INSECTS OF MICRONESIA

Embioptera

By EDWARD S. ROSS

California Academy of Sciences

As previously observed [Ross, 1951, Hawaiian Ent. Soc., Proc. **14** (2): 307-310], the Embioptera fauna of the Pacific islands is meager. Only one genus, *Oligotoma* Latreille, is present and this appears to be the result of human transport. The subgenus *Aposthonia,* which has its center of distribution in Asia and Indonesia, seems to have reached various islands of the Pacific early, during the movements of aboriginal man, whereas *Oligotoma s. str.,* with its center of endemicity in India, has only recently populated certain islands as a result of modern commerce. Embioptera are particularly susceptible to human transport because they are capable of establishing colonies on the surface or in crevices of many objects that comprise the cargo of man. It is even conceivable that the inner surfaces of the hulls of boats could bear colonies. The protection of the silken galleries and the simplicity of the food requirements would contribute greatly to the chances of survival during sea voyages.

The present study has been handicapped by the limited number of samples. Only 12 specimens of the order are available from Micronesia, in spite of the intensive collecting that has been done there recently. The largest series from any one island comprises three specimens. This does not necessarily reflect rarity or sporadic occurrence of the order, but an oversight on the part of collectors who, understandably, make no special effort to find Embioptera.

The United States Office of Naval Research, the Pacific Science Board (National Research Council), the National Science Foundation, and Bishop Museum have made the survey and the publication of the results possible.

The following symbols indicate the museums in which specimens are stored: US (United States National Museum), BISHOP (Bishop Museum), KU (Kyushu University), BM (British Museum), CAS (California Academy of Sciences), CM (Chicago Natural History Museum), TT (Trust Territory), MCZ (Museum of Comparative Zoölogy), and HSPA (Hawaiian Sugar Planters' Association Experiment Station).

Under each species the distribution records are arranged geographically from north to south, from the Bonins to Guam, and then west to east, from Palau to the Gilberts. Within Palau, records are from north to south, and within Truk, from west to east.

Key to Embioptera of Micronesia (Males)

1. Left cercus-basipodite obsolete except for a sclerotic fragment fused to outer-ventral margin of base of left cercus (*Aposthonia*) 2
   Left cercus-basipodite a complete ring, strongly lobed on its inner side (*Oligotoma*) 3

2(1). General color dark brown with blackish head and terminalia. Head narrow, with small eyes, facets small (fig. 1, *a*) ..... **micronesiae**
   General color tan with medium-brown head and terminalia. Head expanded across eyes, which are large and coarsely faceted (fig. 1, *h*) ..... **oceania**

3(1). Left process of tenth abdominal tergite (see figure 1, 10 LP) narrow, acuminate; micro-bifid at apex. Right tergal process (10 RP) with a small but conspicuous, subterminal, outer tooth. Sclerotic process of left paraproct (LPPT) minute, closely paralleling transverse apical margin of hypandrium lobe (HP) ..... **humbertiana**
   Left tergal process broad, spatulate; not apically bifid. Right tergal process without a subterminal outer tooth. Sclerotic process of left paraproct large, sickle-shaped, arcing across hypandrium lobe ..... **saundersii**

Distributional List of Micronesian Embioptera

	N. Mariana	S. Mariana	Ponape	Kusaie	Marcus	Marshall	Gilbert	Other localities
1. Oligotoma (Aposthonia) oceania				×				E. Polynesia; Hawaii
2. Oligotoma (Aposthonia) micronesiae	×					×	×	
3. Oligotoma (Aposthonia) sp.			×					
4. Oligotoma (Oligotoma) humbertiana		×						India, spread over Orient, and to Mexico
5. Oligotoma (Oligotoma) saundersii					×			India, spread to many tropical areas

Family OLIGOTOMIDAE

Genus **Oligotoma** Latreille

Subgenus **Aposthonia** Krauss

Mature males of this subgenus may be distinguished from those of *Oligotoma s. str.* by differences in the abdominal terminalia. The left cercus-basipodite, which is a complete ring with one or more inner lobes in *Oligotoma s. str.*, is reduced to a sclerotic fragment fused to the outer basal rim of the left cercus.

The basal segment of the left cercus, which is a simple cylinder in *Oligotoma s. str.*, is generally distally lobed on its inner side in *Aposthonia.*

The two known species of *Aposthonia* occurring on Pacific islands are closely related and have in common the development of a minute, subterminal, outer tooth on the left tergal process (fig. 1, *d, g, j:* 10 LP). However minute, the presence or absence of such a tooth is constant within a species and is of rare occurrence in the subgenus, for it is found only in members of the *oceania* complex and in an unrelated species, *A. mandibulata* Ross, of New Guinea.

It is probable that the *oceania* complex inhabiting Pacific islands is derived from the fauna of the southern Philippines. This is indicated by the presence of *oceania* in the Davao region of Mindanao. I have before me three males from three different localities near Davao. Two of these are near sea level; but the fact that one is a remote locality at a 3,300-foot altitude on Mount McKinley, strongly suggests this is the region of endemicity of the species. The possibility that the Mindanao stock may be subspecifically distinct from the Pacific island populations will be treated in a future paper, on the Embioptera of the Philippines.

1. **Oligotoma (Aposthonia) oceania** Ross (fig. 1, *h, j*).

Oligotoma (*Aposthonia*) *oceania* Ross, 1951, Hawaiian Ent. Soc., Proc. **14** (2) : 307, fig. 1. (Beaten from *Weinmannia parviflora* at 2,150 ft. alt. Fatu Hiva, Marquesas Islands; type in Bishop Museum.)

DISTRIBUTION: Marquesas Is., Rapa, Society Is., Austral Is., Henderson I., Easter Is., Fanning I., Kusaie, and Hawaiian Is. [Record: "Pâskön" (Easter Island), one male, three juveniles, collected under stones by Kare Bäckström, deposited in the Naturhistoriska Riksmuseum, Stockholm.]

CAROLINE IS. KUSAIE: "Hill 541," 165 m., at light, March 23, 1953, J. F. G. Clarke, one male, deposited in the E. S. Ross collection. Mutunlik, 22 m., at light, Jan. 27, 1953, Clarke (US). Lele (Lelu) I., 4 m., in web on or under bark of standing dead mango tree, Feb. 1953, Clarke; several females, two males (US, BISHOP).

These Kusaie specimens considerably extend the known range of this species. They agree very well with topotypic males except for their slightly larger eyes.

2. **Oligotoma (Aposthonia) micronesiae** Ross, n. sp. (fig. 1, *a-g*).

Holotype, male: General color (based on specimen in alcohol before treatment in KOH and slide preparation) dark brown with head and terminalia darker. Body length (on slide) 8.5 mm.; forewing length 4.8 mm., breadth 1.3 mm. *Head* with form as figured (fig. 1, *a*); cranium blackish brown blending to chestnut brown between antennal sockets and ventrally in gular area and along margins of foramen magnum, clypeal region blackish brown; eyes blackish with a narrow but conspicuous golden margin; antennae (only

seven segments present) unicolorous dark brown with whitish membranes; mandibles as figured, golden brown with blackish brown margins; palpi concolorous with antennae; submentum, as figured, finely rugose and medially depressed, dark chestnut brown becoming blackish brown in basal angles. *Pronotum* blackish brown, concolorous with dark areas of cranium; other sclerites of prothorax smokey brown, clouded and margined with black; fore coxae and trochanters similar in color (remaining segments lost). *Scutae* of

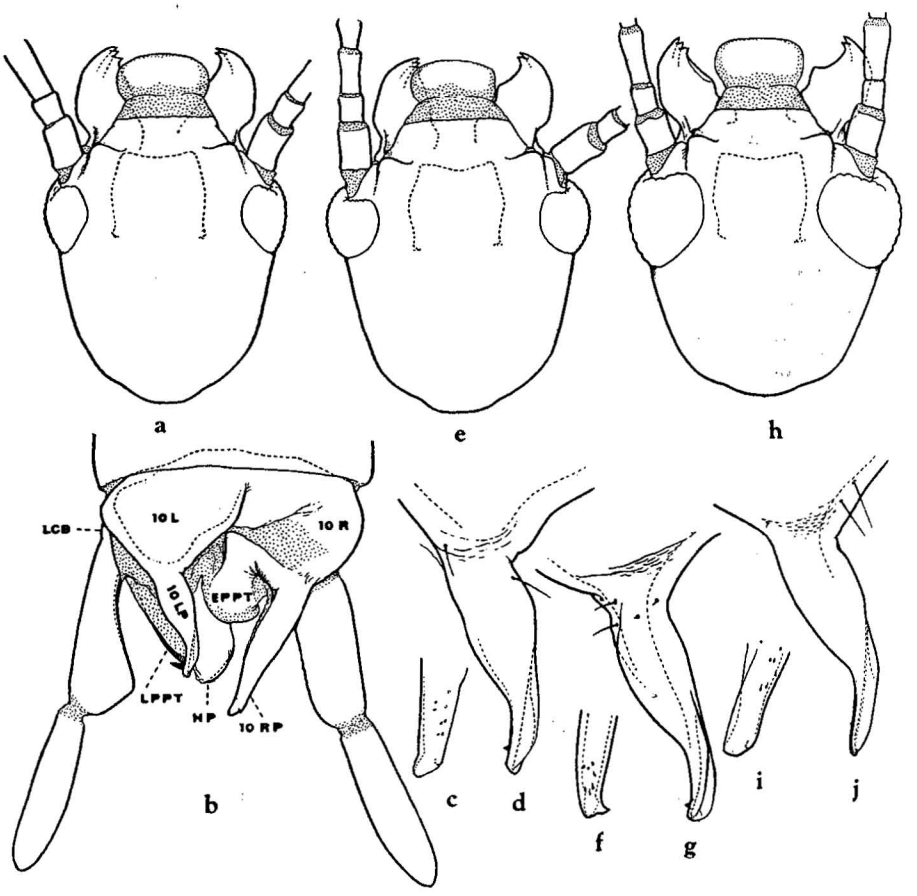

FIGURE 1.—**a-g,** *Oligotoma* (*Aposthonia*) *micronesiae: a,* head (holotype), outline of submentum dotted; *b,* male abdominal terminalia, dorsal (holotype); *c,* apex of right tergal process (holotype); *d,* left tergal process (holotype); *e,* head (Gilbert Is.); *f,* apex of right tergal process (Gilbert Is.); *g,* left tergal process (Gilbert Is.). **h-j,** *O.* (*A.*) *oceania,* from Kusaie: *h,* head; *i,* apex of right tergal process; *j,* left tergal process.

a, e, and *h* drawn to same scale; *b,* larger; *c, d, f, g, i,* and *j* drawn to even larger scale. Outlines, with membranes represented by stippling; shading and setae (except in drawings of processes) omitted. Symbols: 10 L = left hemitergite of tenth segment, 10 LP, its process; 10 R = right hemitergite, 10 RP, its process; EPPT = epiproct; HP = process of hypandrium (ninth sternite); LPPT = process of left paraproct; LCB = left cercus-basipodite.

pterothorax golden brown caudally, blending to dark brown apically; other sclerites of pterothorax essentially golden brown but heavily and irregularly clouded with blackish brown, margins especially darkened. Mid and hind legs with coxae and trochanters smokey brown clouded and margined with blackish brown; femora and tibiae dark brown with intervening joint creamy white, tarsi concolorous with coxae and trochanters. *Wings* with pigmented areas dark brown without noteworthy venational features (as throughout the subgenus); three subterminal cross veins between R_1 and R_{2+3} in forewing, and one subbasal and a terminal cross vein between these veins of the hind wing. *Abdomen* with segments 1 through 7 subcutaneously reddish tan, sclerites faintly tinged with light brown. Abdominal terminalia largely dark brown with inner margin of left hemitergite, basal half of left tergal process, and most of the right tergal process blackish brown, apices of these processes straw yellow; ninth sternite light brown basally blending to blackish brown distally and on process; cerci unicolorous dark brown; structural features as figured, significant among these is the relatively pronounced development of the subterminal tooth on the left tergal process and the gradually, distally expanded, basal segment of the left cercus.

Allotype, female: General color dark brown. Body length 9 mm. Head basically golden amber color but with a "granular" medium-brown superficial pattern caudally, this pigmentation mottled anteriorly; eyes black; antennae with the basal two segments tan, remaining segments smokey brown. Body and legs various shades of dark brown, except coxae, trochanters, and femora-tibial joint which are tan to creamy white. Eighth abdominal sternite sclerotized in lateral thirds, submembranous medially, ninth sternite with a median transverse, rectangulate emargination a little more than one-third the sternal width wide and extending half the sternal length into the basal margin.

Holotype, male, on slide (CAS). Mariana Is.: Anatahan Island, landing beach, Aug. 1951, in flight near coconut trunk, R. M. Bohart.

Allotype, female; disposition and data same as for holotype, except collected in colony on trunk of coconut palm near which holotype was collected in flight.

Additional specimens examined: (1) One male (in alcohol) Marshall Is., Elizabeth I., Jaluit Atoll, Sept. 25, 1953, ex *Messerschmidia,* J. W. Beardsley (US). (2) One male (on slide) Gilbert Islands: Makin I. [Butaritari Atoll], June 11, 1944, J. W. Enke, in E. S. Ross collection.

Specimen 1 agrees very closely in every respect to the holotype, except that the eyes are slightly more inflated as figured for the Gilbert Island specimen (*infra*) and the anterior portions of the cranium and of the submentum are slightly paler.

Specimen 2 agrees with the holotype except as follows: Slightly different cranial form (fig. 1, *e*) with more abruptly inflated eyes; anterior half of cranium (anterior to caudal margins of eyes) golden brown, strongly contrasting with dark chocolate brown of caudal half of cranium which is more or less the uniform cranial color of the holotype; mandibles and anterior two-thirds of submentum golden yellow rather than the uniform dark brown of the holotype; slight differences in the terminalia processes are shown in figure 1, *f, g*. The importance of these differences would depend on consistency in a series. Consistency might justify subspecific status for the Gilbert Islands population.

DISTRIBUTION: Northern Mariana Is., Marshall Is., and Gilbert Is.

Although there are no great abdominal terminalia differences between *micronesiae* and *oceania,* males of the two species are readily separable by the much darker pigmentation of *micronesiae;* the narrower cranium of *micronesiae* with its much smaller eyes; the gradually, rather than abruptly, lobed basal segment of the left cercus of *micronesiae;* and its more conspicuously toothed left tergal process.

3. **Oligotoma** sp.

A mature female from Ponape, Nonpil [Nanipil], Nett District, Feb. 1948, in dead frond of tree fern, collected by Henry S. Dybas, establishes the presence of the order on Ponape. It cannot be identified to species, at this time, however, without associated mature males.

DISTRIBUTION: Ponape.

4. **Oligotoma (Oligotoma) humbertiana** (Saussure).[1]

Embia humbertiana Saussure, 1896, Schweiz. Ent. Ges., Mitt. **9**: 353 (holotype, male, from Ceylon; in Mus. Hist. Natur., Geneva).

Oligotoma humbertiana (Saussure), Davis, 1939, Linn. Soc. New South Wales, Proc. **64**(1-2): 186, fig. 5.—Ross, 1940, Ent. Soc. Am., Ann. **33** (4): 674, figs. 48-50.

Oligotoma saundersii (Westwood) of Krauss, 1911, Zoologica (Stuttgart) **23**(60): 39, and numerous subsequent authors, are misidentifications.

Oligotoma californica (Banks), of Navás, 1923, Acad. Cienc. Zaragoza, Rev. **7**: 31 is a misidentification.

DISTRIBUTION: Probably endemic to southern India, whence it has spread in commerce to Indonesia, the Philippines, South China, Formosa, Mexico (probably introduced in early Spanish trade with Philippines), and probably to other regions. Published records of the species (as *O. saundersii*) from East Africa and South America require verification based on specimens.

S. MARIANA IS. SAIPAN: Jan. 1945, Hagen, one female; Chalan Kanoa, Jan. 1945, under bark of *Poinciana* ?, H. S. Dybas, several mature females and juveniles (CM). TINIAN: Mar. 1945, Hagen, three females. GUAM: Pt. Oca, Mar. 1945, R. Bohart, one male. All specimens in Ross collection.

O. humbertiana was probably recently introduced into the Marianas in military traffic from the Philippines. It is a vigorous "weed" species and may be expected to become very abundant and to steadily extend its range with interisland commerce. The males are often attracted to lights in considerable numbers.

[1] The extensive bibliography of this species has been published elsewhere [Ross, 1940, Ent. Soc. Am., Ann. **33** (4):629-676] and is here abstracted to significant citations.

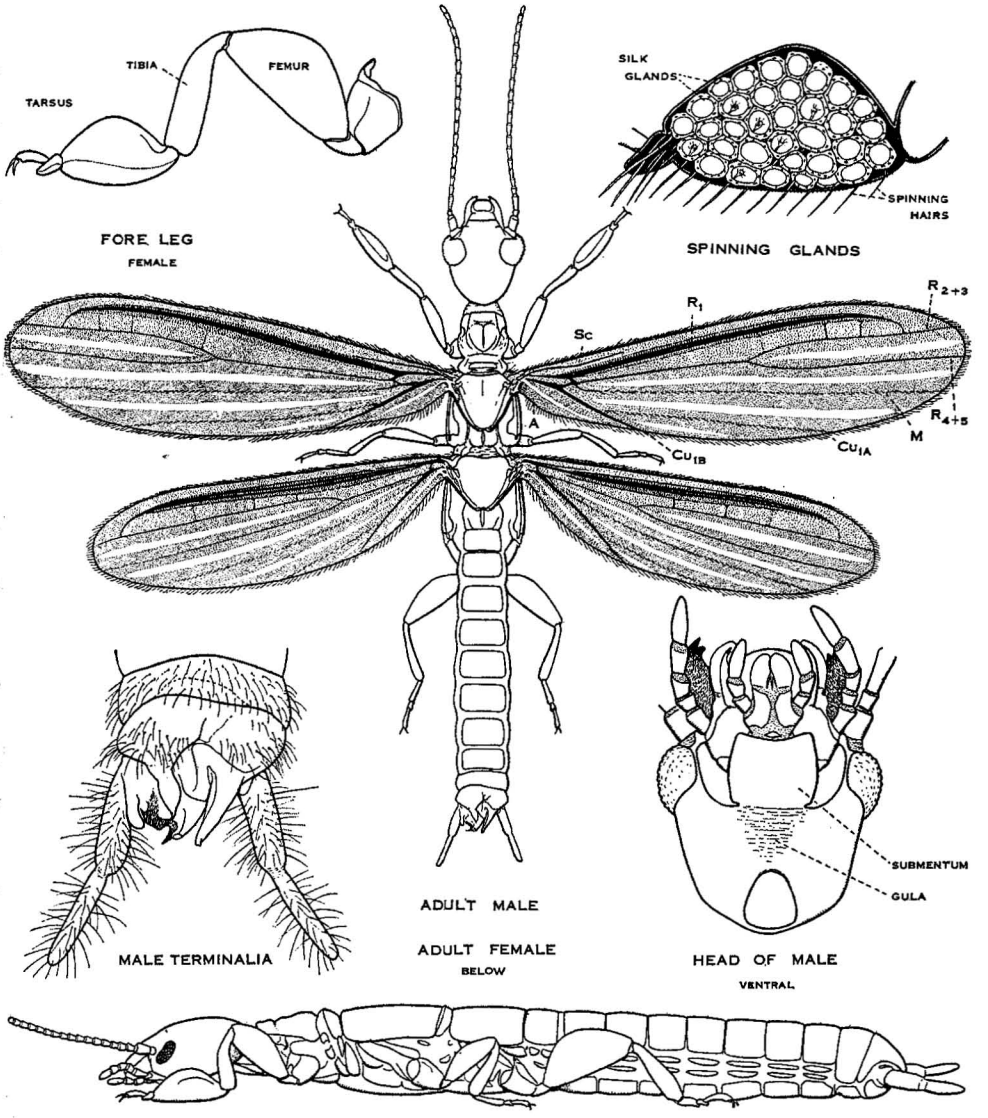

FIGURE 2.—*Oligotoma* (*Oligotoma*) *saundersii*, showing general features of the order and details of the abdominal terminalia. (From Zimmerman, "Insects of Hawaii," vol. 2, 1948.)

This species is readily distinguished from *oceania* and *micronesiae* by means of numerous male terminalia characters. The left tergal process is narrow, strongly tapered and outwardly curled and minutely bifid at its extreme apex. The right tergal process is elongate, parallel-sided to near its apex, thence it is abruptly narrowed and bears a small, but conspicuous, outer distal tooth. The left cercus-basipodite forms a complete ring (only an outer vestige, fused to the base of the cercus, is present in the subgenus *Aposthonia*) which is strongly, inwardly lobed and bears a caudal, tapered extension closely appressed to the basal segment of the left cercus, which is not inwardly lobed distad, as in the species of *Aposthonia.*

5. **Oligotoma (Oligotoma) saundersii** (Westwood). (Figure 2.)

DISTRIBUTION: This species, like *O. humbertiana,* is apparently endemic to southern India but has spread widely in commerce. Its range is even greater than that of *O. humbertiana.* In the Pacific region it is known to be established in Hawaii, Marcus Island, Canton Island, New Caledonia, Indonesia, and Formosa. Sakagami [1953, Shin Konchū 6 (5) : 26] records the species from Marcus Island. I have examined Sakagami's specimens and can confirm the identification. The record is based on seven males, two adult females, and four juvenile females, taken by Sakagami in May 1952. With increased commerce, *O. saundersii* is very likely to become established on many islands of Micronesia.

In common with *O. humbertiana,* males of *O. saundersii* can be most readily distinguished from those of *oceania* and *micronesiae* by the completely ringed and inwardly lobed left cercus-basipodite and by the unlobed basal segment of the left cercus. *O. saundersii* is distinguished from *O. humbertiana* by its darker pigmentation; its broader, spatulate, left tergal process; its evenly tapered right tergal process which is without an outer, subterminal tooth; and its conspicuous, sickle-shaped process of the left paraproct which extends ventrally across the apex of the lobe of the ninth sternite.

ringed and inwardly lobed left cercus-basipodite and by the unlobed basal seg-