistrigatus*, Palau, female; and c, *Hagenomyia bicarunculata*, male.

Formicaleon brahmanicus Banks, 1913, Ent. Soc. Washington, Proc. 15 (3): 142 (n. syn.).

Eidoleon bistrigatus, Esben-Petersen, 1918, Arkiv Zool. 11 (26): 15.—Navás, 1922, Roy. Acad. Cienc. Art. Barcelona, Mem. 17: 12.—Kimmins, 1936, Ann. Mag. Nat. Hist. X, 18 (103): 82.—Esben-Petersen, 1937, B. P. Bishop Mus., Occ. Papers 13 (5): 50.

Terminal segment of labial palpi small, slender, 0.52-0.56 mm. long, 0.11-0.13 mm. wide. Wings slender, hind margin of hind wing almost straight. In hind wing only four cubital crossveins before cubital fork; cubital field with double series of crossveins. Hind margin of ninth abdominal tergite of female nearly straight.

DISTRIBUTION: India to the Tuamotus, Mariana Is., Caroline Is.; 50 Micronesian specimens examined.

N. MARIANA IS. PAGAN: Laguna, Apr. 1940, Yasumatsu and Yoshimura.

S. MARIANA IS. SAIPAN: Afenia (Afetna) Pt., June 1946, Townes. TINIAN: Mar. 1946, Hadden; Mar. 1945, Hagen; Nov. 1952, Beardsley; Hagoya Lake, Mt. Lasso, June 1946, Townes. GUAM: Pt. Oca, July 1945, G. Bohart and Gressitt; Yona, cane field, May 1936, Swezey.

PALAU. BABELTHUAP: Ngerehelong, Sept. 1952, Beardsley; Ngiwal-Ngarard, Aug. 1939, Esaki. KOROR: May 1953, Dec. 1952, Mar. 1954, Beardsley; Nov. 1947, Dybas.

YAP. YAP: Ruul, July 1946, Townes. MAP: July-Aug. 1950, Goss.

Formicaleo acuminatus was described from two cotypes, one from Yayeyama, Ryukyus, the other from Ins. Ogasawara (Bonin Islands). I designate the Yayeyama specimen, the only one now in the Okamoto Collection, as lectotype. Dr. Satoru Kuwayama has kindly compared this specimen with *D. bistrigatus* and has sent me a photograph of it; it is identical with *D. bistrigatus*.

The specimens in the Museum of Comparative Zoölogy labelled *D. brahmanicus* and the Australian specimens of *D. bistrigatus* tend to have somewhat better defined black streaks on the hind wing than do Micronesian and Polynesian specimens, but otherwise they are the same.

3. *Distoleon boninensis* Adams, n. sp. (figs. 1, *a*; 2, *b*).

Very similar to *D. bistrigatus*. Last segment of labial palpus longer and stouter than in *bistrigatus*. Posterior margin of ninth abdominal tergite of female angulate in *boninensis*, straight in *bistrigatus*. *Boninensis* has somewhat broader wings, longer hypostigmatic cells in both wings, in hind wing five to eight crossveins between CuA and CuP (four in *bistrigatus*), and wider cubital field, usually with three rows of crossveins, at least basally. Fore wing with short brown marks up from rhexma and union of CuA₂ and CuP+A₁. Second crossvein beyond apex of hypostigmatic cell not so strongly marked as in *bistrigatus*. Hind wing with brown mark at rhexma, not lineate as in *bistrigatus*.

Measurements (mm.): Fore wing 36.0-39.5 long, 7.4-7.6 wide; hind wing 37.0-39.0 long, 6.0-6.7 wide; body length 29-32; antenna 8.5-9.3; terminal segment, labial palpus, 0.70-0.74 long, 0.16-0.18 wide.

Holotype, female (US 64201), paratypes (BISHOP and MCZ), Omura, Chichi Jima, Bonin Is., four females, June-July 1949, Kondo.

DISTRIBUTION: Bonin Is.

The Bonin Islands specimen of *D. acuminatus* (Okamoto) mentioned above may be identical with this species. However, Okamoto's description is ambiguous, and the Bonin Islands specimen is not available for comparison.

D. boninensis is also very similar to *D. subpunctulatus* (Brauer, 1869, Zool.-bot. Ges. Wien, Verh. 19: 16) from Samoa and Fiji, which differs in having longer and more dense setae on the eighth and ninth abdominal segments of the female, the last segment of the labial palpus is shorter (0.64 mm.) and more slender (0.15 mm.), the wings are shorter and broader, with shorter hypostigmatic cells, wider space between R and Rs, only four to five crossveins between CuA and CuP in the hind wing, and with only a small dot at rhexma of hind wing.

4. *Myrmeleon acer* Walker.

Myrmeleon acer Walker, 1853, Cat. Neuropt. Brit. Mus. 2: 348.—Weele, 1909, Leyden Mus., Notes 31: 41.—Kimmins, 1936, Ann. Mag. Nat. Hist. X, 18 (103): 83.—Esben-Petersen, 1937, B. P. Bishop Mus., Occ. Papers 13 (5): 50.

Myrmeleon solers Walker, 1853, Cat. Neuropt. Brit. Mus. 2: 367.

Myrmeleon inopinus Walker, 1853, Cat. Neuropt. Brit. Mus. 2: 384.

Myrmeleon celebensis McLachlan, 1875, Tijdschr. Ent. 18: 5, pl. 1, fig. 8.—Banks, 1916, Philippine Jour. Sci. 11: 210; 1942, B. P. Bishop Mus., Bull. 172: 30.—Kuwayama, 1953, Essa Ent. Assoc., Trans. 7: 39-41.

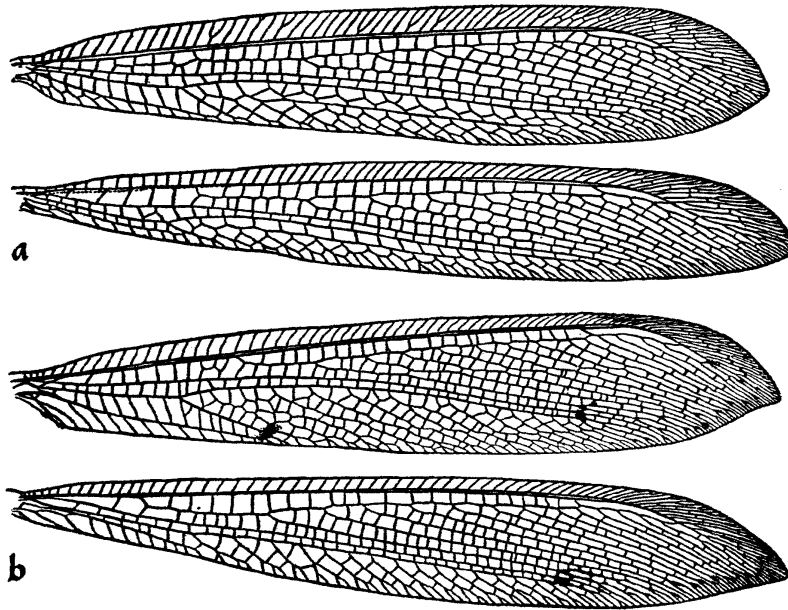


FIGURE 2.—Wings: a, *Hagenomyia bicarunculata*; and b, *Distoleon boninensis*.

DISTRIBUTION: Widespread in the Pacific; 51 Micronesian specimens examined.

S. MARIANA IS. SAIPAN: Garapan, July 1939, Esaki; Nov. 1944, Hagen; Afenia (Afetna) Pt., June 1946, Townes; June 1951, R. Bohart. TINIAN: June 1946, Townes. AGIGUAN: May-June 1952, Kondo; July-Aug. 1954, Davis; June 1952, Owen; June 1952, Peterson. ROTA: June 1946, Townes. GUAM: June 1945, Chaffee; 1923, Mar. 1924, Hornbostel; Nov. 1947, Dybas; Agana, July 1945, Wallace; Pt. Oca, May-June 1945, G. Bohart and Gressitt; Dec. 1945, R. Bohart; Jan., Feb., Apr. 1945, Baker.

PALAU. KOROR: Mar.-July, Aug. 1953, Beardsley; Nov.-Dec. 1947, Dybas; Ngarbaged (Arabaketsu), Dec. 1937, Murakami. PELELIU: Ashiasu-Ngarudoruko, Mar. 1936, Esaki. ANGAUR: Saipan-Higashimura, Mar. 1936, Esaki.

YAP. YAP: May 1936, Ono. MAP: Oct. 1952, Krauss.

According to Weele, the larva of this species is to be found in the sand near the shore, where it digs pits. It resembles that of *M. frontalis*, which was illustrated by Weele (1909, Leyden Mus., Notes 31: 38).

5. *Hagenomyia bicarunculata* (Brauer), n. comb. (figs. 1, *c*; 2, *a*).

Glenurus bicarunculatus Brauer, 1868, Zool.-bot. Ges. Wien, Verh. 18: 186.

—Esbén-Petersen, 1937, B. P. Bishop Mus., Occ. Papers 13 (5): 50.

DISTRIBUTION: Known only from the Palau Is.; five Micronesian specimens examined.

PALAU. KOROR: Dec. 1947, Dybas; Mar. 1954, July 1953, at light, Beardsley. ANGAUR: Mar. 1954, Beardsley.

This appears to be the first group of specimens to be collected since Brauer's description. Although this species differs from the other oriental species of *Hagenomyia* in several respects, I feel that there is little point in making a generic distinction. The wing shape is different from that of other hagenomyias, but the venation is basically the same. In the African species, the hypostigmatic cell of the fore wing is closed posteriorly by Rs, whereas in the oriental species, including *H. bicarunculata*, it is free from Rs. The oriental species, except for *H. bicarunculata*, tend to have the area of the radial sector narrowed toward the edge of the wing, which results in several branches fusing distally. *H. bicarunculata* also differs from the other species in having somewhat shorter antennae.

These specimens are larger (mean length, fore wing, 33 m.) than those described by Brauer.

FAMILY CHRYSOPIDAE

Genus *Chrysopa* Leach

Where possible, identifications made with the aid of the following key should be checked by clearing and dissection of the male genitalia.

KEY TO MICRONESIAN SPECIES OF CHRYSOPA

1. Pronotum with four black dashes, central pair bent so that lateral ends point diagonally back toward posterior pair; scutella each with pair of black dots **ramburi**
- Pronotum without distinct black marks..... 2

2. Head with distinct black marks or red genal marks; scape sometimes with lateral dark stripe..... 3
 Head unmarked, or with red or orange suffusion; scape unmarked or with apical band 7
3. Vertex with pair of black stripes, joined anteriorly to interantennal "x" mark; eight crossveins between Psm and Psc distally to intersection of MP₁₊₂ and MP₃₊₄ *furcifera*
 Vertex unmarked; no black interantennal mark..... 4
4. Antenna with lateral dark stripe on scape; black mark on each lateral margin of clypeus; gradates of fore wing dark..... *astur*
 Antenna unmarked 5
5. Gena pale, black marks on lateral margin of clypeus..... *basalis*
 Genal marks present..... 6
6. Palpus, gena, and lateral margins of clypeus black; gradates of fore wing pale *boninensis*
 Palpus pale, gena with red mark; gradates of fore wing black..... *alcestes*
7. Several anterior branches of Rs without inner gradates in both wings; pronotum distinctly longer than broad; anterior margin rounded..... *oceanica*
 Inner gradate series extends to R2, pronotum not longer than broad..... 8
8. Wing veins densely covered with decumbent setae; vertex suffused with orange *satilota*
 Setae longer, more erect; vertex not orange-suffused..... 9
9. Inner gradate series converges with R; Sc and R fused in male hind wing..... 10
 Inner gradate series parallel to R; Sc and R not fused in male hind wing..... *scelestes*
10. Wing veins mostly white; stigma of male hind wing translucent, colorless; male genitalia as in figure 7, *a-c*..... *jolyana*
 Wing veins green to brown (in dried material); stigma of male hind wing usually brown or green; male genitalia as in figure 5..... *basalis*

1. *Chrysopa oceanica* Walker (fig. 3, *e-f*).

Chrysopa oceanica Walker, 1853, Cat. Neuropt. Brit. Mus. 2: 328 (type in Brit. Mus.).—Kimmins IN Cheesman, 1927, Ent. Soc. London, Trans. 75: 160.—Esbén-Petersen, 1928, Insects of Samoa 7 (3): 102; 1935 (1939), B. P. Bishop Mus., Bull. 142: 137; 1937, B. P. Bishop Mus., Occ. Papers 13 (5): 57.—Banks, 1942, B. P. Bishop Mus., Bull. 172: 29.

Chrysopa v-rubrum Brauer, 1866, Reise Novara, Neuropt., 39.

Chrysopa marcheana Navás, 1910, Rev. Russe Ent. 10: 193 (n. syn.).

Chrysopa ogasawarensis Okamoto, 1914, Tohoku Imp. Univ., Jour. Coll. Agric. 6: 34; 1919, Hokkaido Agric. Exper. Sta., Rept. 9: 59, pl. 6, fig. 9.—Kuwayama, 1924, Nat. Hist. Soc. Formosa, Trans. 13: 12 (n. syn.).

Head yellow, vertex and frons sometimes ochraceous (Polynesian specimens with red along fronto-clypeal suture, and on anterior surface of vertex to margins of antennal receptacles). Scape pale, pedicel, and flagellum light fuscous (flagellum black basally in Philippine specimens). Pronotum longer than broad, anterior margins strongly rounded, truncate medially; blue-green, broad median yellow stripe, anterior corners narrowly red-margined. Pterothorax yellow, abdomen green with yellow median stripe. Wings obtusely pointed, venation entirely green; five to six inner, about 10 outer, gradates in fore wing. End of

abdomen dorsoventrally flattened. Sides of ninth sternite parallel, beyond articulation with ectoprocts sides tapering, apex rounded. Ectoprocts short, same length as ninth sternite, hind margin broadly rounded.

Fore wing 13.2-18 mm. long, 4.6-6.5 mm. wide.

DISTRIBUTION: Widespread in Oceania; 56 Micronesian specimens examined.

BONIN IS. MUKO JIMA: July 1951, R. Bohart. CHICHI JIMA: 1931, Motoike and Ise.

N. MARIANA IS. PAGAN: July 1951, R. Bohart; Laguna, Apr. 1940, Yasumatsu and Yoshimura; Songsong-Regusa, Apr. 1940, Yasumatsu and Yoshimura.

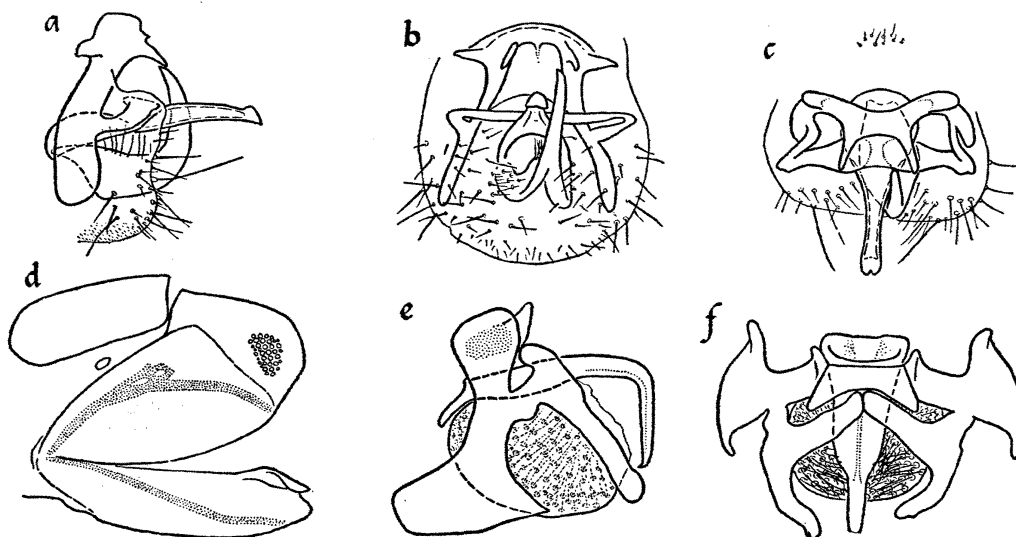


FIGURE 3.—a-d, *Chrysopa ramburi*, Yap: a-c, genital armature; d, lateral view of abdomen; and e-f, *C. oceanica*, Guam, genital armature.

S. MARIANA IS. TINIAN: Mt. Lasso, June 1946, Townes. ROTA: On foliage, June 1946, Townes. GUAM: Mt. Bolanos, Aug. 1952, Mt. Lamlam, Oct. 1952, Krauss; Mt. Alutom, July 1946, Townes; 2 km. southeast of Asan, 200-250 m., Oct. 1947, Dybas; near Pt. Ylig, Pago, May-June 1945, G. Bohart and Gressitt; near Santa Rosa, Pt. Oca (two in light trap, one in bait trap), May-June 1945, G. Bohart and Gressitt; Agana, Nov. 1953, Gressitt; Barrigada, Aug. 1936, Sumay, June 1936, Piti, Apr.-Oct. 1936, Yigo, Oct.-Nov. 1936, all Swezey; Inarajan, Mar. 1946, Maehler; Yigo, Sept. 1937, Oakley; Mata, Nov. 1938, Oakley; Pt. Ritidian, Oct. 1952, Krauss.

PALAU. KOROR: Jan.-May 1953, Beardsley; Aug. 1939, Esaki; Ngarbaged, Dec. 1937, Murakami.

YAP. YAP: Giliman, June 1957, Sabrosky.

CAROLINE ATOLLS. SOROL: Sorol I., Oct. 1952, Krauss.

PONAPE. Peipalap Pk., June-Sept. 1950, Adams; Mt. Temwetemwensekir, 150-300 m., Feb. 1948, Dybas; Colonia, Jan. 1953, Clarke.

Chrysopa marcheana was described from the Mariana Islands and *C. ogasawarensis*, from the Bonin Islands. The descriptions of these species agree with *C. oceanica* in all respects, and *C. oceanica* is known to occur in both these localities.

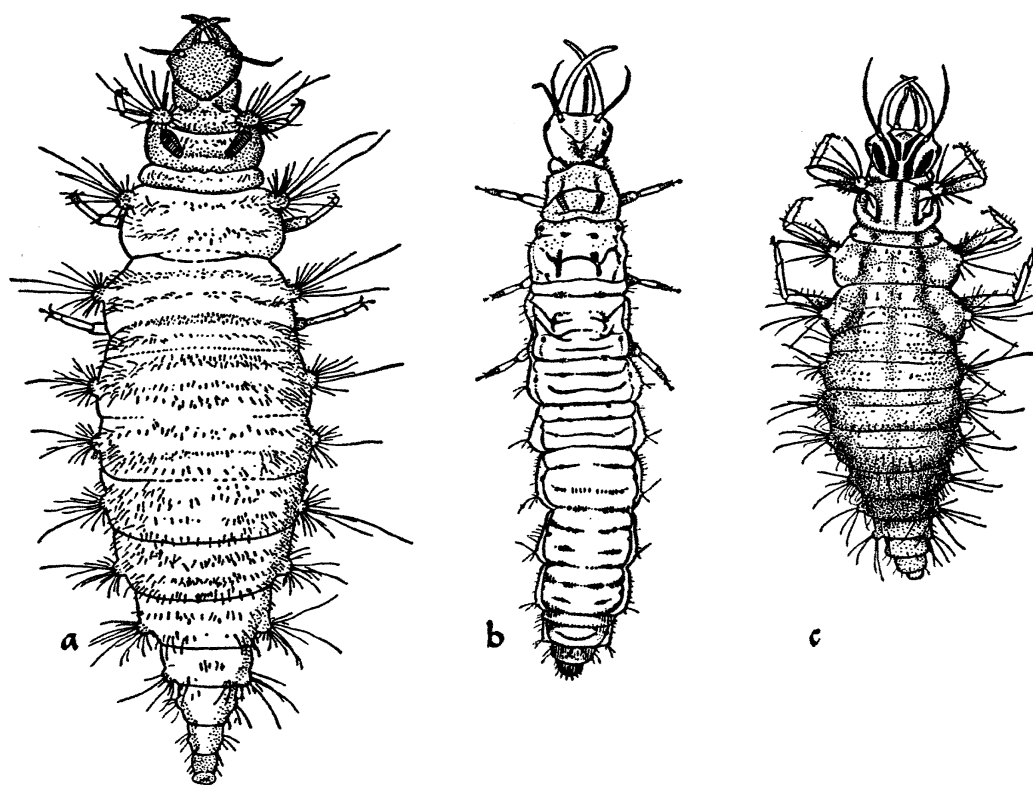


FIGURE 4.—Larvae: a, *Chrysopa ramburi*, Kwajalein; b, *Chrysopa* sp., probably *scelestes*, Palau; and c, *C. basalis*, Ponape.

2. *Chrysopa ramburi* Schneider (figs. 3, a-d; 4, a).

Chrysopa ramburi Schneider, 1851, Symb. Monogr. Gen. Chrysopae, 107 (Australia).—Walker, 1853, Cat. Neuropt. Brit. Mus. 2: 254.—Esbens-Petersen, 1928, Insects of Samoa 7 (3): 99, pl. 3, fig. 1; 1937, B. P. Bishop Mus., Occ. Papers 13 (5): 57.—Handschin, 1937, Naturf. Ges. Basel, Verh. 47: 132.

Chrysopa jaluitana Kempny, 1904, Zool.-bot. Ges. Wien, Verh. 54: 353 (n. syn.; Jaluit, Marshalls; type in Vienna Mus.)—Esbén-Petersen, 1928, Insects of Samoa 7 (3): 100.—Banks, 1930, Federated Malay States Mus., Jour. 16: 380.

Chrysopa vicina Kempny, 1904, Zool.-bot. Ges. Wien, Verh. 54: 354.

Chrysopa neutra Navás, 1910, Brotéria 9: 47.

Chrysopa reaumeri Navás, 1914, Rev. Real Acad. Madrid 12: 646, fig. 1.

Chrysopa notosticta Navás, 1914, Soc. Sci. Brussels, Ann. 38: 104, fig. 31.

Chrysopa deuthera Navás, 1914, Soc. Sci. Brussels, Ann. 38: 73.

Greenish yellow. Head markings variable; red dash on each side of fronto-clypeal suture, and red stripe on each side of vertex. Palpi pale, fuscous at tips. Scape pale, sometimes with posterior and lateral stripes, pedicel black laterally, flagellum fuscous, pale basally. Pronotum wide, anterior margin broadly rounded; transverse black dash each side; between end of this dash and posterior corner runs another black dash. Scutellum with pair of black dots anteriorly. Venation pale, cubital crossveins and ends of first and second anal in fore wing black; three to six inner, five to nine outer, gradates in fore wing; two to six inner, four to eight outer, gradates in hind wing. Wing tips rounded. End of male abdomen flattened; tip of ninth sternite rounded, with ligulate extension each side near tip. Fore wing 8.5-14.2 mm. long, 2.5-5.0 mm. wide.

DISTRIBUTION: Malaya, Timor, Australia, most of Micronesia except the Bonin Is., Tonga, Society Is., Samoa; 56 Micronesian specimens examined.

N. MARIANA IS. AGRIHAN: July 1949, Mead.

S. MARIANA IS. GUAM: Dec. 1945, R. Bohart; Jan.-Apr. 1945, Baker; Pt. Oca, June 1945, light trap, G. Bohart and Gressitt; 2 km. southeast of Asan, Jan.-Apr. 1945, Baker.

PALAU. ANGAUR: Feb. 1948, Dybas; Ngerkabesang, July 1946, Townes.

YAP. YAP: Kolonia, July-Aug. 1950, Goss; Mar. 1954, Beardsley; Yaptown, July 1946, Townes.

CAROLINE ATOLLS. ULITHI: Mogmog I., July 1946, Townes. NOMWIN: Nomwin I., Feb. 1954, Beardsley. KAPINGAMARANGI: Touhou I., Aug. 1954, light, Niering.

MARSHALL IS. ENIWETOK: Jobtan (Japtan) I., May 1946, *Ipomoea alba* and other vegetation, Townes; Aumon, May 1946, Townes; Bogombogo, Dec. 1950, on *Tournefortia* and blossoms of *Scaevola*, Oshiro. LAE: Lae I., Oct. 1953, reared from cocoon on *Acalypha* infested with *Icerya*, Beardsley. KWAJALEIN: May 1954, Keck; Bweje I., May 1945, Wallace. LIKIEP: Mar. 1950, Langford; Aug. 1946, Townes. JALUIT: Sydney Pier, Aug. 1946, Oakley.

GILBERT IS. TARAWA: Betio I., Aug. 1956, Brown. ONOTOA: Buiartun I., July 1951, Moul.

This species is immediately recognizable by the pronotal markings. (Kempny's species appear to be color varieties only.) The larva (fig. 4, a) appears to be a trash carrier. The association of this larva with *C. ramburi* is not absolutely certain, but no other species of *Chrysopa* has been recorded from Kwajalein.

3. *Chrysopa basalis* Walker (figs. 4, c; 5; 6).

Chrysopa basalis Walker, 1853, Cat. Neuropt. Brit. Mus. 2: 239 (Ryukyu Is.; type in Brit. Mus.).—Okamoto, 1919, Hokkaido Agric. Exper. Sta., Rept. 9: 58.—Cheesman, 1927, Ent. Soc. London, Trans. 75: 160.—Esben-Petersen, 1928, Insects of Samoa 7 (3): 105; 1935 (1939), B. P. Bishop Mus., Bull. 142: 13, 137; 1937, B. P. Bishop Mus., Occ. Papers 13 (5): 55.—Kimmins, 1936, Ann. Mag. Nat. Hist. X, 18 (103): 85.—Banks, 1937, Philippine Jour. Sci. 62: 282.

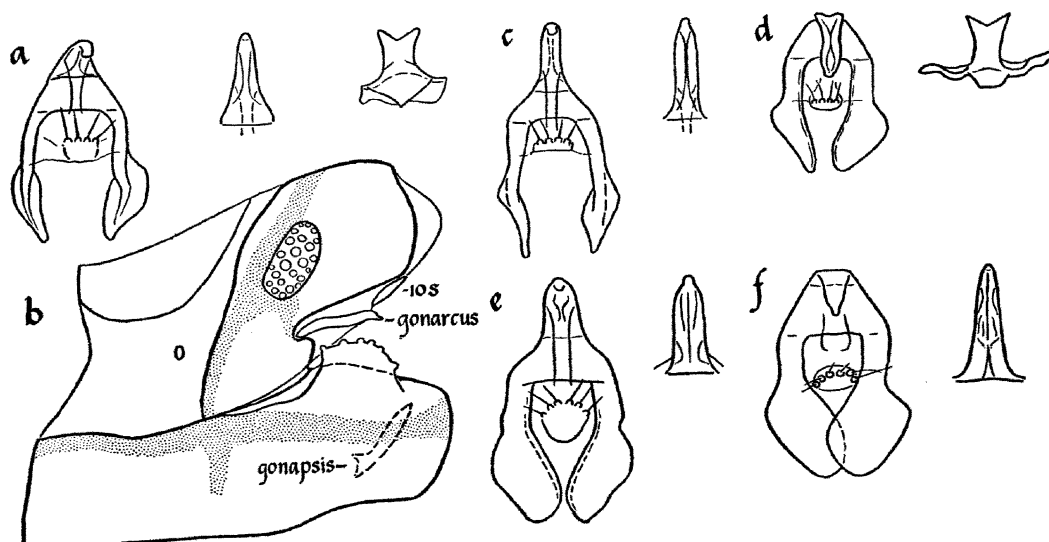


FIGURE 5.—*Chrysopa basalis*: a, pseudopenis and parameres, dorsal view of pseudopenis, and gonapsis; b, lateral view of abdomen, holotype of *C. latotalis*, Australia; c, pseudopenis and parameres and dorsal view of pseudopenis, paratype of *C. tagalica*, Luzon; d, pseudopenis and parameres and gonapsis, Palau; e, pseudopenis and parameres and dorsal view of pseudopenis, Ponape; and f, pseudopenis and parameres and dorsal view of pseudopenis, Austral Islands.

Chrysopa microphyta McLachlan, 1883, Ann. Mag. Nat. Hist. V, 12: 300 (n. syn.).—Zimmerman, 1939, Hawaiian Ent. Soc., Proc. 10 (3): 490; 1957, Insects of Hawaii 6: 92-94.

Chrysopa olatatis Banks, 1910, Psyche 17: 101 (n. syn.; Pt. Darwin, Australia; Sept. 9, 1908, male, MCZ 11955).—Handschin, 1935, Rev. Suisse Zool. 42: 697.

Chrysopa latotalis Banks, 1910, Psyche 17: 101-102 (n. syn.; Kuranda, Australia; Perkins, MCZ 11956).—Handschin, 1935, Rev. Suisse Zool. 42: 697.

Chrysopa tagalica Banks, 1913 (1914), Ent. Soc. Washington, Proc. 15 (4) : 174 (n. syn.; Los Banos, Philippine Is.; Baker, MCZ 11952); 1942, B. P. Bishop Mus., Bull. 172 : 29.

Chrysopa skottsbergi Esben-Petersen, 1924, Nat. Hist. Juan Fernandez and Easter I. 3 (3) : 310; 1928, Insects of Samoa 7 (3) : 104.

Chrysopa delmasi Navás, 1927, Pontif. Accad. Scienz. Roma, Mem. 10 : 20.

Anisochrysa paradoxa Nakahara, 1955, Kontyû 23 : 145-146, fig. 5 (n. syn.; genotype of *Anisochrysa*).

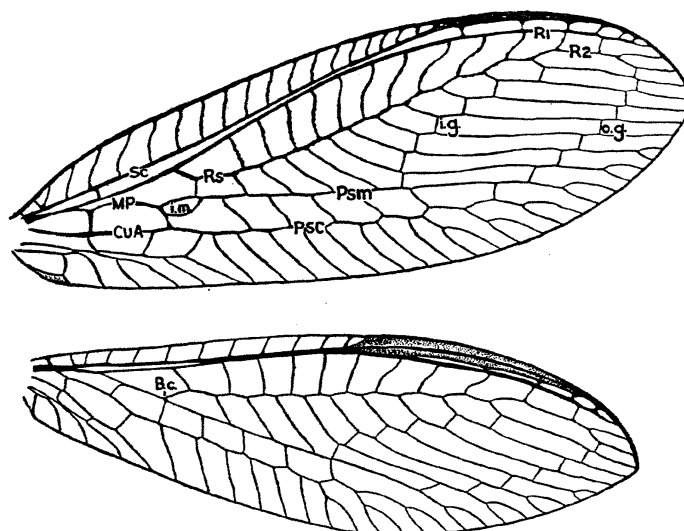


FIGURE 6.—*Chrysopa basalis*, Palau, male wings. B.c., Banksian cell; CuA, cubitus anterior; i.g., inner gradate crossveins; i.m., intramedian; MP, media posterior; o.g., outer gradate crossveins; Psc, pseudocubitus; Psm, pseudomedia; R, radius; R2, second radius; Rs, radial sector; Sc, subcosta.

Head usually without distinct markings, sometimes faint black spot on each lateral margin of clypeus (Palau specimens). Antenna pale, flagellar segments near base plainly longer than wide. Pronotum slightly wider than long. Body green, conspicuous orange-yellow mid-dorsal stripe.

Wing broad, apices blunt. Venation pale; first cubital crossvein in fore wing dark; gradates in fore wing sometimes dark. Rs in both wings only slightly sinuate. Inner gradate series of both wings converging with Rs, so that basal inner gradates about twice as far from Rs as apical inner gradates. Subcosta and radius in hind wing of male fused basad of stigma. Stigma in male heavily developed; in fore wing narrow, in hind wing wider and often brown-pigmented, never fused with radius.

DISTRIBUTION: Australia, Philippines, Formosa, Ryukyus, Marianas, Carolines, Marshalls, Gilberts, Ellice Is., Samoa, Society Is., Austral Is., Marquesas, Tuamotus, Easter Island, Hawaiian Is.; 83 Micronesian specimens examined.

N. MARIANA IS. AGRIHAN: Aug. 1945, Borrer and Holder. PAGAN: Songsong-Regusa and Regusa-Tarague, Apr. 1940, Yasumatsu and Yoshimura.

S. MARIANA IS. SAIPAN: Matansha-Calabera, May 1940, Yasumatsu and Yoshimura; June 1951, R. Bohart; Kannat Edot, June 1946, Townes. TINIAN: Mar. 1946, in cornfield, Hadden; Mt. Lasso, June 1946, swept, Townes; Sonson, Nov. 1937, Esaki. AGIGUAN: May-June 1952, Kondo and Peterson. GUAM: Pt. Oca, May-June 1945, light, G. Bohart and Gressitt.

PALAU. BABELTHUAP: Ngerehelong, May 1957, Sabrosky; Imeliik (Aimelik), Aug. 1953, Beardsley. KOROR: Jan.-Feb., May, July 1953, Beardsley; Apr.-May 1949, Langford; Jan.-Mar. 1948, Dybas; Mar. 1948, Maehler; July 1946, Townes and Oakley; islet near Koror, Sept. 1952, Krauss.

PONAPE. Colonia, Nov. 1953, Beardsley; Jan. 1953, Clarke; Colonia-Palikir, Dec. 1937, Esaki; Agric. Exper. Sta., June-Sept. 1950, Adams; Jan. 1953, Gressitt, Mar. 1948, Dybas; Mt. Temwetemwensekir, 180 m., Jan. 1953, Gressitt; 150-300 m., Feb. 1948, Dybas; Mt. Dolotomw, 650 m., Mt. Pairot, 700 m., Mt. Dolen Net, 200 m., and Lenger I., all June-Sept. 1950, Adams; Nanpohnmal, Jan. 1953, Clarke; Nanipil, Nett District, Feb. 1948, Dybas; Dolen Eireke (Sankaku Yama), Jan. 1938, Esaki.

MARSHALL IS. AILINGLAPALAP ATOLL: Bikajela (Bigatyelang) I., Aug. 1946, Townes.

GILBERT IS. ONOTOA: Buiartun I., at light, June 1951, Moul.

This species shows much geographic variation, some of which is of a clinal nature. Polynesian (except Hawaiian) specimens have a black band at the apex of the scape above and a somewhat more slender pseudopenis than specimens from the eastern Carolines and Marianas. The expanded portion of the paramere in both the Polynesian and Micronesian specimens is heavy and twisted so that the margins opposite the pseudopenis are approximate; Philippine, Australian, and Formosan specimens have this portion of the paramere lying in the sagittal plane, and somewhat more slender pseudopenes. Palau specimens are intermediate between these types. A small plate between the paramere arms bears four setae (Australia, Philippines, Formosa, Palaus) or five to six setae (rest of Micronesia and Polynesia). Males from Palau have unusually heavy wing veins; the radial crossveins near the stigma are so strongly sinuate and slanted that Rs appears to throw off branches to each side. The inner gradates are more distant from the outer series in Palau specimens, the intramedian cell may occasionally be formed like that of *Nothochrysa*, the basal Banksian cell in the hind wing is reduced or absent, and the wing membrane is sometimes cloudy.

C. olatatis Banks was characterized as having a red spot on the vertex; the holotype has no such spot, although there are several grains of a reddish foreign material on the vertex. *C. tagalica*, *C. olatatis*, and *C. latotalis* are indis-

tinguishable and are considered synonymous with *C. basalis*. Dr. Waro Nakahara has kindly examined the type of his *Anisochrysa paradoxa* and has sent me a sketch of its genitalia, which are like those of the Philippine form of *Chrysopa basalis*, slender with four bristles on the plate between the paramere arms.

The larva of *C. basalis*, known through rearing (fig. 4, c, Ponape, Agric. Exper. Sta.) is a trash carrier. A similar trash-carrying larva from the Palau Is. (Peleliu Is., Jan. 25, 1948, Dybas, beating vegetation) has longer mandibles, and a wider head, solidly dark but for a thin, pale Y-mark and a spot on the frons; pronotum with a thin median black stripe and a large irregular black mark on each side; mesonotum with a pair of black spots; rest of body pale; and setae much longer and stouter, serrate, on thorax borne on longer, stalked tubercles. If the Peleliu larva proves to be that of the adult Palau form of *C. basalis*, the latter will probably have to be considered specifically distinct from the central Micronesian form.

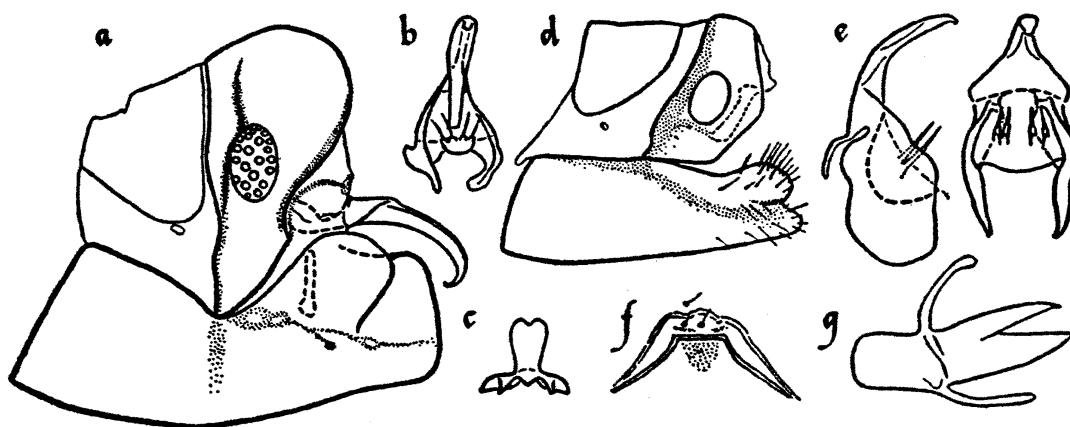


FIGURE 7.—a-c, *Chrysopa jolyana*: a, lateral view of abdomen, b, genital armature, and c, gonapsis; d-g, *C. boninensis*, Bonin Islands; d, lateral view of abdomen, e, genital armature, f, gonarcus, and g, gonapsis.

4. *Chrysopa jolyana*? Navás (fig. 7, a-c).

Chrysopa jolyana Navás, 1910, Rev. Russe Ent. 10: 4-5 (Malekula, New Hebrides; type in Paris Mus.).

Vertex lemon yellow, bordered with pale green anteriorly. Frons and gena ivory, clypeus and labrum golden yellow. Antenna pale. Pronotum broad as in *basalis*, with black setae over dorsal surface. Anterior cervical sclerites with black lateral spot. Thorax, including pronotum, ivory with lemon yellow mid-dorsal stripe. Pleura white with pale setae, legs ivory with black setae. Venation as in *basalis*; Sc and R fused in hind wing of male. Veins mostly colorless, translucent; in middle third of fore wing, veins near margins (C, costal veinlets, Sc, and first few veinlets from PsCu) and some at wing apex white. In middle third of hind wing, veins behind R white. Pterostigmata unpigmented, not so

heavy as in *basalis*. In fore wing, gradates and first crossvein between Rs+MA and MP₁₊₂ dark. In hind wing, outer gradates dark, inner white. Five inner, six outer, gradates in both wings.

Genitalia: Gonarcus weakly sclerotized, thin band supporting small lozenge-shaped median plate.

Fore wing: 8.7 mm. long, 3.5 mm. wide.

DISTRIBUTION: New Hebrides, Mariana Is.

S. MARIANA IS. SAIPAN: Tanapag, Jan. 12, 1949, Maehler (US).

This species differs chiefly from *C. basalis* in the coloration and the structure of the male genitalia. The specimen does not appear to be bleached or teneral. As the type of *C. jolyana*, the only known specimen, is a female, a positive identification will be impossible until additional material from the New Hebrides becomes available. Drawings of the Saipan specimen were compared with the type by M. Auber; he concluded that the venation appeared to place *C. jolyana* in the *basalis* group. The pale coloration is sufficiently unusual in *Chrysopa* to make it seem probable that the Saipan specimen is conspecific with *C. jolyana*.

5. *Chrysopa boninensis* Okamoto (fig. 7, d-g).

Chrysopa boninensis Okamoto, 1914, Tohoku Imp. Univ., Jour. Coll. Agric.

6: 62; 1919, Hokkaido Agric. Exper. Sta., Rept. 9: 61, pl. 1, fig. 16, pl. 4, figs. 19, 20, pl. 5, fig. 7.—Kuwayama, 1924, Nat. Hist. Soc. Formosa, Trans. 13: 12; 1956, Ent. Soc. Shikoku, Trans. 5: 29.

Head pale, black stripe on lateral margin of clypeus and spot on each gena; maxillary palpus black, labial palpus pale. Pronotum wider than long, anterior margin broadly curved. Mid-dorsal pale stripe faint. Wings fairly broad, tip blunt; venation pale, cubital crossveins in fore wing faintly dark. Setae dark, straight, short, numerous. Five to six inner, seven to eight outer, gradates in fore wing, apical inner gradates closer to Rs than are basal gradates. Ninth sternite narrowed behind to point; above, shelf-like ridge with apical bulbous process each side. Paramere arms broad, space between arms sclerotized, deeply concave, bearing four heavy tapered setae on stalk-like bases. Gonapsis ligulate, with lateral arms and internal lobe of variable shape.

Fore wing 10.5-12 mm. long, 3.4-3.7 mm. wide.

DISTRIBUTION: Bonin Islands, Formosa, Honshu, Shikoku; nine Micronesian specimens examined.

BONIN IS. CHICHI JIMA: June 1936, Ikeda; July 1951, R. Bohart; July 1949, Mead; Futami-ko, May 1956, Clagg.

6. *Chrysopa scelestes* Banks (fig. 8).

Chrysopa scelestes Banks, 1911, Ent. Soc. Washington, Proc. 13: 103.

Light green with pale yellow mid-dorsal stripe. Head pale, clypeus and gena often suffused with red; Koror specimens may have orange marks on anterior part of vertex, between antennae, and on frons and clypeus. Antenna pale, fuscous at tip. Pronotum much broader than long, anterior margin straight, corners only slightly rounded. Wings slender, pointed, veins green with fairly long, nearly straight, pale setae. Pterostigmata inconspicuous; subcostal crossveins behind stigma weak; five to seven inner, six to eight outer, gradates in fore wing, the gradate series parallel to Rs.

Gonarcus arched, arms flattened. Parameres attached to margin of gonarcus, formed as thin flat plates, each bearing stout prong, directed mediad and ventrad. Thin, curved rod extending down inner side of genital pocket; behind this, on surface of genital pocket, sclerotized band extending between ends of paramere arms up over face of genital armature, then folded back down. Band widens abruptly, forming elliptical, weakly sclerotized plate on downward fold, which covers genital armature.

Fore wing 8.7-11.0 mm. long, 2.75-3.6 mm. wide.

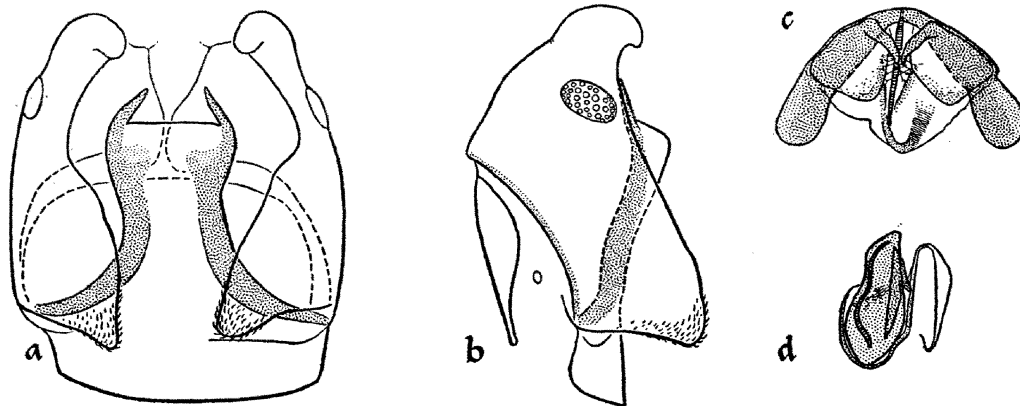


FIGURE 8.—*Chrysopa scelestes*, holotype: a, ventral view of abdomen; b, lateral view of abdomen; c, posterior view of genital armature; and d, lateral view of genital armature.

DISTRIBUTION: India, Caroline and Mariana Is.; 54 Micronesian specimens examined.

S. MARIANA IS. TINIAN: June 1946, Townes.

PALAU. BABELTHUAP: Ulimang, Dec. 1947, Dybas; Ngerkabesang (Arakabesan), July 1946, Townes; Iwang, 8 m., and east Ngatpang, 65 m., Dec. 1952, Gressitt; Airai, Ngerimal River, May 1957, Sabrosky. **KOROR:** Oct., Dec. 1952, and Jan.-Apr. 1953, Beardsley; Nov.-Dec. 1947, and Jan. 1948, Dybas; July 1946, Townes; Apr. 1957, Sabrosky. **MALAKAL:** May 1957, Sabrosky.

YAP. YAP: Mar. 1954, Beardsley; Kolonia, south Yap, central Yap, and Ruul District, all July-Aug. 1950, Goss. **RUMUNG:** Southern part, July-Aug. 1950, Goss. **MAP:** Southern part, July-Aug. 1950, Goss.

TRUK. WENA (Moen): Nantaku (Civ. Admin. Area), Mar. 1949, Potts.

PONAPE. Colonia, June-Sept. 1950, Adams.

The only specimen in the Museum of Comparative Zoölogy is a male from Pusa, Bengal, April 2, 1908, leaves of Guinea grass, A.H., C. No. 678, holotype MCZ 11962.

A pair of unusual larvae from Ulimang, Babelthuap, Dec. 1947, Dybas (fig. 4, b) may belong to this species; adults of *C. scelestes* were collected there at

about the same time. These larvae are much flattened, nearly without setae, shortlegged, and somewhat reminiscent of cucujid larvae.

7. *Chrysopa satilota* Banks (fig. 9).

Chrysopa satilota Banks, 1910, *Psyche* 17: 102 (Australia; type in MCZ); 1942, B. P. Bishop Mus., Bull. 172: 29.

Straw yellow, head yellow, vertex, face, and sometimes scape orange; pedicel and flagellum pale, fuscous distally. Pronotum about as long as broad, anterior margin rounded; anterior corners narrowly red-margined. Pterothorax and abdomen light greenish yellow with lemon yellow mid-dorsal stripe; pleura ivory, legs translucent white. Wings slender, pointed, venation pale green (usually yellow in dried material); veins densely covered with long decumbent setae. Seven to nine inner, nine to 10 outer, gradates in fore wing.

Fore wing 12.5-16.0 mm. long, 3.9-5.0 mm. wide.

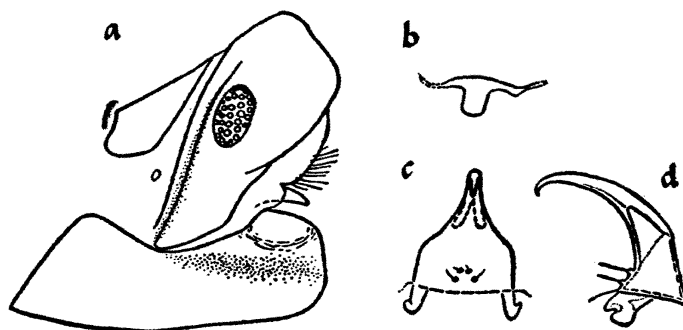


FIGURE 9.—*Chrysopa satilota*, Guam: a, lateral view of abdomen; b, gonarcus; and c, d, genital armature.

DISTRIBUTION: Australia, Palau, Marianas; nine Micronesian specimens examined.

S. MARIANA IS. GUAM: 1911, Fullaway; Pt. Oca, June 1945, G. Bohart and Gressitt; Piti, Apr. 1936, Swezey; 2 km. southeast of Asan, Jan.-Apr. 1945, Baker.

PALAU. KOROR: Mar. 1948, Maehler.

The long pronotum, orange head markings, and decumbent setae on wing veins are characteristic of *C. satilota*.

8. *Chrysopa furcifera* Okamoto (fig. 10).

Chrysopa furcifera Okamoto, 1914, *Tohoku Imp. Univ., Jour. Coll. Agric.* 6: 61; 1919, *Hokkaido Agric. Exper. Sta., Rept.* 9: 57, pl. 1, fig. 15, pl. 7, fig. 5.—Kuwayama, 1924, *Nat. Hist. Soc. Formosa, Trans.* 13: 12.—Banks, 1937, *Philippine Jour. Sci.* 62: 285.—Takeuchi, 1955, *Coloured Illustrations Insects Japan, Osaka*, 3: 71.—Kuwayama, 1956, *Ent. Soc. Shikoku, Trans.* 5: 29.

Head pale, marked with black as follows: Two stripes on vertex, connected to X-mark between antennae, dash on each side of fronto-clypeal suture, lateral margins of clypeus and labrum, and gena. Palpus black. Scape with lateral black stripe, pedicel black, flagellum dark. Pronotum short, broad. Thorax and abdomen pale, with many short, black setae. Apex of abdomen pointed in both sexes. Gonarcus heavily sclerotized, with median tooth. Pseudopenis heavily sclerotized; paramere arms flattened, each bearing loosely articulated hook-like process.

Wings extremely slender, pointed. Venation pale, setae short, black. Eight inner, eight to nine outer, gradates in fore wing. Eight "crossveins" between Psm and Psc distally to intramedian cell.

Fore wing 11-12.5 mm. long, 3.1-3.4 mm. wide. Body length about 10 mm.

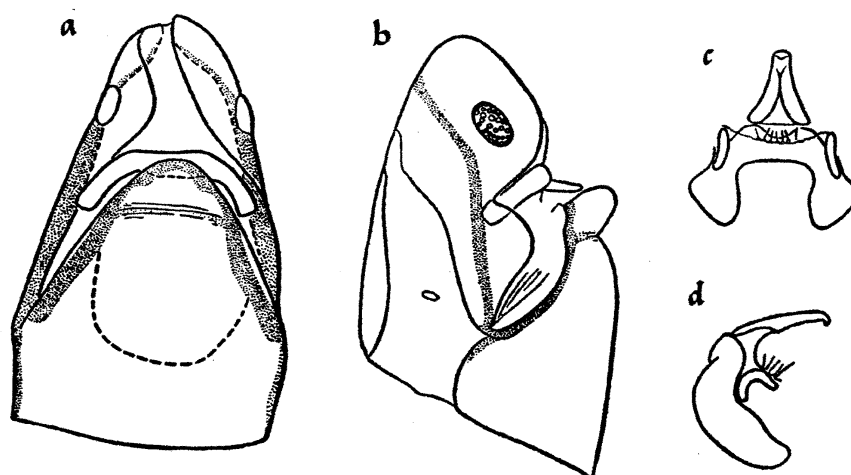


FIGURE 10.—*Chrysopa furcifera*, Bonin Islands: a, b, ventral and lateral views of abdomen; and c, d, genital armature.

DISTRIBUTION: Japan, Bonin Is., Ryukyu Is., Formosa, Philippines; two Micronesian specimens examined.

BONIN IS. CHICHI JIMA: Omura, June 1949, Mead; Futami-ko, May 1956, Clagg.

A pair of specimens from Acupan, Benguet, Luzon, 10-VI, Banks, in the Museum of Comparative Zoölogy, have the gonarcus, pseudopenis, and paramere arms more weakly sclerotized than the Micronesian specimen. The species has not previously been recorded from the Philippine Islands.

9. *Chrysopa astur* Banks (fig. 11, a-e).

Chrysopa astur Banks, 1937, Philippine Jour. Sci. 62: 283.

Head yellow, face faintly suffused with red, black spot on each side clypeus; gena pale in Micronesian specimens. Antenna pale, narrow longitudinal dark line on lateral surface of scape, sometimes faint. Palpus pale, fuscous at tips. Pronotum about as long as wide. Legs pale, hind tibiae moderately swollen. Thorax and legs covered with short pale setae. Venation pale green, gradates and surrounding membrane in fore wing dark. Veins

bearing long, pale setae. In fore wing, 20 to 25 costal veinlets, six to eight branches of Rs anterior to Psm, three to seven inner, six to eight outer, gradates, series sometimes irregular; six to seven "crossveins" beyond end of first intramedian cell. In hind wing, four to five inner, five to seven outer, gradates.

Genitalia: Tenth sternite a small oval plate. Gonarcus well sclerotized, with median tooth. Gonapsis more or less flat, with central ridge projecting anteriorly.

Fore wing 10.2-11.5 mm. long, 3.8-4.0 mm. wide; hind wing 9.5-10.0 mm. long, 3.2 mm. wide.

DISTRIBUTION: Ryukyu, Yap, and Palau Is.; four Micronesian specimens examined.

PALAU. KOROR: July 1946, Townes; July 1951, Dec. 1952, Gressitt.

YAP. YAP: Dugor-Kanif-Ruul, Sept. 1939, Esaki.

The type, from Iriomote Island, Ryukyu Islands, in the Museum of Comparative Zoölogy, has stronger dark markings: a black genal spot, and more crossveins at base of wing dark.

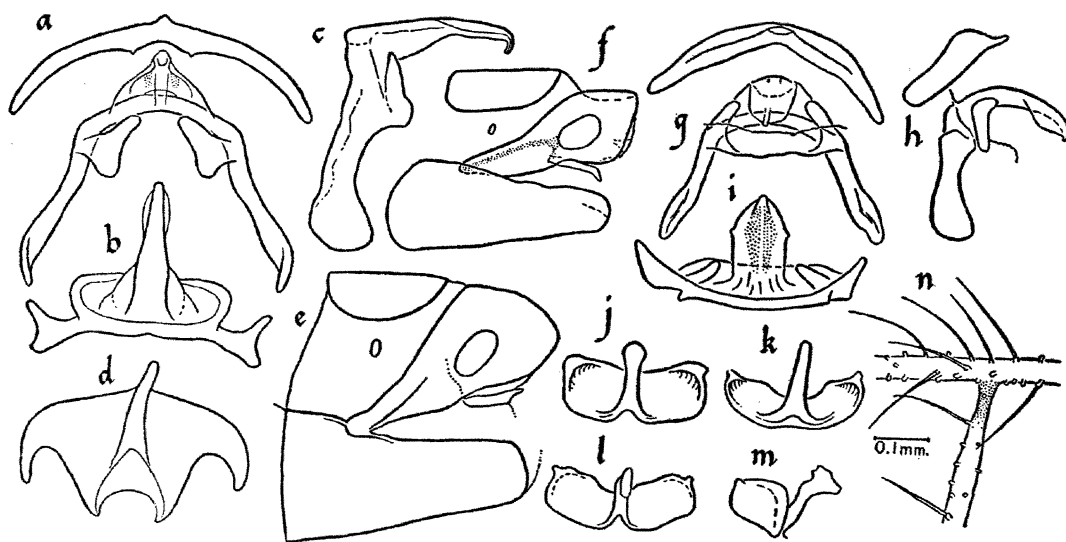


FIGURE 11.—a-e, *Chrysopa astur*, Palau: a-c, genital armature, d, gonapsis, and e, lateral view of abdomen; f-n, *C. alcestes* (f-k, n, Bonin Islands; l, m, type): f, lateral view of abdomen, g-i, genital armature, j-m, gonapses, and n, portion of male fore wing, showing junction of radial crossveins with R and scale for all figures except e, f.

10. *Chrysopa alcestes* Banks (fig. 11, f-n).

Chrysopa alcestes Banks, 1911, Ent. Soc. Washington, Proc. 13: 102 (Pusa, Bengal; type, male, MCZ 11961).

Pale yellow green, mid-dorsal stripe only faintly indicated; red marks on gena, sometimes extending onto clypeus, and anterior cervical sclerite; lateral margins of pronotum sometimes pinkish. Palpus pale to fuscous. Pronotum slightly broader than long,

strong transverse ridge in middle. Wing venation green, crossveins dark at each end, gradates dark. In male, most crossveins swollen except at ends, and setal bases strongly produced, giving veins warty appearance.

Wings slender, tip blunt, pterostigma inconspicuous in both sexes. In fore wing, 19 to 22 costal veinlets proximal to stigma, seven to nine radial crossveins, Rs with five to seven branches; three to five inner, four to five outer, gradates. In hind wing, two to four inner, three to four outer, gradates.

Genitalia: Apex of 10th tergite slightly more acute in type than in Bonin Islands specimens. In one Bonin specimen, medial process of gonapsis straight and tip expanded; in type, bent and tip irregularly expanded.

DISTRIBUTION: Bengal (type), Bonin Is.; five Micronesian specimens examined.

BONIN IS. CHICHI JIMA: Futami-ko, May 1956, Clagg.

This species is related to *C. astur*, the wings of which are not so densely setose, and in which the crossveins and setal bases are normal. The peculiar distributional records of *C. scelestes* and *C. alcestes* are probably indicative only of insufficient collecting.

Bibliography of the Neuropterida

Bibliography of the Neuropterida Reference number (r#):
1288

Reference Citation:

Adams, P. A. 1959 [1959.04.10]. Neuroptera: Myrmeleontidae and Chrysopidae. *Insects of Micronesia* 8:13-33.

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