

Academy of Natural Sciences

The Crickets of New Caledonia (Gryllidae)

Author(s): Daniel Otte, Richard D. Alexander, William Cade

Source: *Proceedings of the Academy of Natural Sciences of Philadelphia*, Vol. 139, No. 1 (1987), pp. 375-457

Published by: Academy of Natural Sciences

Stable URL: <http://www.jstor.org/stable/4064904>

Accessed: 17/06/2010 02:31

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/action/showPublisher?publisherCode=ans>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



Academy of Natural Sciences is collaborating with JSTOR to digitize, preserve and extend access to *Proceedings of the Academy of Natural Sciences of Philadelphia*.

<http://www.jstor.org>

The Crickets of New Caledonia (Gryllidae)

DANIEL OTTE

*Academy of Natural Sciences of Philadelphia
Philadelphia, Pennsylvania 19103*

RICHARD D. ALEXANDER

*Museum of Zoology, University of Michigan
Ann Arbor, Michigan 48109*

WILLIAM CADE

*Biological Sciences, Brock University
St. Catharines, Ontario L2S 3A1 Canada*

ABSTRACT.—In New Caledonia the family Gryllidae is represented by 12 subfamilies, 28 genera and at least 87 species. In this work we describe nine new genera and 55 new species. The New Caledonian fauna, though close to Australia, is very distinctive and is represented by several species groups (*Notosciobia*, *Koghiella*, *Tremellia*, *Agnotecous*, *Adenopterus*, *Archenopterus*, *Calscirtus*, and *Matuanus*) which have radiated on the island. Much of this fauna seems to have radiated along the now mainly submarine Norfolk Ridge, [New Caledonia, crickets, Gryllidae, new species, songs, systematics, types]

HISTORY OF NEW CALEDONIA

The island of New Caledonia, centrally located among the submarine ridges, marginal basins, and island arcs of the South West Pacific forms a major link in the chain of islands running between New Guinea and New Zealand. It is situated on a submerged ridge which is part of the former tectonic block that detached from Austro-Antarctica between 78 and 56 million years ago. The block was split by the New Caledonia Basin, now located between Norfolk and Lord Howe islands, about 65 m.y. ago (Ballance 1980; Coleman 1980). This was a relatively shortlived plate which grew in surface through the formation of new sea floor along its western and southern margins (between Australia and Lord Howe

Rise). It later fused to become a part of the active eastern margin of the much larger Australian plate which was moving in a northerly direction into the Pacific Plate, and was accompanied by the emergence of land along its eastern margins. The block now contains two marine ridges, united in the south in the vicinity of western New Zealand. The more eastern *Norfolk Ridge* runs from New Zealand to New Caledonia and includes Norfolk Island near its center. The western ridge, the *Lord Howe Rise*, runs from New Zealand in a NNW direction towards Queensland, but then at Lord Howe Island bends north to the Chesterfield Reefs. New Caledonia is part of the *Inner Melanesian Arc* (Carey 1938b; Glaessner 1950) which extends from the eastern most point of New Guinea through New Caledonia and

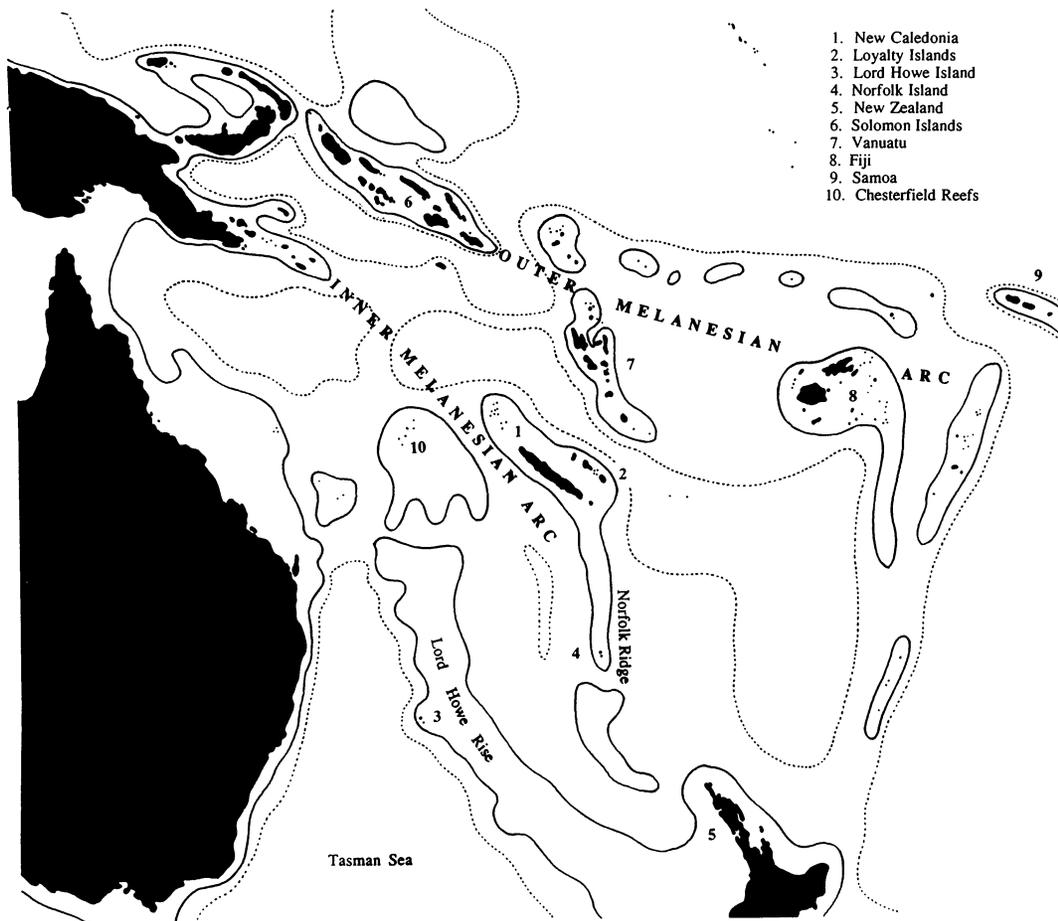


FIG. 1. Position of New Caledonia in the Southwest Pacific.

Norfolk Island to New Zealand. This arc is much older than another arc to the north which developed when a new front was established between Australian and Pacific plates; the newer *Outer Melanesian Arc* extends from northern New Guinea through New Britain, the Solomons, Vanuatu, Fiji, and Samoa, then southwards to the Kermadec Group.

Today New Caledonia is a French Territory in the southwest Pacific positioned at approximately 21S 166E; it lies about a thousand miles northeast of Brisbane, Australia, and a thousand miles NNE of New Zealand. Its nearest island

neighbors are Vanuatu (the New Hebrides) 480 km NNE and the Loyalty Islands less than 150 km to the east. This narrow island (ca. 390 km long and on average 50 km wide) is much older than neighboring island groups. Its geological history relates more to northern New Zealand and southeast New Guinea. Its mountainous terrain, made up of ultramafic rocks, was produced through sea floor overthrust from the east sometime in the middle of the Tertiary. The three highest points are Mt Panié (1628m) in the north, Mé Maoya (1500m) in the center, and Mt Humboldt (1618m) in the south.

New Caledonia is one of the older land masses in Australasia. The first emergence of land in the area was probably in the upper Jurassic. Cretaceous deposits contain coal and suggest that alternation of land and marine facies took place until further episodes of uplift occurred in the Eocene, after which land in the area was probably always present in greater or lesser amounts. This would mean that land was in existence at the time of the dispersal of Gondwanaland from the beginning of the Cretaceous onwards and could be reflected in the composition of the flora and fauna.

New Caledonia is noted for its old, diverse and highly endemic flora. It contains many presumed relicts from a Cretaceous Australasian-Antarctic flora which probably reached New Caledonia before the opening of the Tasman Sea. That sea subsequently isolated the island from the rainforest taxa flowing into Australasia from the Oriental tropics. The New Zealand flora may have arisen in a similar manner and was also shielded from competition from new invaders from the north.

More modern taxa did reach New Caledonia, some directly from Australia, possibly mainly during periodic exposures of the Chesterfield Reefs, but mostly through association with the Inner Melanesian Arc from New Guinea.

As Australia moved northwards, Indo-Malayan elements began to penetrate it in the early Tertiary, and this increased greatly in the closing stages of the Oligocene. Before and during the Miocene, access to Australasia was probably mainly from China via Taiwan, the Philippines, and the Outer Melanesian Arc, then to parts of the inner Arc and Australia.

Prior to the influx of Indo-Malayan elements a Melanesian biota had established itself all along the inner Melanesian Arc as shown by similarities between the vegetation of subtropical New Zealand, montane New Caledonia and highland New Guinea. As the land area increased in Indonesia in the Pliocene and Pleistocene, numerous more competitive but less dispersive Oriental plant taxa moved into Melanesia and displaced much of the Melanesian flora, particu-

larly in New Guinea, though some elements were restricted to certain habitats such as high altitudes or poor soils. In such habitats the flora has held its own and has even advanced westwards into the Oriental Region.

CONNECTIONS TO AUSTRALIA

The more ancient southern elements in New Caledonia are most evident in the groups with poor powers of dispersal such as, among insects, the Ephemeroptera and Cerambycidae, but much less so in the more dispersive ones such as the Lepidoptera and to some extent the birds (Holloway 1977). These old connections are predominantly with Australia or with Australia and New Zealand together, particularly in the flora. There are few exclusive connections with New Zealand, except in some insect groups such as the Ephemeroptera, Trichoptera, and Cerambycidae. Phytogeographic patterns suggest that exclusive links between New Caledonia and New Zealand could have arisen through the extinction of Australian representatives during the increase of aridity and the consequent restriction of rainforests on the Australian continent throughout the later Tertiary. Such extinction would have been most likely in groups dependent on tropical rainforest conditions (Holloway 1977).

Colonization of New Caledonia from Australia may have occurred on several occasions through the Chesterfield Islands and almost certainly did during recent glaciations.

For highly dispersive groups of Lepidoptera the presence of these stepping stones was not essential, as indicated by the number of vagrant Australian species of Macroheterocera recorded on Norfolk over a period of six years (Holloway 1977).

A chain of islands on the Lord Howe Rise may have provided a route for interchange between New Caledonia and New Zealand.

The floristic and faunistic differences between New Caledonia and Fiji are large and Vanuatu, though much closer to New Caledonia, has a



FIG. 2. New Caledonia, showing general relief.

biota which is much more closely related to that of Fiji.

ORIGIN OF CRICKET FAUNA

The crickets of New Caledonia can be divided into two elements: the endemic groups which are now restricted to the island and the recent dispersives which are widely distributed over the Southwest Pacific.

Widespread and highly dispersive groups which show no evidence of having speciated on New Caledonia may have been introduced relatively recently on the island. Some may have been carried there by man, but others are strong fliers and may have migrated there on their own. It seems more likely that they were introduced by humans, because they commonly inhabit areas transformed by humans. Some may have been included in freight carried to the islands over the last 100 years or so, or their eggs could have been transported in soil or in plants imported there.

Brachytrupinae

New Caledonia has but one genus, *Notosciobia*, which is related to Australian *Cephalogryllus* and might even be considered congeneric with it. Whether it came directly from Australia or en-

tered New Caledonia along the Inner Melanesian Arc cannot be determined until the New Guinea fauna is studied. We know only that superficially similar crickets occur in New Guinea and the western Solomons, but these have not been examined in detail. We have not found this group in Fiji, Samoa, Guadalcanal, or in the Caroline Islands.

Notosciobia shows a primary and secondary radiation; at least 15 species can be assigned to three species groups. Our sampling of the genus must be considered preliminary and it is likely that many more species will be found.

Gryllinae

The Gryllinae have entered New Caledonia relatively recently. Only three species are known to occur there and all are widespread in the southwest Pacific and Australia. There is, as yet, no evidence of song and morphological differentiation there. By contrast the Gryllinae have penetrated much further along the Outer Melanesian Arc as far as Fiji.

Gryllini

The genus *Teleogryllus* ranges throughout sub-Saharan Africa, then eastwards through southern Asia to China and Japan, all of South-



east Asia, Australia, and the Pacific as far as Hawaii. The highest diversity is in Africa where at least three levels of radiation can be discerned. Only *Gryllus* in this subfamily has a wider distribution. Among other groups only *Gryllotalpa*, *Anaxipha*, *Pteronemobius* and *Oecanthus* have ranges of equivalent or greater size. Two species occur on New Caledonia. *T. oceanicus* occurs through much of the western Pacific and extends from Australia to Tahiti, and from the Caroline Islands to Hawaii. In the south it extends to Norfolk island. *T. marini* is known from eastern Australia, Fiji, and Samoa. The distribution of these two species in New Guinea and westwards is not yet known, but it is possible that they are widespread in Indomalaysia.

Modicogryllini

Lepidogryllus is the only member of this tribe in New Caledonia. The only species, *Lepidogryllus comparatus*, is also known from Australia and has reached as far east as Norfolk Island, New Caledonia, and the eastern Solomons. It is probably on New Guinea and Vanuatu as well. We did not find it in Fiji, Samoa, or the Caroline islands.

Nemobiinae

New Caledonia possesses two of three known

tribes of Nemobiinae, namely the Nemobiini and Thetellini. The former is also known from Lord Howe Island, Norfolk Island, New Zealand, and Australia. The latter tribe is oceanic and ranges through much of the Indian and Pacific oceans. The radiation of the Nemobiini seems to be related to the breakup of the eastern edge of the Australian plate and the subsequent formation of the Inner Melanesian Arc.

Nemobiini

Bobilla is widespread over southeastern Australia and is also known from southwestern Australia, Tasmania, and New Zealand. In New Caledonia it is represented by two species, but additional species will probably be found. It does not occur on Lord Howe or Norfolk islands.

Koghiella is endemic to New Caledonia, but closely related to *Ignambina*, also from New Caledonia and *Dictyonemobius* from Lord Howe and Norfolk islands. The genus displays two levels of radiation in New Caledonia and is probably derived from the more widely distributed *Bobilla*.

Amonemobius. The placement of this species close to *Koghiella* is tentative, and is based principally on the close resemblance of the forewings to those of *Koghiella*.

Paniella and *Fikola*. The positions of these genera are uncertain, especially the latter, which is based on a single female. It may represent a wingless relative of *Koghiella*.

Thetellini

This tribe is presently known to extend from the east coast of Africa across to northern Australia and eastwards to Hawaii. It has not yet been collected near the American coasts, but may well extend across the entire Pacific. The members of this tribe are found along rocky and coral shorelines and are usually found in the splash zone. However, in Hawaii and on Krakatau they are also found on lava flows and in lava caves distant from the sea. Presently the tribe comprises the genera *Thetella*, *Apteronomobius*, *Caconemobius*, *Ionemobius* and perhaps *Orintia*. The last genus, recently described by Gorochoff (1986) is, unfortunately, represented only by a single female.

Trigonidiinae

The Trigonidiinae have spread far and wide across the Pacific and are known from most islands. In some island systems they have speciated to an extreme degree and make up the bulk of the fauna (Hawaii, Fiji, and others). New Caledonia, however, presents a puzzle, for the subfamily is poorly represented there. We found only three species, two of which (*Trigonidomorpha sjöstedti* and *Metioche vittaticollis*) are widespread in Australia and the Pacific. The only other species, *Anaxipha caledonica*, though common on the island, appears to be the only endemic member of this subfamily. Why is such a highly dispersive group not better represented in New Caledonia? Did the group reach New Caledonia very late, or did it encounter well entrenched groups of crickets which had already usurped the normal trigonidiine niches? *Anaxipha caledonica* is now flightless and lives in the native forests, suggesting that it was not brought in by humans.

Pentacentrinae

This subfamily, though abundant in the region north of Australia, has not been found in New Caledonia or any other western or southwestern Pacific islands. This is surprising in view of the fact that many species are macropterous. Two species are known from Australia.

Phalangopsinae

This entirely flightless subfamily is very capable of crossing major bodies of water, though how it does so remains a mystery. It is represented in New Caledonia by a single genus, *Caltathra*, which seems most closely related to *Tathra* and *Endotaria* of Australia and *Nesitathra* of Norfolk Island. We do not yet know enough about the subfamily in New Guinea or in the Outer Melanesian Arc to say anything about how the group reached New Caledonia. The subfamily is also represented in the Southwest Pacific by *Howeta* and *Endacusta* on Lord Howe Island. Quite possibly these islands acquired these crickets early, during the breakup of the Australian plate. Though not generically diverse, the group is speciose in Australia. We have recently found the subfamily on Yap and Ponape in the Caroline islands. The subfamily has not been found on New Zealand, but may very well be found in the forests of North Island.

Itarinae

The origin of the only genus, *Tremellia*, is unknown and open to speculation. Australia itself has only one species and therefore seems an unlikely source. The presence of *Tremellia* in the Philippines and on Java suggests that it may have come to New Caledonia via New Guinea and the Inner Melanesian Arc. The subfamily, but not the genus, is present on Fiji but not Samoa. New Caledonia has five species of *Tremellia*, but it is likely that many additional species occur in the rain forests.

Euscirtinae

The members of this tribe are known from Africa to eastern Asia and Australia. The last continent

contains five genera: *Euscirtus*, *Merrinella*, *Turana*, *Tozeria*, and *Patiscus*. Little is known about this group north of Australia and it is not known to extend along the Outer Melanesian Arc. New Caledonia has only one genus and species (*Proturana subaptera*). It is quite similar to *Merrinella* in Australia. This group is not known in the eastern Solomon islands, Fiji, or the Caroline Islands.

Eneopterinae

Two genera of this world-wide group reached New Caledonia and one of them has radiated there. *Agnotecous*, seems most closely related to the Australian and Indomalasian genus *Lebinthus* and *Lebinthus*-like genera from the eastern Solomons and from the western Caroline islands. It seems likely that the genus came by way of the Inner Melanesian Arc and not directly from Australia where *Lebinthus* is represented by only two species. *Lebinthus*-like eneopterines are absent from Fiji and Samoa.

The other genus, *Cardiodactylus*, is widespread through the western Pacific. It is especially prevalent in New Guinea and along the Outer Melanesian Arc, to Fiji and Samoa, and is also present in New Guinea and the western Caroline Islands. We found a single species in New Caledonia. One species is known from Australia. The genus evidently does not extend beyond New Caledonia.

Podoscirtinae

This subfamily is represented in New Caledonia by five genera; three of them are endemic, another is shared with Norfolk island; and only *Aphonooides* extends outside of the Inner Melanesian Arc.

Aphonooides, is widespread in Australia and New Guinea. It has not yet been seen in New Caledonia, but since one species has been collected in the Loyalty Islands, it is likely to occur on New Caledonia as well.

Calscirtus and *Insulascirtus*. This clade radiated in the central Inner Melanesian Arc. Superficially it is similar to *Tamborina* and *Ma-*

dasumma of Australia, though the genitalia and the body shape suggest that it is not derived from either. *Calscirtus* is confined to New Caledonia and is represented by three species, though many more species probably exist in the rain forests. It is most closely related to *Insulascirtus*, a genus of wingless species from Lord Howe Island (five species) and Norfolk Island (two species).

Adenopterus and *Archenopterus*. *Adenopterus* was previously known only from Norfolk Island, though one species, previously under *Munda*, had been described from New Caledonia. The present distribution of the genus is New Caledonia (15 species), Loyalty Islands (one species), and Norfolk Island (one species). It is related and probably derived from the new genus *Archenopterus* which is known only from New Caledonia (six species). These genera are not closely similar to any Australian genera, and have several very odd morphological characteristics not seen anywhere else in the world. This group, like *Calscirtus* and *Insulascirtus*, radiated in the central Inner Melanesian Arc.

Oecanthinae

Aside from a single introduced, or, perhaps, recent immigrant (*Oecanthus rufescens*), tree crickets are absent from New Caledonia. This state of affairs is reminiscent of Trigonidiinae. *O. rufescens* is widespread in Australia and also known from the eastern Solomons and Fiji. Tree crickets are also absent from Fiji (except for the above-noted *O. rufescens*) and from Samoa; nor have they reached the Caroline Islands (Palau, Yap, Ponape). Two genera have speciated in Australia and New Guinea, so it is surprising that the subfamily has not reached New Caledonia or Fiji. It is especially surprising since the Oecanthines have undergone three to four levels of radiation in Hawaii. The absence of the subfamily in the southwest Pacific suggests perhaps that tree crickets reached Hawaii from the Americas.

Pteroplantinae

This subfamily extends from India to Fiji and into the western Caroline islands (Palau). It has not

yet been found along the Inner Melanesian Arc.

Mogoplistinae

Scaly crickets are well represented in New Caledonia. The taxonomy of this group is very difficult and we have not included them in this work. Several species appear to resemble species from the mangroves in Queensland. Mogoplistines have penetrated most of the Pacific islands in spite of the fact that no members fly. Probably their eggs are deposited in wood and are carried from island to island.

Gryllotalpinae

We did not encounter mole crickets in spite of the fact that we often listened for them in places which seemed suitable. Chopard (1915), however, lists *Gryllotalpa australis* (Erichson) from the Loyalty Islands. The subfamily seems to be largely absent from the southwest Pacific islands (New Caledonia, Fiji, Samoa), which is surprising since it has penetrated the Caroline Islands as far as Ponape. New Zealand has the genus *Triamescaptor*.

Myrmecophilinae

Although this group is world-wide in distribution it is not known from in New Caledonia. However, we made no concerted effort to find it and believe that it will eventually be found in ant nests.

MUSEUM DEPOSITORIES

ANN ARBOR: University of Michigan Museum of Zoology

BASEL: Naturhistorisches Museum

BUDAPEST: Zoological Department, Hungarian Natural History Museum

HONOLULU: Bernice P. Bishop Museum, Honolulu

LENINGRAD: Zoological Institute, Academy of Sciences, USSR

PHILADELPHIA: Academy of Natural Sciences of Philadelphia

VIENNA: Naturhistorisches Museum

MORPHOLOGICAL ABBREVIATIONS

M	male
MN	male nymph
F	female
FN	female nymph
RW	rostral width (measured at anterior extremity)
SW	scape width (width of basal antennal segment)
PL	pronotal length (measured along the midline)
PW	pronotal width (greatest width)
FWL	forewing length (greatest length from posterior margin of pronotum)
ML	mirror length (greatest overall longitudinal length)
MW	mirror width (greatest overall horizontal length)
FL	hind femur length
FW	hind femur width (greatest width)
TL	tibial length (not including apical spurs)
CL	cercal length
OL	ovipositor length (measured from upper base of ovipositor to tip)
SPS	spermatophore sac.
MAPs	muscle attachment plate (two drop-shaped markings in anterior half of pronotal disk.
p/s	pulses per second
ch/s	chirps per second
chL	chirp length
KHz	frequency in kilohertz
°C	degrees centigrade

COLLECTING SITES

3. Ducos Peninsula, near Noumea, dry brushy roadside, 26 ii 1983.
4. Yahoue, near Noumea, forest and stream, 27 ii 1983.
5. Mount Koghi, west slope of Mount Bouo, tall rainforest, 27 11 1983.
6. East coast, about 12 km southeast of Thio,

- forest along beach, 28 ii 1983.
7. Negropo, near Canala, disturbed forest, 1 iii 1983.
 8. 14 km west of Canala, 1 iii 1983.
 10. 25 km west of Canala, road through forest, 1 iii 1983.
 11. 27 km west of Canala, road through forest, 1 iii 1983.
 12. 28 km west of Canala, road through forest, 1 iii 1983.
 13. 34 km west of Canala, road through forest, 1 iii 1983.
 14. Poe Beach, West of Borail, beach area, 1 iii 1983.
 15. 43 km west of Houailou, forest, 2 iii 1983.
 16. 40 km west of Houailou, forest, 2 iii 1983.
 17. Tenemba River Valley, east of Tenemba, near Ponérihouen, 3 iii 1983.
 18. Tiéte, north side of Poindimié, beach, 3 iii 1983.
 19. Amoa River Valley, near Poindimié, grassy roadside, 3 iii 1983.
 20. Amoa River Valley, 3 km west of main road, near Poindimié, 3 iii 1983.
 21. Amoa River Valley, 6.4 km west of main road, near Poindimié, forest, 3 iii 1983.
 22. Amoa River Valley, 8.4 km west of main road, near Poindimié, forest, 3 iii 1983.
 23. Tiwaka River Valley, 5 km west of main road, near Poindimié, 3 iii 1983.
 24. Hienghene, grottoes south of town, near beach, 5 iii 1983.
 25. Hienghene, ca. 4 km west of bridge, 5 iii 1983.
 26. about 10 km southeast of Oubatche, coastal forest, 6 iii 1983.
 27. about 17 km southeast of Oubatche, coastal forest, 6 iii 1983.
 28. about 14.9 km southeast of Oubatche, coastal forest, 6 iii 1983.
 29. Koumac, grottoes area, 7 km east of town, 7 iii 1983.
 30. mountain forest above Koné, road to Panaki, 7 iii 1983.
 31. beach west of Koné, Plage de Foe, 8 iii 1983.
 32. near Nétlial, 8 iii 1983.

33. stream near Goipin, northwest of Nékiaï and Poya, stream and forest, 8 iii 1983.

LIST OF SPECIES

Brachytrupinae

Cephalogryllini

Notosciobia Chopard

~~Nola Group~~

nola Otte, n. sp.

goipina Otte, n. sp.

canala Otte, n. sp.

paranola Otte, Otte, n. sp.

thiensis Otte, n. sp.

animata Otte, n. sp.

puebensis Otte, n. sp.

oubatchia Otte, n. sp.

rouxi Chopard

velutina Chopard

lifouensis Gorochov 1986 (from

Cephalogryllus)

Poya Group

poya Otte, n. sp.

Fausta Group

fausta Otte, n. sp.

rex Otte, n. sp.

hirsuta Otte, n. sp.

Tape recorded species

[konensis] song species

[parapoya] song species

Gryllinae

Gryllini

Teleogryllus

oceanicus (Le Guillou)

marini Otte & Alexander

Modicogryllini

Lepidogryllus Otte and Alexander

comparatus (Walker)

Gryllus lepidoides Chopard 1915: 138.Synonym of *Lepidogryllus comparatus*

Walker

Nemobiinae

Nemobiini

Bobilla Otte & Alexander

avita Otte, n. sp.

pacificica Gorochov 1986 (from *Bullita*)

- Koghiella** Otte, n. gen.
bouo Otte, n. sp.
parabouo Otte, n. sp.
semibouo Otte, n. sp.
thio Otte, n. sp.
caledonica Chopard 1970 (from *Dictyonemobius*)
- Ignambina** Otte, n. gen.
oubatchia Otte, n. sp.
- Amonemobius** Otte, n. gen.
vexans Otte, n. sp.
- Paniella** Otte, n. gen.
apterus (Chopard) (from *Nemobius* (*Prone mobius*))
- Apteronemobius** Chopard
Paora Gorochov 1986 (new synonym)
gusevae Gorochov 1986
- Thetellini**
Ionemobius Otte, n. gen.
alliciens Otte, n. sp.
Fikola Gorochov 1986
fusca Gorochov 1986
Orintia Gorochov 1986
incrustata Gorochov 1986
- Trigonidiinae**
Trigonidomorpha Chopard
sjöstedti Chopard
- Metioche**
vittaticollis Stal
flavipes Saussure
Anaxipha Saussure
caledonica Otte, n. sp.
- Phalangopsinae**
Caltathra Otte, n. gen.
dubia Chopard (from *Endacustes*)
steinmanni Gorochov 1986
panaki Otte, n. sp.
- Itarinae**
Tremellia Stal
sarasini (Chopard 1915)
caledonica Otte, n. sp.
alpha Otte, n. sp.
beta Otte, n. sp.
tiwaka Otte, n. sp.
- Eneopterinae**
Agnotecous Saussure
obscurus Chopard 1970 (from *Lebinthus*)
yahoue Otte, n. sp.
tapinopus Saussure 1978
brachypterus Gorochov 1986
novaecaledoniae Gorochov 1986
robusta (Chopard 1915) (from *Eurepa*)
- Cardiodactylus** Saussure
novae-guineae (de Haan)
- Euscyratinae**
Proturana Otte, n. gen.
subaptera (Chopard 1970) from *Euscyrthus*
- Podoscirtinae**
Adenopterus Chopard
Peltia Gorochov 1986 (new synonym)
Kraussi Group
kraussi Otte, n. sp.
sylvaticus Otte, n. sp.
sarasini Chopard (from *Munda*)
rouxi Chopard (from *Munda*)
roseola Gorochov 1986 (from *Peltia*)
caledonicus Otte, n. sp.
dumbeus Otte, n. sp.
confixus Otte, n. sp.
dubius Otte, n. sp.
perplexus Otte, n. sp.
paraperplexus Otte, n. sp.
euperplexus Otte, n. sp.
- Sarrameus Group**
sarrameus Otte, n. sp.
yahouensis Otte, n. sp.
tchambicus Otte, n. sp.
admirandus Otte, n. sp.
- Crouensis Group**
crouensis Otte, n. sp.
lifouensis Otte, n. sp.
saussurei (Chopard) (from *Munda*)
baloghi Gorochov 1986
- Archenopterus** Otte, n. gen.
gressitti Otte, n. sp.
maai Otte, n. sp.
hemipteroides Otte, n. sp.

bouensis Otte, n. sp.
amoensis Otte, n. sp.
hemiphonus Otte, n. sp.

Aphonoides Chopard
ouveus Otte, n. sp.

Calscirtus n. gen.
amoa Otte, n. sp.
paniensis Otte, n. sp.
timbiensis Otte, n. sp.

Matuanus Gorochov 1986
priapus (Saussure)(from *Munda*)
elegans Otte, n. sp.
caledonicus (Saussure) (from
Aphonoides)
flavomaculatus Gorochov 1986
neoplumus Otte, n. sp.
rufidulus (Saussure)(from *Munda*)

Oecanthinae

Oecanthus rufescens Serville

Gryllotalpinae

Gryllotalpa australis (Erichson)

Nomina Dubia

Podoscirtinae

Tapinopus platyceps Saussure
 (type lost?, replacement specimen is from
 southern Africa)

Other species listed from New Caledonia

Munda insularis Saussure 1878: 639. This species is listed from Fiji and New Caledonia (the latter specimen from the Vienna museum was called a variety belongs to *Adenopterus crouensis* n.sp.)

Munda tacita (Saussure). The species was described from "New Guinea ?" Chopard 1967 lists it from New Caledonia, but it is very doubtful that it occurs there.

Teleogryllus commodus Walker listed from New Caledonia is probably *T. oceanicus* or *T. marini*.

BRACHYTRUPINAE Cephalogryllini

NOTOSCIOBIA Chopard

Notosciobia Chopard 1915: 140. Type species:
N. rouxi Chopard (New Caledonia).

RECOGNITION OF GENUS. Male epiphallus bilobed, separated by a wide U-shaped gap; lobes terminating in points; spermatophore tube mold long or short; ectoparameres variable in shape; virga usually very long and slender, short in slender in the Poya Group. Pronotum longer than wide, with a distinct groove in the posterior half of each lateral lobe; with roughly parallel sides or front of pronotum wider than posterior. Forewings with an incomplete mirror (or a mirror with poorly defined posterior margin and mostly filled with cells)(usually with well defined posterior margin and not divided into cells in Australian *Cephalogryllus*. Hind tibiae short. Pronotum and legs very pubescent. Without hindwings. Dorsum of abdomen with a row of small narrow dark horizontal lines running laterally on each tergite. Legs usually very light brown, tibiae slightly darker and with a dark brown on lower face. Tympana present only on outer face. Without a median ocellus, although in some species the location of the ocellus is still evident. Occiput, entire pronotum, legs and abdomen covered with short fine pubescence. Hindwings absent. Fore- and middle tibiae with 3 and 4 apical spurs respectively.

BIOLOGY. All species in this genus have been found in leaf litter on the forest floor and all were found in wet forest on the crest of the mountain or in moist ravines. They were found at sea level only on the windward side of the island. Some of the species live in burrows in the juvenile stages and adults of several species were also associated with burrows where they were found with nymphs of all stages. Several species were found under rotting logs. The songs are all relatively simple and are often given in bursts, such that long silent periods alternate with periods when a

number of males sing simultaneously. In some species males that sing near one another alternate in the production of songs.

Nola Group

Distinguished from the Poya Group by the shape of the epiphallic lobes and the large size of the spermatophore tube mold.

Notosciobia nola Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Yahoúé, near Noumea, forest floor, 27 ii 1983 (Alexander, Cade & Otte #4). ANN ARBOR.

RECOGNITION. Figs. 4, 6A, 7. Tables 1, 2. Song consisting of short trains of rapidly delivered pairs of pulses. Harp with three veins. Unlike *paranola* each ectoparamere is distinctly bilobed at the apex, epiphallus with a more V-shaped gap, file with fewer than 100 teeth. Ectoparameres most similar to *goipina*, but differs in song and in having fewer than 100 teeth. Differs from *canala* in having excised ectoparameres and in the male song.

Males: Large for genus. Head and pronotum dark brown to black. Wings and abdomen greyish-brown. Head: dorsum dark brown to black; face and cheeks dark brown. Pronotum: dorsum dark brown to black, MAPs reddish. Forewings: dark brown to black in basal and apical areas and lateral field. Hindfemora with brown oblique stripes on outer face; region just before knees dark brown; tibiae mostly dark brown.

SONG. Short trains of rapidly delivered pairs of pulses (Fig. 4).

HABITAT. Several males were heard singing on a steep forested bank. We caught one of them that was hidden beneath rotting logs.

SPECIMENS. *Holotype* M, ANN ARBOR.

Notosciobia goipina Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, 40 km west of Houailou, rain forest, 2 iii 1983 (Alexan-

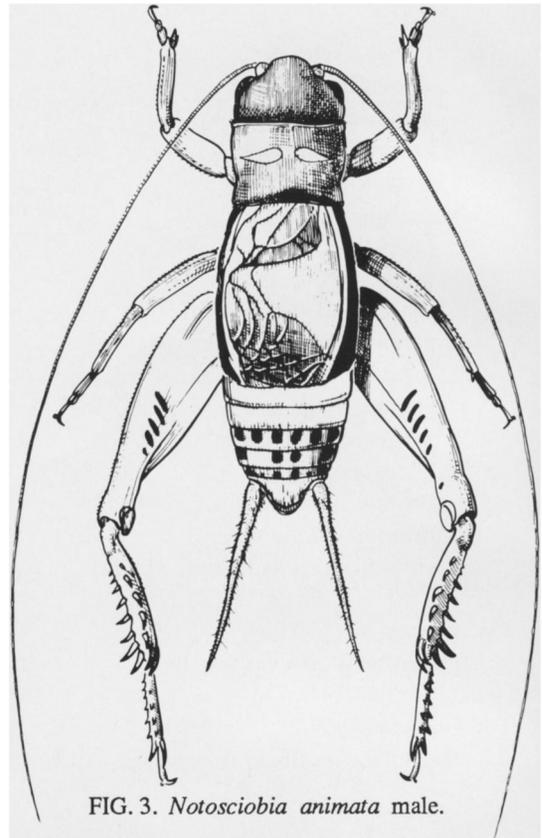


FIG. 3. *Notosciobia animata* male.

der, Cade & Otte). ANN ARBOR.

RECOGNITION. Figs. 4, 6B, 8. Tables 1, 2. Most similar to *nola* (genitalia largely indistinguishable) but file with more than 100 teeth, and song with higher pulse and chirp rates.

Males: Large for genus. Head and pronotum dark brown to black. Pronotum: dorsum wider in anterior than posterior end, dark reddish brown, MAPs reddish brown; lateral lobes dark reddish brown to black. Forewings: dorsum dark brown to black in basal and apical areas and on lateral field. Abdomen: spotted and blotchy with gray and dark brown; venter pale, subgenital plate brown. Legs all pale. Hindfemora with rows of small brown markings.

HABITAT. Collected in forest on a bank above a small creek where it was found in leaf litter.

SONG. Short groups of double-pulse chirps.

SPECIMENS. *Holotype* M, ANN ARBOR. *Paratypes*: (PHILADELPHIA and ANN ARBOR) Same data as holotype, 2M. Near Goipin, northwest of

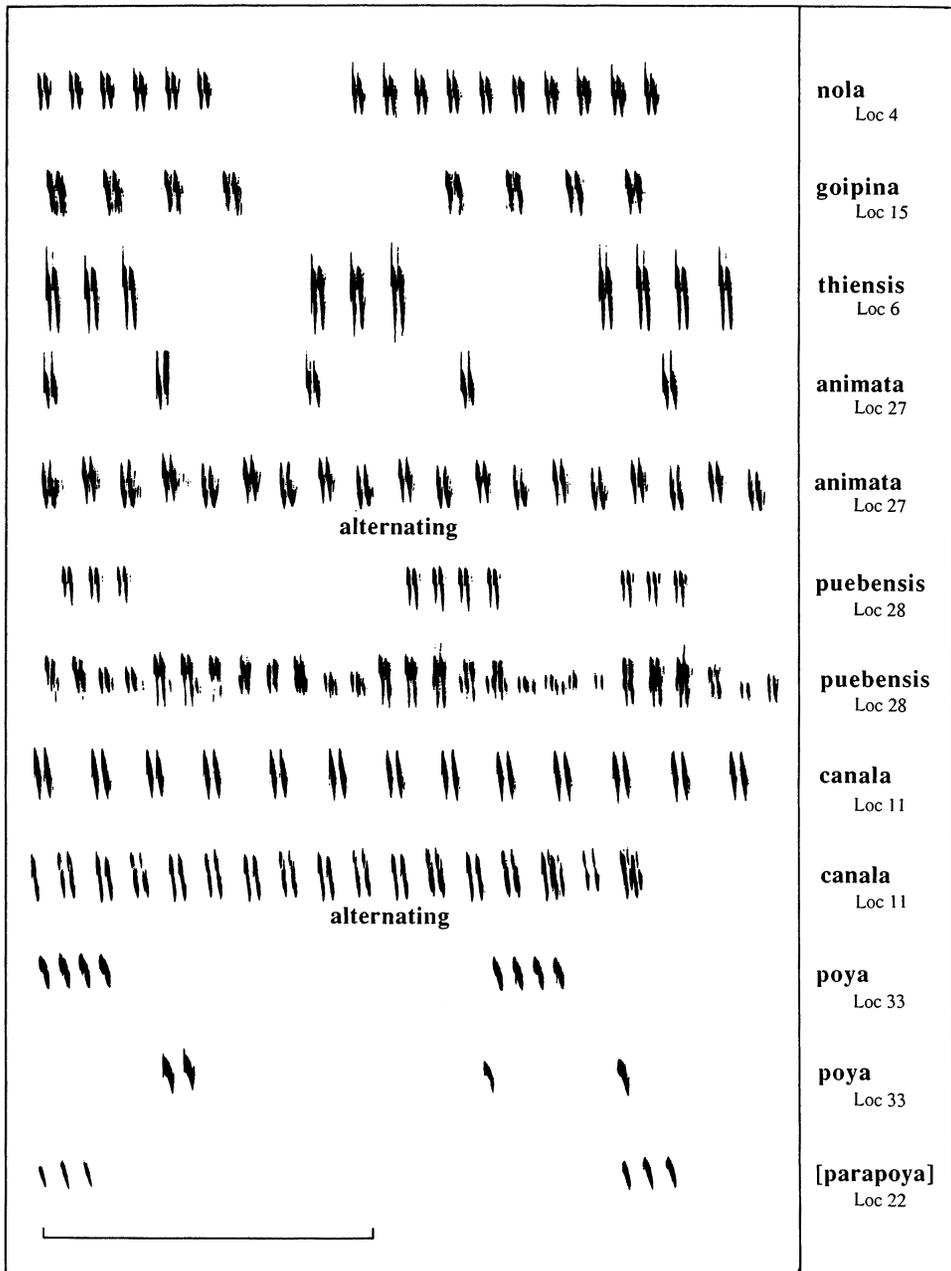


FIG. 4. *Notosciobia* songs in the Nola and Poya groups. For *animata* and *canala* the songs of soloing and alternating males are shown (Loc, locality where recording was made).

Table 1. Comparison of *Notosciobia* species. (For abbreviations see Methods).

	No. file teeth	BL	FL	CL	FWL/PL	TL/FL	Subapical spurs in./out.
<i>nola</i>							
HM	97	23	13.5	11	1.92	0.54	6/6
<i>goipina</i>							
HM	109	25	14	9.5	1.98	0.54	6/6
PM Loc16	109	23	12.9	-	-	-	-
PM Loc 33	102	27	14	7.7	1.75	0.57	6/6
<i>thiensis</i>							
HM	123	19	11.2	7.5	2.7	0.58	6/5
PF		21	10.5				6/5
PF		19	11				6/6
<i>paranola</i>							
HM	111	24	15	9.5	2.5	-	6/6
<i>animata</i>							
HM	103	15	9	5.4	2.36	0.56	6/5
PM	103	14	8.5	5.2	2.4		6/6
PM	110	14.8	8.7			0.55	7/6
PM	108	14.5	9	5.7	2.36		6/6
PF		15	8.5	5.9			5/6
<i>oubatchia</i>							
HM	79	14	9.3	6.8	2.1	0.51	4,5/5,6
<i>canala</i>							
HM	96	24	13.5	8.3	1.89	0.53	6/7
<i>puebensis</i>							
HM	98	17	9.8	6	2.4	0.54	6/5
<i>rouxi</i>							
HM	100	24	15	11	1.43	0.59	6/5
<i>velutina</i>							
HM	67	17	12	7.2	1.4	0.41	5/6
<i>poya</i>							
HM	ca. 140	14.5	9	5.7	3.09	-	5,5/3,4
<i>fausta</i>							
HM	88	14.5	8.4	5.6	1.75	0.57	4/3
<i>rex</i>							
HM	65	16	9.6	-	1.71	-	5/5
<i>hirsuta</i>							
HM	70	14	8	5	2.14	-	5/4

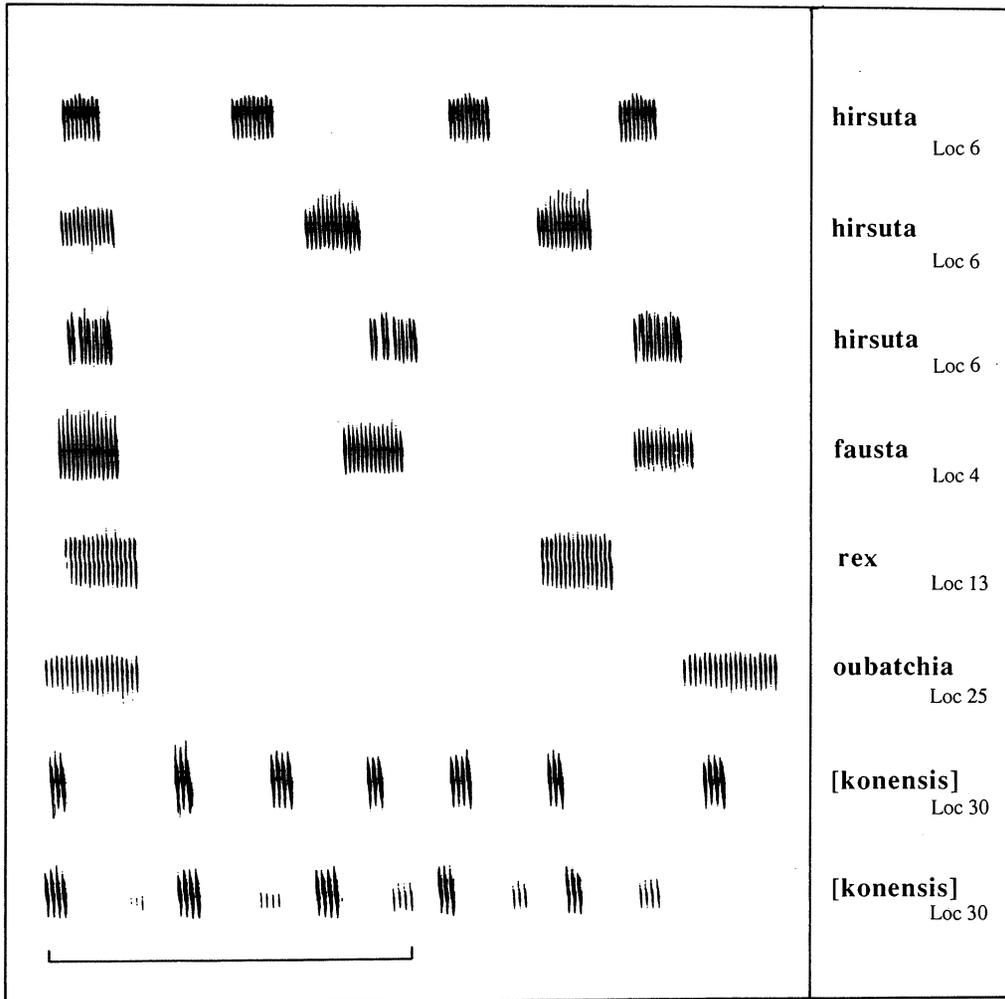


FIG. 5. *Notosciobia* songs in the Fausta Group.

Nékiāi and Poya, 8 iii 1983 (Alexander, Cade & Otte #) 1M.

***Notosciobia canala* Otte, n. sp.**

TYPE. *Holotype* M, New Caledonia, ca. 28 km w of Canala, 1 iii 1983 (Alexander, Cade & Otte). PHILADELPHIA.

RECOGNITION. Figs. 4, 6K, 9. Table 1, 2. Most

similar to *goipina* and *nola*, but ectoparameres without a ventral depression at apex, and song consisting of a continuous train of double-pulse chirps.

Male: Head: dorsum dark reddish brown; face dark reddish brown. Pronotum: dorsum slightly lighter than head, with red MAPs. Forewings: lighter brown in central area dark brown in basal and apical areas and on lateral field. Abdomen: mostly light brown but each tergite with trans-

verse row of small dark streaks. Fore- and midfemora pale brown and with dark brown along the lower distal surfaces. Hindfemora pale brown with dark brown oblique stripes on outer face.

SONG. A rapid train of double pulse chirps. Males singing near one another may alternate their chirps.

HABITAT. Rain forest, and along the steep vegetated road banks at the forest margin.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratype*: same data as holotype, 1M, ANN ARBOR.

Notosciobia paranola Otte, n. sp.

TYPE. *Holotype* M. New Caledonia, Mt. Koghi, west slope of Mt Bouo, tall forest, 27 ii 1983 (Alexander, Cade & Otte). PHILADELPHIA.

RECOGNITION. Figs. 6I, 7. Tables 1, 2. Differs from the similarly sized *nola* in having a forewing which is more than twice the length of the pronotum (see also *nola* recognition) and in the shape of the ectoparameres. Similar to *thiensis* in male genitalia but considerably larger and with 5 harp veins.

Male: Head dark brown; pronotum rusty brown; abdomen spotted pale and brown on dorsum. Forewings more than twice the length of the pronotum. Hindfemora with faint brown stripes on outer face.

SONG. Not known.

HABITAT. Found along a trail in a tall montane forest.

SPECIMENS. *Holotype* M, PHILADELPHIA.

Notosciobia thiensis Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, ca. 12 km south of Thio, in forest along beach, 28 ii 1983 (Alexander, Cade & Otte). PHILADELPHIA.

RECOGNITION. Figs. 4, 6C, 7. Tables 1, 2. Morphologically very similar to *paranola* but harp with only three veins, file with over 120 teeth, body length less than 20 mm, Hindfemora length less than 12 mm.

Male: Light reddish brown head and pronotum and yellowish legs. Head: dorsum reddish brown with 6 very faint pale stripes on occiput and vertex; face and cheeks reddish brown. Pronotum uniformly reddish brown. Forewings pale grey brown, becoming much darker in basal and apical areas and on lateral field. Abdomen pale brown. Legs ivory colored. Hindfemora with light brown oblique streaks on outer and inner faces, and with a pale streak along the upper crest, with dark red brown marks on inner and outer faces just before the knees. Hindtibiae pale brown on upper face, dark on lower face.

Females: coloration similar to male; forewings very small and non-overlapping, appearing as small hemicircular pads at posterior margin of pronotum. Ovipositor about half as long as pronotum.

SONG. Short bursts of double-pulse chirps.

HABITAT. Collected in leaf litter among rotten branches in a forest along the beach.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratypes*: same data as holotype, 2M, 2F, ANN ARBOR & PHILADELPHIA.

Notosciobia animata Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, 17 km southeast of Oubatche, coastal forest, 6 iii 1983 (Alexander, Cade & Otte #27). PHILADELPHIA.

RECOGNITION. Figs. 4, 6D, 8. Tables 1, 2. Song consisting of trains of double-pulse chirps. Spermatophore sac relatively short (in *oubatchia* it is also short, but the ectoparameres are bilobed at the apex).

Males: Head and pronotum reddish; forewings greyish; abdomen light brown. Head: dorsum reddish; face and cheeks reddish. Pronotum uniformly reddish. Forewings greyish. Abdomen light brown. Legs all yellowish brown. Hindfemora without distinct outer oblique stripes.

Female: same color and size as male; ovipositor about one third as long as pronotum.

SONG. Trains of double-pulse chirps. Adjacent males may alternate with one another in the production of double-pulse units (Fig. 4). This

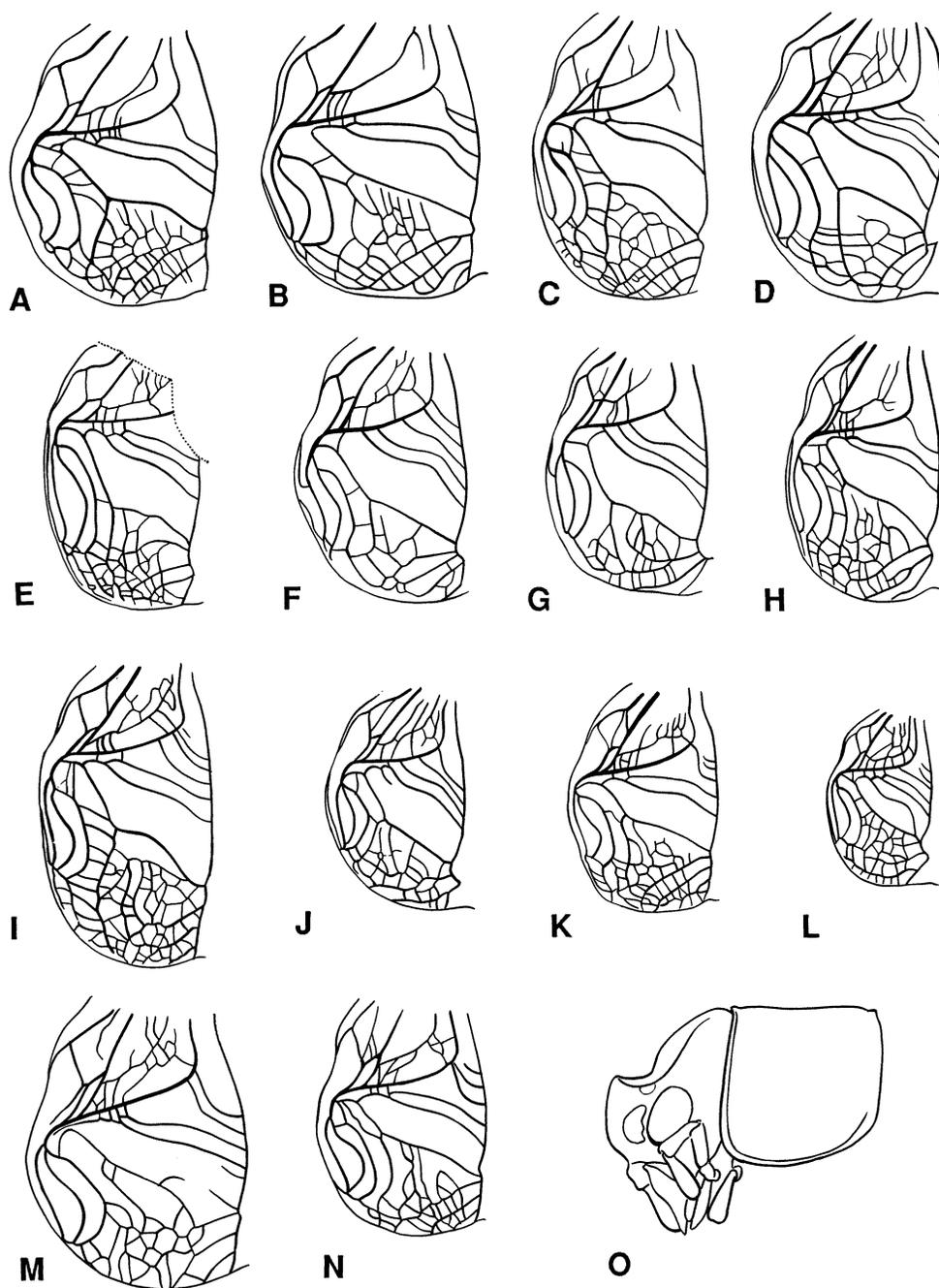


FIG. 6. *Notosciobia*. A-N, forewings (all but *goipina* of holotype). A, *nola*. B, *goipina* paratype. C, *thiensis*. D, *animata*. E, *poya*. F, *fausta*. G, *hirsuta*. H, *oubatchia*. I, *paranola*. J, *rex*. K, *canala*. L, *puebensis*. M, *rouxi*. N, *velutina*. O, *rouxi* head and pronotum of holotype.

behavior is very similar to that of *canala*.

HABITAT. Leaf litter in a dense coastal forest. The species lives in burrows.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratypes:* same data as holotype, 13M, 1F, PHILADELPHIA & ANN ARBOR.

Notosciobia puebensis Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, 14.8 km southeast of Oubatche, coastal forest, 6 iii 1983 (Alexander, Cade & Otte). ANN ARBOR.

RECOGNITION. Figs. 4, 6L, 8. Tables 1, 2. Song consists of short burst of double-pulse chirps similar to *thiensis*. Harp with 6 veins; last harp vein connected to mirror in holotype. Genitalia similar to *animata*, but spermatophore sac much longer. Hindfemora without oblique dark stripes on outer face.

Male: Head, pronotum and forewings reddish brown. Abdomen: pale brown. Legs all pale brown. Hindfemora without dark oblique stripes on outer face.

SONG. Short groups of double pulse chirps.

HABITAT. Found in leaf litter in coastal forests.

SPECIMENS. *Holotype* M, ANN ARBOR.

Notosciobia oubatchia Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Hiengene, 4 km W of Bridge (Alexander, Cade & Otte) ANN ARBOR.

RECOGNITION. Figs. 5, 6, 9. Tables 1, 2. Male genitalia similar to *animata*, but ectoparameres bilobed at apex; song consisting of short chirps with a very rapid pulse rate.

Male: Head: dark reddish brown on dorsum and face; cheeks reddish brown. Pronotum: dorsum dark brown; lateral lobes dark brown, but lighter along anterior and lower margin. Forewings: reddish brown, but becoming black in apical area. Abdomen: dorsum dark brown, but each tergite with four pale spots. Fore- and midlegs: ivory colored. Hindfemora pale but

with oblique dark brown stripes on outer face.

SONG. Widely spaced short chirps with a rapid pulse rate.

HABITAT. Rainforest on the northeast side of New Caledonia.

SPECIMENS. *Holotype* M, ANN ARBOR.

Notosciobia rouxi Chopard

Notosciobia rouxi Chopard 1915: 141. *Holotype* M, New Caledonia, Mont Ignambi, alt. 800 m, 8 viii 1911. BASEL.

RECOGNITION. Figs. 6M, O, 10. Table 1. Head of male with a huge concavity on the forehead. Ectoparameres distinctly notched at apex. Forewing with no traces of a mirror.

SPECIMENS. *Holotype* M, BASEL.

Notosciobia velutina Chopard

Notosciobia velutina Chopard 1915: 144. 2 males types, New Caledonia, Foret du Mont Panié, alt. 500 m, 27 vi 1911. BASEL.

RECOGNITION. Figs. 6N, 10. Table 1. Distinguished from other members of this group in the configuration of the male genitalia.

SPECIMENS. *Holotype* M, BASEL.

Notosciobia lifouensis Gorochov, n. comb.

Cephalogryllus lifouensis Gorochov 1986:704. *Holotype* M, Lifou Island, Loyalty Islands. LENINGRAD. NEW COMBINATION. Type not examined.

RECOGNITION. See Figs 76-79 in Gorochov 1986:707. Gorochov mistakenly placed this species in *Cephalogryllus*. Examination of his figures shows a striking resemblance of this species to *Notosciobia* (Nola group) of New Caledonia.

Poya Group

Distinguished from the Nola and Fausta Group in having a deep median gap in the epiphallus and in

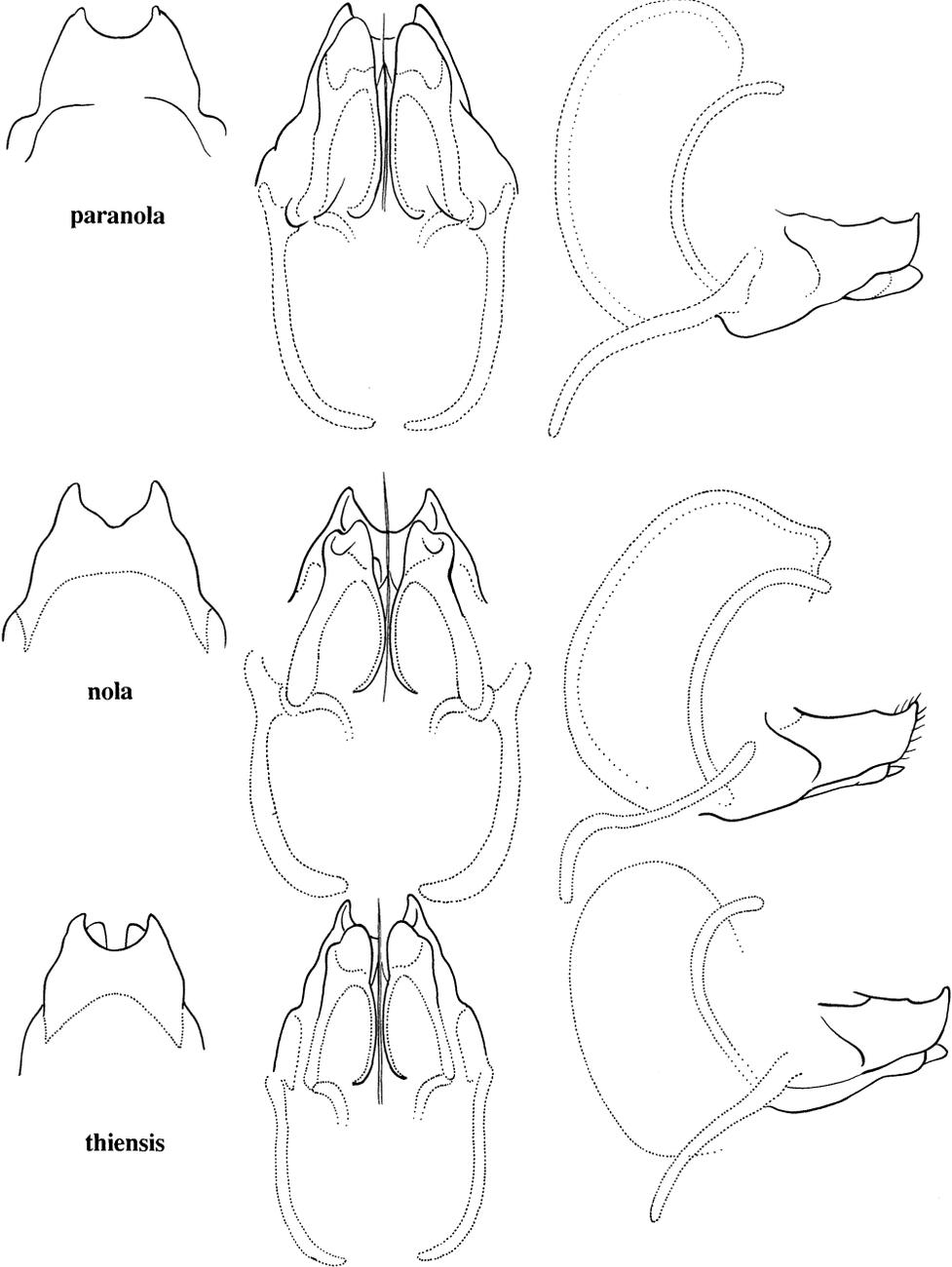


FIG. 7. *Notosciobia* (Nola group) male genitalia (holotypes).

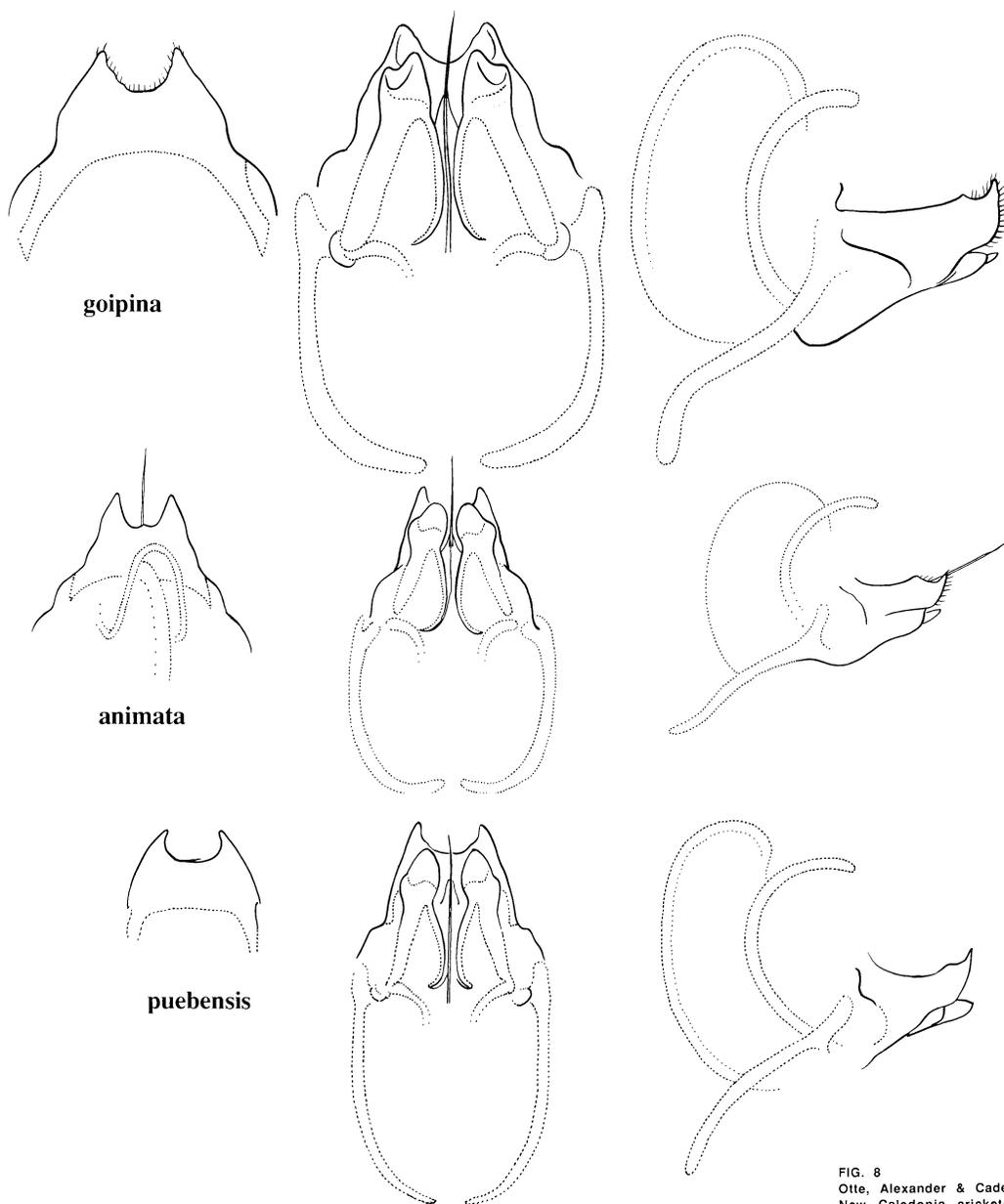


FIG. 8
Otte, Alexander & Cade
New Caledonia crickets

FIG. 8. *Notosciobia* (Nola group) male genitalia (holotypes).

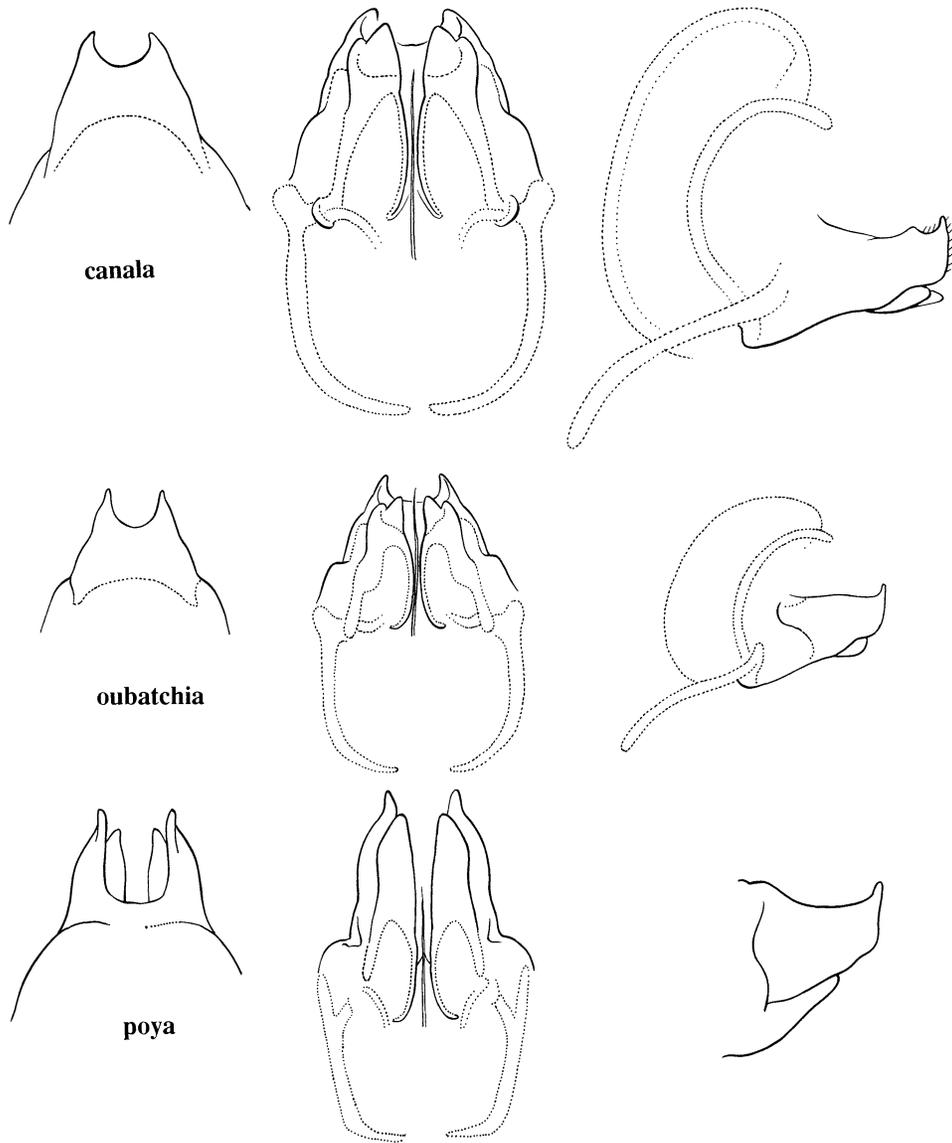


FIG. 9. *Notosciobia* (Nola and Poya groups) male genitalia (holotypes).

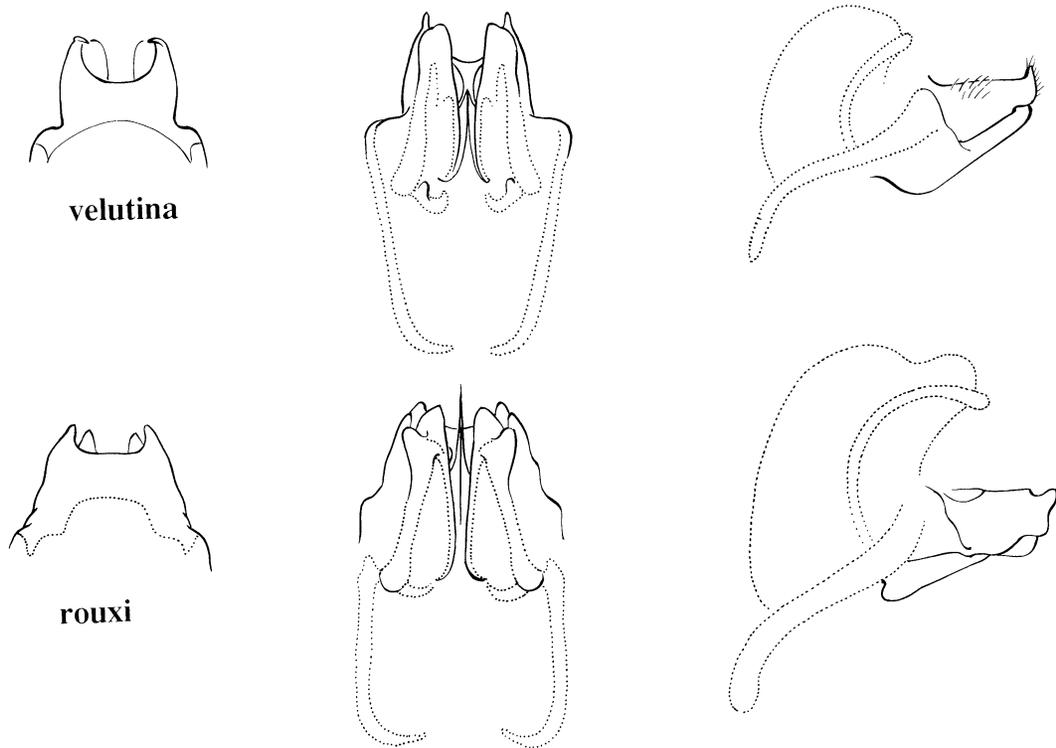


FIG. 10. *Notosciobia* (Nola group) male genitalia (holotypes).

having very long ectoparameres. Like the *Fausta* group it has a very short spermatophore sac.

***Notosciobia poya* Otte, n. sp.**

TYPE. *Holotype* M, New Caledonia, near Goipin, northwest of Nékiaï, forest along stream, 8 iii 1983 (Alexander, Cade & Otte #33). PHILADELPHIA.

RECOGNITION. Figs. 4, 6E, 9. Tables 1, 2. Male epiphallus with a deep U-shaped median gap; ectoparameres very long. Song consists of chirps with one to four pulses.

Male: Body color reddish brown. Head: dorsum with five broad black bands separated by narrow reddish bands; face and cheeks brown. Pronotum: dorsum brown, posterior margin black; lateral lobes brown. Forewings: dorsum

brown, apical area no darker than central area. Legs: femora pale yellow-brown; tibiae slightly darker especially on lower face. Hindfemora with brown oblique stripes.

SONG. Chirps containing from one to four pulses.

HABITAT. Forest floor litter, on a bank above a small creek. Males live in burrows.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratype:* same data as holotype, 1M, ANN ARBOR.

Fausta Group

Distinguished from the Nola and Poya groups in having a distinctly V-shaped central cleft in the epiphallus, in having a very short spermatophore sac and in having inward turning ectoparameres.

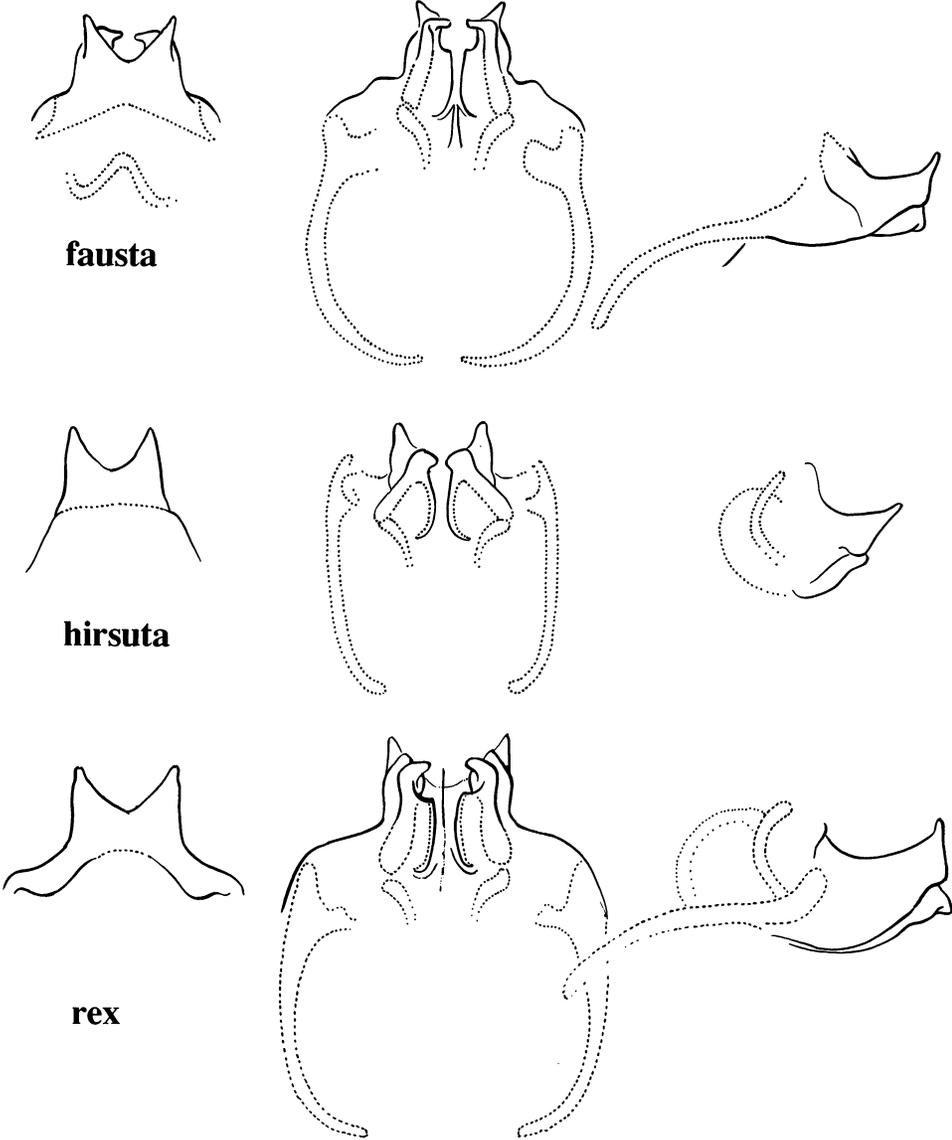


FIG. 11. *Notosciobia* (Fausta group) male genitalia.

Notosciobia fausta Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Yahoué, near Noumea, forest floor, 17 ii 1983 (Alexander, Cade & Otte # 4). PHILADELPHIA.

RECOGNITION. Figs. 5, 6F, 10. Tables 1, 2. Ectoparameres narrow and turned sharply inwards at apex. Epiphallus distinctly longer than in *hirsuta*. Song very similar to *hirsuta* and *rex*.

Male: Head reddish, pronotum reddish and black; abdomen speckled. Head: entirely reddish. Pronotum: dorsum dark reddish brown, posterior third black; lateral lobes dark reddish brown, but becoming ivory colored in lower front corner. Forewings: dorsum brown, darker in apical area; lateral field dark brown. Abdomen: dorsum mottled, venter uniformly pale. All femora ivory colored. Hindfemora with brown oblique stripes on outer face.

SONG. A succession of short chirps with a very rapid pulse rate.

HABITAT. Forest floor among litter in a tall forest above a small stream.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratype*: same data as holotype, 1M, ANN ARBOR.

Notosciobia rex Otte, n. sp.

TYPE. *Holotype* M. New Caledonia, 34 km west of Canala, 1 iii 1983 (Alexander, Cade & Otte). PHILADELPHIA.

RECOGNITION. Figs. 5, 6J, 11. Tables 1, 2. Male quite similar to *fausta* epiphallus not so slender at apex (side view) and apex of ectoparameres not turning in so sharply.

Male: Very similar to *hirsuta*, but differing in the shape of the ectoparameres.

SONG. A succession of short chirps with a very rapid pulse rate.

HABITAT. Rain forest along mountain road.

SPECIMENS. *Holotype* M, PHILADELPHIA.

Notosciobia hirsuta Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, about 12 km south of Thio, forest along beach, 18 ii 1983

(Alexander, Cade & Otte #6). PHILADELPHIA

RECOGNITION. Figs. 5, 6G, 11. Tables 1, 2. Ectoparameres rounded at apex and without an angular projection along inner margin (as in *rex* and *fausta*). Song similar to *fausta*, but sometimes pulses produced in pairs.

Male: Head and pronotum dark reddish brown. Pronotum: dorsum dark reddish brown, anterior margin and posterior third black, MAPs orange; lateral lobes dark reddish brown in anterior two-thirds and blackish in posterior third. Forewings: dorsum brown to dark brown in apical area; lateral field dark brown. Legs all pale yellowish brown. Hindfemora with faint oblique stripes, brown before knees on inner, outer and upper faces.

SONG. A train of short chirps with very rapid pulse rates.

HABITAT. Leaf litter and debris on forest floor along a beach.

SPECIMENS. *Holotype* M, PHILADELPHIA.

TAPE RECORDED SPECIES

[Notosciobia konensis]

This species was tape recorded at Loc 30. It inhabited forest litter. The structure of its song shows that it belongs to the Nola group (Fig. 5).

[Notosciobia parapoya]

This species was tape recorded in a forest at Loc 22. Its song suggests that it belongs to the Poya group.

Subfamily GRYLLINAE
GRYLLINI**Teleogryllus oceanicus** (Le Guillou)

This species is widespread through the South-west Pacific from northern Australia and New Guinea eastwards to Hawaii. It was also recorded from Norfolk Island (Otte & Rentz

1985). At some localities this species was heard singing with *T. marini* (See Fig. 12 for song).

DISTRIBUTION RECORDS. Locs 8, 18, 19.

***Teleogryllus marini* Otte & Alexander**

This species is now known from Queensland, Fiji, and New Caledonia. It lives in very moist grasses and ditches, and is sometimes accompanied by *T. oceanicus*. (See Fig. 12 for song).

DISTRIBUTION RECORDS. Locs 18, 19, 23

MODICOGRYLLINI

***Lepidogryllus comparatus* (Walker)**

Gryllus lepidoides Chopard 1915: 138. *Holotype* F, New Caledonia, Ni, 6 ii 1912. BASEL. NEW SYNONYM.

This species is known from Australia, Norfolk Island, and New Caledonia. It is often found in drier grassy areas, especially on the west side of the island, sometimes on stony road banks. The song consists of a single beep-like sound with a very rapid pulse rate (see Otte and Alexander 1983 for song).

DISTRIBUTION RECORDS. Locs 3, 9, 30.

***Gryllodes sigillatus* (Walker)**

This cosmopolitan cricket was heard in Noumea and a single female was collected on the east side of the island. This song consists of a rapid train of double-pulse chirps (see Otte and Alexander 1983).

Subfamily NEMOBIINAE

New Caledonia has a diverse Nemobiinae fauna, with seven genera and twelve species. Only one genus, *Bobilla*, is found outside New Caledonia (Australia and New Zealand). The genera *Bobilla*, *Koghiella* and *Ignambina* are

very similar to *Dictyonemobius* of Lord Howe and Norfolk islands and are here united into the Bobilla Genus Group. *Ionemobius* is very similar to *Thetella* which is widespread through the Pacific, but *Amonobius* and *Paniella* cannot yet be related to genera elsewhere.

BOBILLA Otte & Alexander

Bullita Gorochov 1986:693. NEW SYNONYM. Type species: *Bullita pacifica* Gorochov 1986: 694.

TYPE SPECIES: *Bobilla bivittata* (Walker)

RECOGNITION OF GENUS. Differs from *Koghiella* in the male genitalia—the apical lobes of the epiphallus bend sharply downwards, have small lumps, and do not extend much beyond the ectoparameres.

Previously this genus was known only from eastern and southern Australia. But it is now also known from New Zealand. Swan 1972 described *Pteronemobius bigelowi* and *P. nigrovus* from New Zealand. Examination of the male genitalia reveals that these are both *Bobilla* species.

***Bobilla avita* Otte, n. sp.**

TYPE. *Holotype* M, New Caledonia, Loc. 5, Mt Koghi, West slope of Mt. Bouo, tall forest, 27 ii 1983 (Otte, Alexander, & Cade). PHILADELPHIA.

RECOGNITION. Figs. 14, 15. Table 3. This is the only known member of the genus in New Caledonia. See generic recognition above.

Males: Body color blackish, with orange-brown legs. Head: dorsum black, face black, cheeks black. Pronotum: dorsum dark brown, slightly lighter than lateral lobes, sometimes with a pale patch in each anterior quarter; lateral lobes black. Forewings: dorsum dark brown but with a pale strak along edge of farsal field; lateral field dark brown. Abdomen: dorsum black, venter brown. Fore- and midlegs: uniformly orange-brown. Hindfemora: orange-brown, without oblique stripes. Cerci: orange brown.

Table 2. Comparison of *Notosciobia* songs. (p/s, pulses per second; ch/s, chirps per second; p/ch, pulses per chirp; KHZ, frequency in kiloHerz. °C, degrees centigrade; solo, single male singing; alt, two males singing simultaneously and alternating.

	p/s	ch/s	p/ch [ch duration]	KHz	°C
<i>Brachytrupinae</i>					
<i>fausta</i>					
Loc 4	78.8	1.38	[0.15]	4.5	24
Loc 4	82.6	1.23		5.2	24
Loc 4	85	1.3	[0.12]	4.7	24
Loc 4	80.9	2.9	[0.06-0.15]	5	24
Loc 4	82.8	1.28	[0.16]	5.2	24
Loc 4	86	1.15	[0.15]	4.6	24
Loc 5	85	0.63	[0.19]	4.2	21.7
Loc 5	82.6	0.5-0.8	[0.16]	4	21.7
Loc 5	86	0.5	[0.17]	3.5	21.7
<i>hirsuta</i>					
Loc 6	91.7	1.27	[0.13]	4.1	26
Loc 6	86	1.95	[0.12]	4.7	26
Loc 6	86	2.28	[0.15]	4.5	26
<i>oubatchia</i>					
Loc 27	64.5	0.55	[0.31]	4.6	24
Loc 27	64.5	0.59	[0.3]	4.5	24
Loc 27	60.9	0.57	[0.31]	3.9	24
<i>oubatchia???</i>					
Loc 25	70.8	0.57	[0.26]	5.2	23
Loc 25	71.7	0.6	[0.23]	5	23
<i>rex</i>					
Loc 13	80.6	0.72	[0.21]	4.2	22
Loc 13	80	0.72	[0.21]	4.2	22
Loc 13	79.8	0.76	[0.2]	4.2	22
<i>[konensis]</i>					
Loc 30	63.1	2.8	3-4	4.2	23
Loc 30	62.9	2.8	3-4	4.2	23
Loc 30	62.1	2.6	3-5	4.5	23
Loc 30	63.4	3.6	3-4	4.2	23
Loc 30	60.7	2.1	3-4	4	23
<i>poya</i>					
Loc 33	16.1	0.72	4	3.3	24.4
Loc 33	16.1	0.7	3-4	3	24.4
Loc 33	15.6	0.22	2	3.5	24.4
Loc 33	19.1	0.7	5-6	3.2	24.4
<i>[parapoya]</i>					
Loc 22	14.3	0.43	3-4	4.2	24
Loc 22	14.3	0.61	3	4.2	24
<i>goipina</i>					
Loc 15	35.8	5.5	2	3.7	21
<i>thiensis</i>					
Loc 6	46.3	9.1	2	4.9	26
Loc 6	43	8.3	2	5	26
Loc 6					

Table 2 (continued)

	p/s	ch/s	p/ch [ch duration]	KHz	°C
<i>nola</i>					
Loc 4	46.9	10.4	2	4	24
Loc 4	51.1	10.1	2	4	24
<i>animata</i>					
Loc 27	47.8	2.87	2	4.8	24
Loc 27	51.6	4.16	2	5.2	24
Loc 27	49.1	4.16	2	4.7	24
<i>canala</i>					
Loc 15	35.6	5.86 solo	2	4	21
Loc 12	35.8	5.73 solo	2	4	22
Loc 11	35.2	4.1-5.7 solo	2	3.8	22
Loc 11	36.5	4.1 alt	2	4	22
Loc 11	33.4	4.4 alt	2	3.8	22
Loc 11	32.8	6.1 solo	2	3.9	22
Loc 11	33.7	5.3 solo	2	3.8	22
Loc 11	25	6.5	2	3.5	22
Loc 11	33.4	3.2 alt	2	4	22
<i>puebensis</i>					
Loc 28	51.6	12.3	2	4.2	24
Loc 28	59.5	11.5	2	4.2	24
Loc 28	52.4	11.8	2	4.3	24
Loc 28	62	12.3	2	4.3	24
GRYLLINAE					
<i>Lepidogryllus comparatus</i>					
Loc 9	172		[0.73]	4.5	24
Loc 3	172		[0.6]	4.3	26
	p/s	pairs/chr	ch/s		
	pt 1	pt 2			
<i>Teleogryllus oceanicus</i>					
Fiji	17.6	30.7	0.57	8.8	4.7
Fiji	17.2	27.5	0.63	7.8	4.7
Fiji	18.1	33.4	0.54	9.6	26
Loc 19	17.8	29.9	0.6	8.6	5
Loc 18	16.1	37.6	0.43	9	5
Loc 8	15.6	29.7	0.53	7	5.1
Loc 4	19.1	34.4	0.56	9.6	4.8
<i>Teleogryllus marini</i>					
Loc 23	18.7	47.3	0.4	9.4	3.3
Loc 19	17.2	39.7	0.43	6.8	2.8
Loc 19	19.1	45	0.42	8.1	3.5
Loc 19	18.1	44.9	0.4	11.1	3.5
Loc 19	18.6	45.3	0.41	9.7	3.3
Loc 19	19.6	35.3	0.56	9	3.2
Loc 18	19.8	49.1	0.4	8.2	3.2
Loc 18	20.2	51.6	0.39	6.9	3.3
Loc 18	18.6	45.9	0.41	7.4	3.3
Loc 19	22.6	34.4	0.66	13.2	3.5
Loc 19	23.1	44.2	0.52	10	3.5
Loc 18 court	18.1	64.5	0.28	trill	3.2
Loc 8	19.9	33.3	0.6	10.7 var	3.5

Table 2 (continued)

	p/s	ch/s	p/ch [ch duration]	KHz	°C
OECANTHINAE					
<i>Oecanthus rufescens</i>					
Loc 33	48.7	-	cont.	3.2	24.4
Loc 10	41.3	-	var.	3.6	22
Loc 3	55	-	var.	3.7	26
Loc 6	58.5	-	var.	3.7	26
NEMOBIINAE					
<i>Koghiella bouo</i>					
Loc 4	101	-	[0.93]	5.7	24
Loc 5	90.3	-	[1]	5.6	21.7
Loc 5	91	-	[0.93]	5.3	21.7
Loc 5	94.6	-	[1.74]	5.5	21.7
<i>Koghiella bouo??</i>					
Loc 33	105	-	[0.53]	5	24.4
<i>Koghiella thio</i>					
Loc 6	101	0.25	[0.9]	6	26
Loc 6	99.2	-		6.2	26
Loc 6	99.2	-	[0.93]	5.9	26
<i>Koghiella sp.</i>					
Loc 19	21	0.78	[0.5]	7.2	24
Loc 19	72.8		[0.38]	8	24
Loc 19	70.8	-	[0.49]	7.4	24
Loc 33	70	-	[0.44]	8	24.4
<i>Koghiella sp.</i>					
Loc 10	86	-	[0.81]	5.8	22
Loc 10	86	-	[0.8]	5.7	22
Loc 10	85	-	[0.7]	6	22
<i>Koghiella semibouo</i>					
Loc 5	48.2	0.86	[0.49]	5.5	21.7
Loc 5	47.3	0.83	[0.55]	5.5	21.7
<i>Koghiella caledonica</i>					
Loc 24	64.5	2.42	[0.08]	5.8	24
<i>Amonemobius vexans</i>					
Loc 22	86	2.23	[0.09]	6.5	24
ITARINAE					
<i>Tremellia beta</i>					
Loc 5	86	2.03	[2.1]	3.5	21.7
Loc 5	89	-	[3]	3.5	21.7
Loc 5	87	-	[2.6]	3.5	21.7
Loc 5	86	-	-	3.5	21.7
<i>Tremellia tiwaka</i>					
Loc 30	59.8	1.1	[0.7]	3.8	23
Loc 23	59.1	0.82	[0.84]	3.7	24
<i>Tremellia caledonica</i>					
Loc 5	45	0.13	[2]	3.3	21.7
Loc 5	46			3.5	21.7

Table 2 (continued)

	p/s	ch/s	p/ch [ch duration]	KHz	°C
<i>Tremellia caledonica??</i>					
Loc 22	49.9	-	[1.71]	3.5	24
Loc 10	41.8	-	[1.51]	3.5	22
<i>Tremellia sp?</i>					
Loc 13	33.1	-	[1.74]	3.1	22
Loc 12	33.3	-	-	3.2	22
<i>Tremellia sp?</i>					
Loc 5	24.6	0.8	[0.37]	4.7	21.7
PODOSCIRTINAE					
<i>Calscirtus paniensis</i>					
Loc 27	64.5	0.14	[0.35]	3.2	24
Loc 27	63.4	0.11	[0.41]	3	24
<i>Archenopterus bouensis</i>					
Loc 5	13.2	-	[1.5-2.0]	4	21.7
Loc 5	12.9	-	[1.3+]	4.1	21.7
Podoscirtinae 1					
Loc 5	24.2	0.17	[0.47]	4.2	21.7
Podoscirtinae 2					
Loc 30	22.9	0.25	[0.45]	4.5	23
Loc 16	22.2	0.31	[0.47]	4.5	21
Loc 10	23.5	-	[0.62]	4.2	22
Loc 10	23.7	0.22	[0.6]	4.3	22
Podoscirtinae 3					
Loc 4	26.2	1.1	[0.47]	5.7	24
Loc 5	25.5	0.9	[0.46]	4.8	21.7
Podoscirtinae 4					
Loc 4	36.9	0.29	[0.23]	4.9	24
Loc 4	38.7	0.17	[0.21]	4.8	24
Podoscirtinae 5					
Loc 30	33.1	-	[0.15]	5.3	23
Loc 19	33.4	0.32	[0.22]	5	24
Loc 19	38.2	-	[0.12]	5	24
Loc 19	36.2	-	[0.16]	4.7	21
Loc 19	36.8	-	-	4.7	21
Loc 9	34.4	0.32	[0.21]	4.4	21
Loc 9	32.3	-	[0.17]	4.2	21

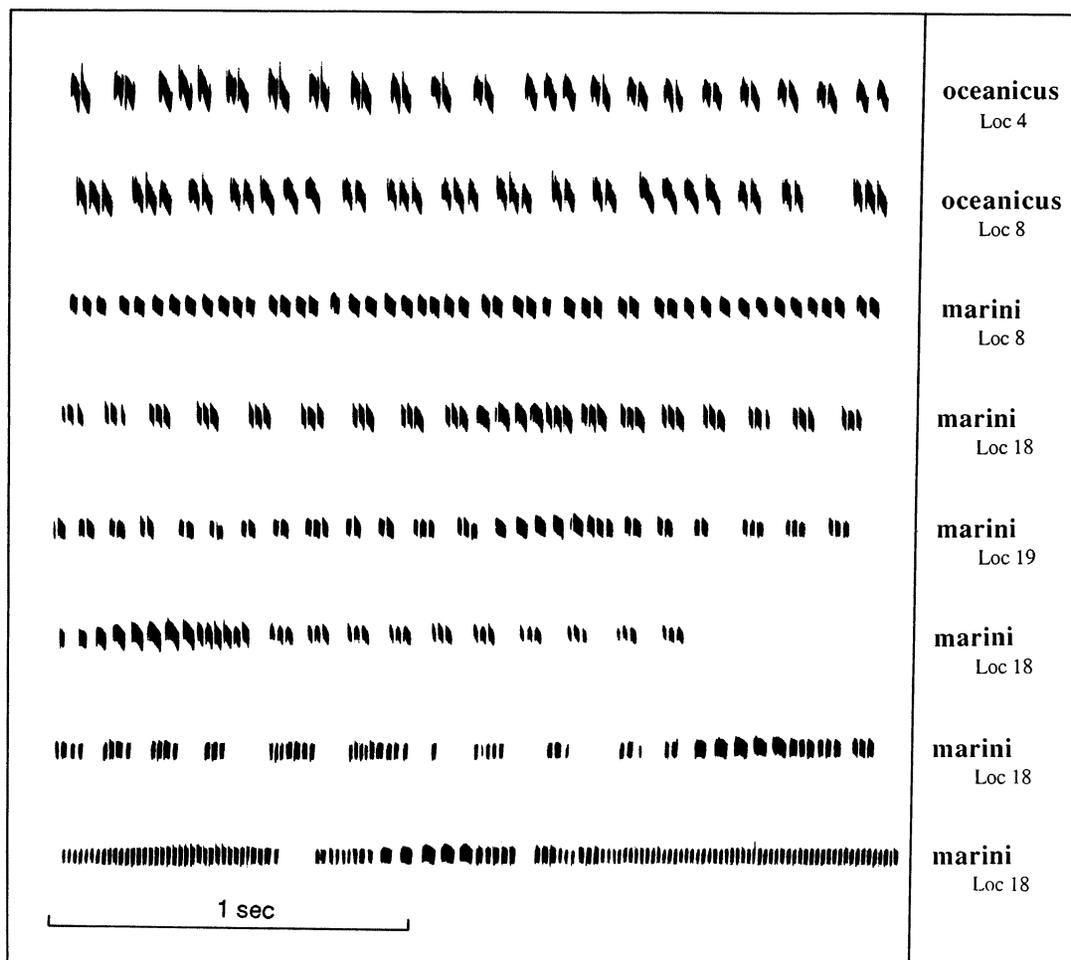


FIG. 12. *Teleogryllus* songs. 1st and 2nd songs: normal *oceanicus* songs. 3rd song: atypical *marini* song which appears to be more similar to *oceanicus* songs but the low frequency indicates that it belongs to *marini*. 4th, 5th, and 6th songs: typical *marini* calling songs. 7th song: calling song transition to courtship song. 8th song: presumed courtship song. (Scale = 1 second).

Females: colored like males. Forewings very short, longest along side of body, overlapping medially, dorsal field pearly along posterior margin.

BIOLOGY. Collected in leaf litter and along a trail in a tall rain forest.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratypes*: same data as holotype, 2M 4F, PHILADELPHIA & ANN ARBOR.

***Bobilla pacifica* Gorochov**

Bullita pacifica Gorochov 1986: 694. *Holotype* M, Oceania, New Caledonia (no additional data). LENINGRAD. Type not examined.

RECOGNITION. Fig.15B. This species differs from *avita* in the male genitalia.

Gorochov (1986) provides the following description: Male (holotype). In size rather small

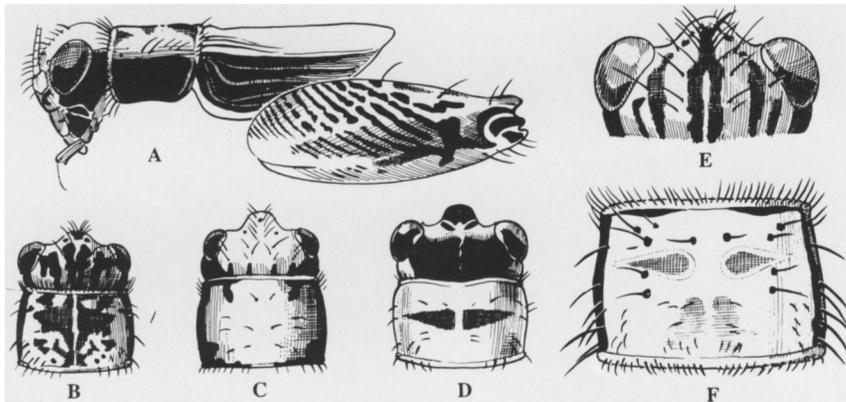


FIG. 13. Nemobiinae (holotypes). A, *Koghiella parabou*. B, *Koghiella bouo*. C, *Ionemobius alliciens*. D, *Koghiella caledonica* head. E, *Koghiella caledonica* pronotum.

Table 3. Morphological comparison of Nemobiinae species. See Methods for abbreviations.

	No. file teeth	BL	FL	FWL/PL	TL/FL	OL/FL	CL/FL
<i>Bobilla avita</i>							
Loc 5 M (n=3)	106-107	6.5-7.5	4.3-4.5	2.2-2.3	0.80-0.82	-	ca. 0.95
Loc 5 F (n=2)	-	6.1, 7.3	4.2, 4.3	ca. 0.55	ca. 0.8	0.65, 0.66	-
<i>Koghiella bouo</i>							
HM	57	7.3	4.6	-	0.68	-	-
<i>Koghiella semibouo</i>							
HM	87	7	4.3	2	-	-	0.8
FM	87	7.7	4.6	2	-	-	-
<i>Koghiella parabou</i>							
HM	94	9.7	5.4	2.1	0.7	-	-
PF	-	8.7	5	-	-	0.97	0.85
<i>Koghiella thio</i>							
M (n=3)	90-92	7.3-7.8	4.2-4.8	-	ca. 0.7	-	0.7-0.9
F	-	7.8	4.5	-	-	0.87	0.8
<i>Koghiella caledonica</i>							
M Loc 10	84	6.9	3.8	2.1	-	-	0.74
M Loc 33	80	8.1	4.7	1.85	-	-	0.75
M Loc 24	84	7.8	4.5	1.9	-	-	0.72
F Loc 10	-	8.3	4.5	-	-	0.85	0.76
F Loc 33	-	7.4	4.9	0.48	-	0.81	-
F (n=3) Loc 24	-	7.9-8.7	4.3-4.9	0.42	-	0.85-1.1	0.78-0.91
<i>Ignambina oubatchia</i>							
HM	106	7.7	4.6	2.3	0.75	-	0.83
PM	-	7.9	4.2	2.2	-	-	-
PF	-	7.3	4.6	0.33	-	0.8	0.8
<i>Ionemobius alliciens</i>							
HM (n=3)	55-58	7.7-8.9	4.6-4.8	1.7-1.8	-	-	0.6-0.7
PF	-	8.5	5.3	0.26	-	0.87	0.75
<i>Amonemobius caledonicus</i>							
HM	71	7.5	4.8	2.3	0.85	-	-
PF	-	6.6	4.6	-	0.77	0.63	-

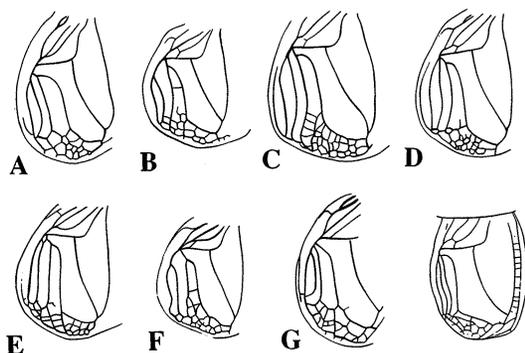


FIG. 14. Nemobiinae male forewings (holotypes). A, *Bobilla avita*. B, *Koghiella bouo*. C, *Koghiella parabouo*. D, *Koghiella thio*. E, *Koghiella caledonica*. F, *Ionemobius alliciens*. G, *Amonemobius vexans*. H, *Apter-onemobius gusevae* (from Gorochov 1986).

for tribe. The color of the body is chestnut brown, unicolorous, only the disc of the pronotum has poorly developed bright markings [his fig. 30]. The wing covers are also chestnut brown, but the dorsal surface along the fold is with a very narrow bright streak. The legs are also brown, monochrome, only on the rear femora have barely noticeable oblique lines. The wing veins and the male genitalia as are in [his figs 5-7, 30]. Body length 6 mm; pronotal length 1.5 mm; forewing length 3.3 mm; hindfemur length 4.4 mm.

SPECIMENS. *Holotype* M, LENINGRAD.

KOGHIELLA n. gen.

TYPE SPECIES: *Koghiella bouo* Otte, n. sp.

RECOGNITION OF GENUS. Figs. 13-18. Table 3. Most similar to *Bobilla* (of Australia, New Zealand and New Caledonia), *Ignambina* (New Caledonia) and *Dictyonemobius* (of Norfolk and Lord Howe islands). Unlike *Bobilla* the apical epiphallic lobes extend well beyond the ectoparameres and are not turned downwards. Unlike *Ignambina* the epiphallus is bifurcate at the apex.

Body color dark brown to blackish on sides of body, variegated pale and dark brown on dorsum of pronotum and abdomen. Head with four broader and two narrower longitudinal dark bands on occiput and vertex, with long stout

black bristles. Face usually with two parallel dark stripes on face which diverge from one another ventrad, following the antennal sockets and with a broad dark area descending from the eyes onto the mandibles. Pronotum: Dorsum reddish brown to pale brown, often with dark maculations; lateral lobes blackish. Forewings: without a mirror; with one harp vein, diagonal vein and Cu_2 in chordal area share an exclusive common stem; dorsal field generally brown to dark brown, veins in apical area, chordal area and basal areas often very pale; lateral field dark. Fore- and midfemora pale, with larger dark areas generally basal to large black bristles; tibiae banded with dark brown; fortibiae with large outer and no inner tympanum; fore- and midtibiae with two and three apical spurs respectively. Hindfemora with dark oblique stripes on outer

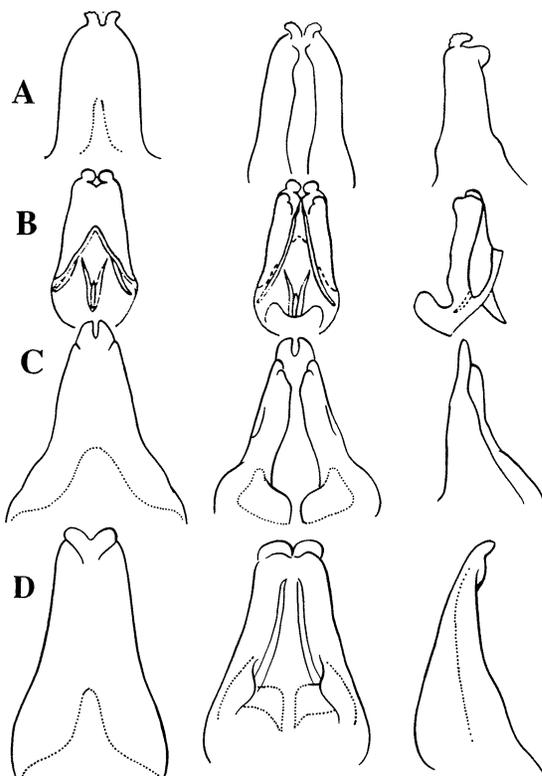


FIG. 15. Nemobiinae male genitalia (holotypes). A, *Bobilla avita*. B, *Bobilla pacifica* (from Gorochov) C, *Koghiella bouo*. D, *Koghiella parabouo*.

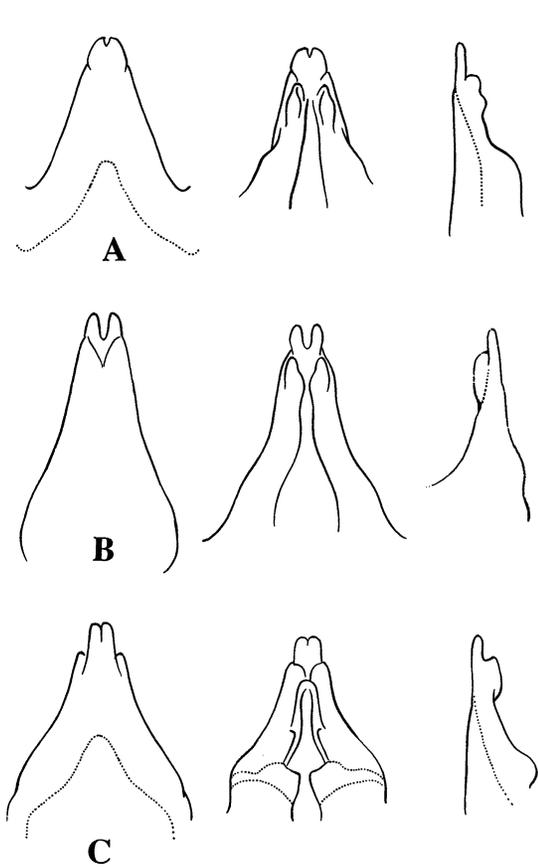


FIG. 16. Nemobiinae male genitalia (holotypes). A, *Koghiella semibouo*. B, *Koghiella thio*. C, *Koghiella caledonica*.

and upper faces. Hindtibiae with dark to black bands on posterior face between the spurs; with four inner and five outer subapicals. Abdomen: pale brown to reddish brown, speckled with darker spots, lateral surface of tergites black.

Females: Size and color like males; forewings shorter than pronotum, bristly, transversely truncated (appears to be a tergite), meeting at midline, longest along side of body.

Koghiella bouo Otte, n. sp.

TYPE. Holotype M, New Caledonia, Loc. 5, Mt Koghi, West slope of Mt Bouo, tall forest, 27 ii

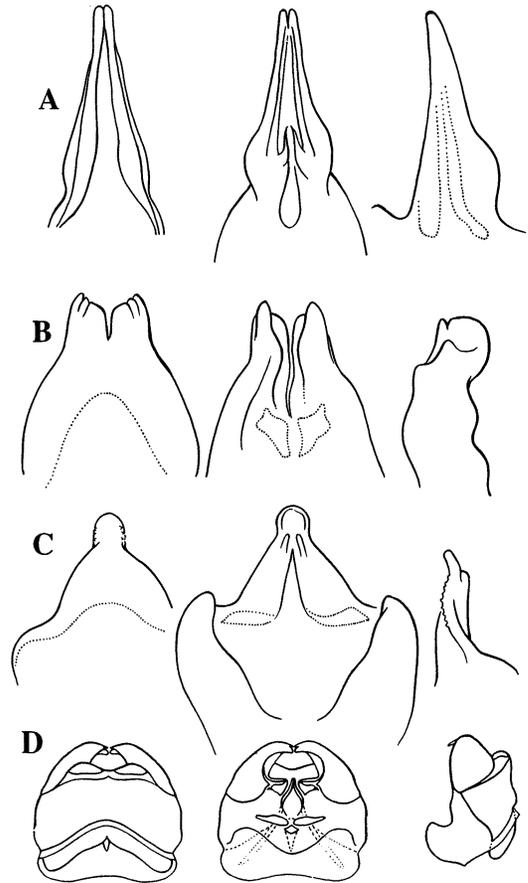


FIG. 17. Nemobiinae male genitalia (holotypes). A, *Ionemobius alliciens*. B, *Amonemobius vexans*. C, *Ignambina oubatchia*. D, *Aptonemobius gusevae*.

1983 (Alexander, Cade & Otte). PHILADELPHIA.

RECOGNITION. Figs. 13B, 14B, 15. Table 3. Most easily confused with *semibouo* and *thio*, but apex of epiphallus with a narrow U-shaped cleft which is as deep as the terminal lobes are wide. Stridulatory file with fewer than 70 teeth (more than 80 teeth in *thio* and *semibouo*).

Males: Head: dorsum marked as shown in figure. Face with two parallel dark stripes on frons which diverge towards clypeus, with broad dark area descending from eyes onto mandibles; central portion of clypeus and labrum ivory colored; cheeks dark brown to black. Promotum: dorsum

marked as shown in figure; lateral lobes black. Forewings: dark brown, veins 2A and 3A, base of stridulum, chords and apical veins pale. Abdomen: dorsum variegated dark brown and pale brown, but mostly dark brown; venter medium brown with indistinct light and dark bands. Fore- and midlegs: femora pale with large dark brown patches, especially at base of black setae; tibiae banded with dark brown. Hindfemora: with numerous dark brown oblique stripes on upper and outer faces. Cerci: medium brown.

Koghiella parabouo Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Mt. Koghi, west slope of Mt Bouo, tall forest, 27 ii 1983 (Alexander, Otte & Cade #5). PHILADELPHIA.

RECOGNITION. Figs. 13A, 14C, 15D. Table 3. Very similar to *bouo* and *semibouo* but apical cleft of epiphallus wide, V-shaped and entire structure bending downwards (in side view). Body also larger than these two species.

Males: Head: dorsum with 4 major longitudinal bands and 2 small ones lateral to these; face with two dark bands diverging ventrad; cheeks dark brown. Pronotum: dorsum pale brown with symmetrical dark brown spots and markings; lateral lobes dark brown to black. Forewings: dorsum dark brown with pale veins in apical, chordal and basal areas, lateral field dark brown. Abdomen: dorsum pale brown with dark spots, markings becoming larger laterally; venter lighter brown, with indistinct brownish areas, subgenital plate dark brown. Fore- and midlegs with large dark and pale areas. Hindfemora with with stong oblique dark brown stripes on upper and outer faces.

Female: Similar to male in size and color.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratypes*: Same data as holotype, 1F, PHILADELPHIA. 34 km west of Canala, 1M, ANN ARBOR

Koghiella semibouo Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Loc. 5, Mt Koghi, West slope of Mt Bouo, tall forest, 27 ii 1983 (Alexander, Cade, and Otte). PHILADEL-

PHIA.

RECOGNITION. Figs. 16A. Table 3. May be confused with *bouo*; differs in having a small apical cleft on the epiphallus and in having more than 80 file teeth.

Males: Head: vertex and occiput without distinct dark bands (similar to *bouo*). Face similar to *bouo*; cheeks dark brown to black. Pronotum: dorsum not strongly variegated, much lighter than lateral lobes; lateral lobes blackish. Abdomen: dorsum variegated dark and pale brown, becoming blackish along lateral margins; venter brown with 4 longitudinal rows of darker brown markings. Fore- and midlegs: femora pale brown with a distal dark brown ring, and with dark brown spots at bases of bristles; tibiae with 3 dark crossbands only on upper face. Hindfemora: orange brown with dark brown oblique stripes on upper and outer faces. Cerci medium brown.

Females not known.

BIOLOGY. Collected along grassy trails in tall rainforest.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratype*: same data as holotype, 1M, PHILADELPHIA.

Koghiella thio Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Loc. 6, 12 km SE Thio, forest along beach, 28 ii 1983 (Alexander, Cade & Otte). PHILADELPHIA.

RECOGNITION. Figs. 14D, 16B. Table 3. Distinguished from other members of the genus by the male genitalia—the apical lobes are widely separated by a deep U-shaped cleft. Also differs from the very similar *bouo* in having more than 85 file teeth.

Males: Body highly speckled. Dorsum of body (except forewings) pale with black spots, side of head, pronotum and forewings black. Head: vertex and occiput with 6 indistinct slightly reddish longitudinal bands; most prominent aspect are the rows of heavy black bristles, each emerging from a brown to dark brown spot. Median ocellus raised above plain of the forehead and facing forwards. Face with a broad dark band descending from eyes to ends of man-

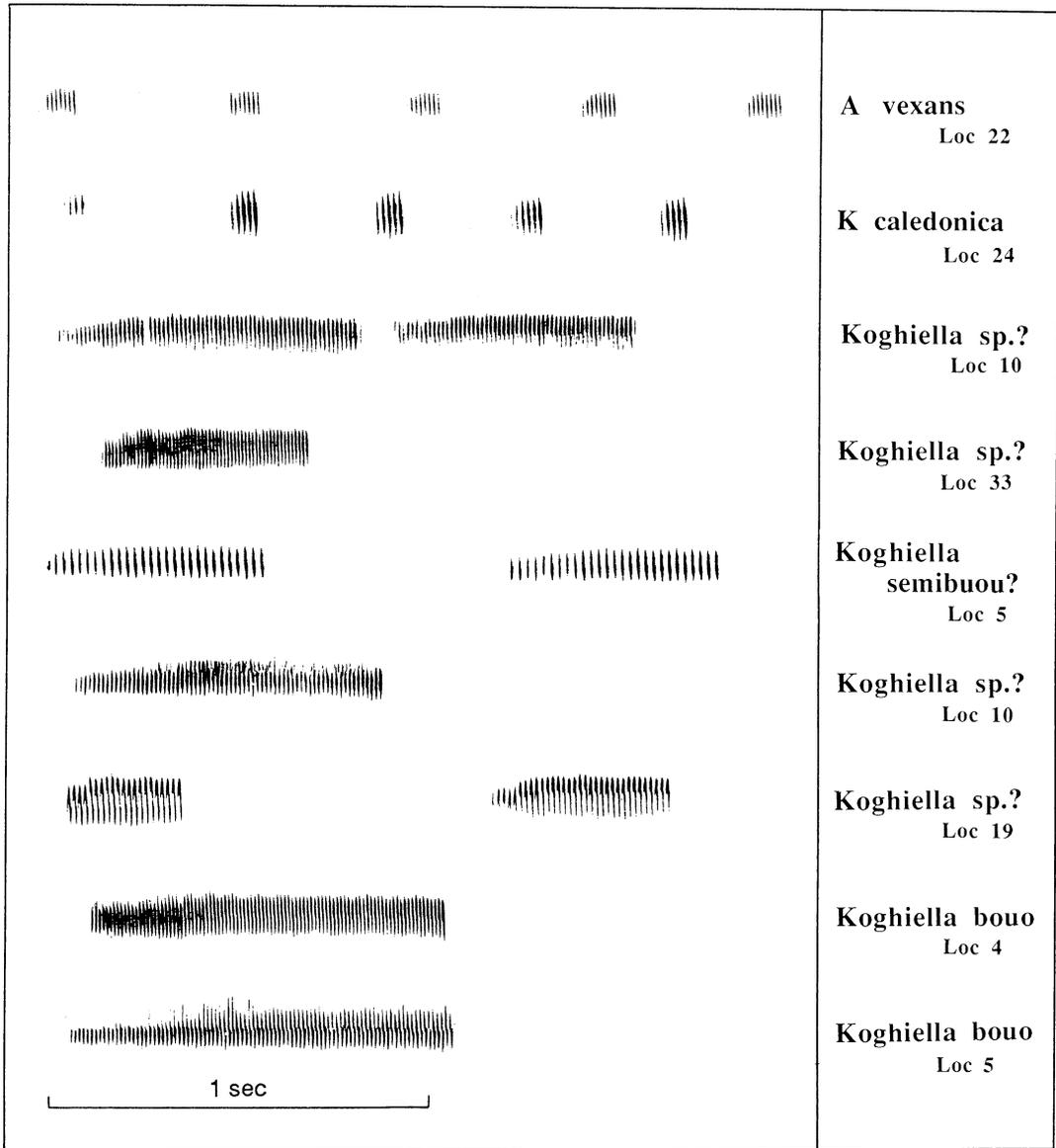


FIG. 18. Nemobiinae songs (scale = 1second).

dibles; frons with 2 dark bands descending towards clypeus then bending laterally. Upper lobe of clypeus with 3 dark brown markings, one medial, two lateral; lower lobes with two basal dark brown marks then ivory. Labrum pale centrally, brownish laterally. Cheeks medium to dark brown up to top of eyes, then pale. Pronotum pale brown; slightly darker on MAPs,

with numerous small brown spots, each at the base of a bristle. Forewings: dorsum brown, but veins 2A, 3A, chords, and apical veins and Cu_1 and M veins pale; lateral field dark brown. Abdomen: dorsum with numerous fine black setae; pale brown with small and large spots forming a row across each tergite: tergite becoming dark brown on lateral face. Fore- and

midfemora: very pale, but with dark brown marks mainly proximal to each black bristle, and dark brown at apex. Tibiae brown to dark brown, forming 3 indistinct bands. Hindlegs: femora ivory with numerous dark brown oblique stripes upper and outer faces; tibiae dark brown with pale areas around bases of spurs. Cerci: pale to medium brown.

Females: Colored like male. Forewings very short, meeting at midline, posterior border with heavy bristles like tergites which follow.

BIOLOGY. Collected in coastal forest along the beach, especially among rocks and litter along a small stream running through the forest.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratypes:* same data as holotype, 2M 1F, PHILADELPHIA.

Koghiella caledonica (Chopard)

Dictyonemobius caledonicus Chopard 1970: 285.

Holotype M, New Caledonia, Hienghene, Grotte, 5 ix 1965. VIENNA. Type examined.

RECOGNITION. Figs. 13D, 14E, 16C. Table 3. Very similar to *thio*, but epiphallus with very narrow, closely juxtaposed apical lobes; also differs in having fewer than 85 file teeth.

Males: Head: dorsum with indistinct to moderately distinct brown bands. Forewings dark brown, but pale on veins 2A, 3A, base of stridulum, some apical veins, especially on extreme outer margins of apical area. Abdomen: dorsum mostly dark brown with pale spots. Legs like *thio*.

BIOLOGY. Collected along a road which ran through the forest.

SPECIMENS. *Holotype* M, VIENNA. About 25 km west of Canala, along road through forest, 1 iii 1983 (Alexander, Cade and Otte) 1M, PHILADELPHIA. 28 km west of Canala, 1 iii 1983 (Alexander) 1F, ANN ARBOR. Loc. 16, 2M, ANN ARBOR.

IGNAMBINA Otte, n. gen.

Ignambina oubatchia Otte, n. sp.

RECOGNITION OF GENUS. Very similar to *Koghiella*. Differs from all other species in having a uniquely shaped epiphallus: the apical lobe not bifurcate and epiphallus very wide at base and with small blunt spines on dorsal face.

Ignambina oubatchia Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, ca. 17 km SE of Oubatche, coastal forest, 6 iii 1983 (Alexander, Otte and Cade # 27). ANN ARBOR.

RECOGNITION. Fig. 17C. Table 3. Very similar to *Koghiella caledonica*. Differs from all other species in having a uniquely shaped epiphallus.

Males: In shape and color largely indistinguishable from *caledonica*.

SPECIMENS. *Holotype* M, ANN ARBOR. *Paratypes:* Same data as holotype, 2M, ANN ARBOR and PHILADELPHIA.

AMONEMOBIUS n. gen.

TYPE SPECIES: *A. vexans* Otte, n. sp.

RECOGNITION OF GENUS. Ectoparameres of male genitalia extending beyond epiphallus; epiphallus with a deep median cleft (Fig.). Dorsum of head mostly pale but with occiput with four small black stripes; region posterior to eyes black; dorsum of pronotum largely pale but with a dark patch in each corner. Foretibiae with a large opening only on the outer face.

Amonemobius vexans Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Amoa river valley, 8.4 km west of main coastal road near Poindimié, 3 iii 1983 (Alexander, Cade & Otte). PHILADELPHIA.

RECOGNITION. Figs. 14G, 17B. Table 3. *Male*: Body color very pale with dark brown to black patches on the head, pronotum, abdomen and legs. Head: dorsum marked as in Fig. ; face largely ivory but frons with two brown streaks descending between the antennae then curving laterally halfway between the clypeus and the antennal sockets and with a central dark mark which carries over onto the clypeus; cheeks with a broad black band descending from the lower margin of the eye onto the base of the mandible. Pronotum: dorsum ivory and black (Fig.); lateral lobes blackish. Forewings: dorsum dark brown but ivory at junctions of chords and stridulum and around distal ends of chords; lateral field dark brown. Abdomen: dorsum pale with some black spots and markings; venter pale brown. Fore- and midlegs: femora ivory colored and with two broad dark bands; tibiae with two dark bands. Hindlegs: femora ivory with three dark bands in distal two thirds; tibiae pale with a dark stripe between the spurs, and with two dark cross bands in the basal third. Cerci light brown.

SONG. Not known.

HABITAT. Found on banks along a road through the forest in the Amoa Valley.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratype*: 17 km southeast of Oubatche, 6 iii 1983 (Alexander, Cade & Otte) 1F, ANN ARBOR.

APTERONEMOBIUS Chopard

Apteronomobius Chopard 1929: 29. Type species: *A. longipes* Chopard 1929: 29, by monotypy.

Paora Gorochov 1986:692. Type species: *Paora gusevae* Gorochov 1986. New synonym.

Apteronomobius gusevae (Gorochov)

Paora gusevae Gorochov 1986:692. *Holotype* M, New Caledonia (no other data). LENINGRAD. NEW COMBINATION.

Recognition. Comparison of the male genitalia of *Apteronomobius darwini* (Otte and Alexander 1983 Fig. 147A) and Gorochov's *Paora gusevae* (Fig. 17D) shows that this species belongs to *Apteronomobius*.

PANIELLA n. gen.

TYPE SPECIES: *Ignambina oubatchia* Otte, n. sp.

RECOGNITION. See *P. apterus* below.

Paniella apterus (Chopard)

Pronemobius apterus Chopard 1915: 133. Types: 2M. New Caledonia, summit of Mont Panié, 1600 m, 28 vii 1911. BASEL and PARIS.

NOTES ON HOLOTYPE. Foretibiae without a tympanum. Fore- and midtibiae with 2 and 3 apical spurs, respectively. Hindfemora with only 3 inner and 3 outer subapical spurs.

Thetellini

IONOMOBIUS n. gen.

TYPE SPECIES: *A. vexans* Otte, n. sp.

RECOGNITION OF GENUS. *Epiphallus* very slender and tapering, similar to *Thetella*. Differs from *Thetella* in having two and three apical spurs on the Fore- and middle tibiae (2 and 2 in *Thetella*), and in having a black head. Foretibiae with only a large outer tympanum.

RELATIONSHIP. The genitalia of *Ionemobius* and *Thetella* are so similar that the two perhaps should be treated as members of the same genus.

Ionemobius alliciens Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, about 12 km southeast of Thio, forest along beach, 28 ii 1983 (Alexander, Cade & Otte #6). PHILADELPHIA.

RECOGNITION. Figs. 13C, 14F, 17A. Table 3. Epiphallus very slender. Dorsum of head black. Dorsum of pronotum pale but muscle attachment plates brown. *Males*: Body color pale but with dark brown on head. Head: occiput and vertex black but with a pale band which runs between the posterior margins of the antennal sockets; forehead black; face mostly dark brown on frons, but with a pale area beneath each antennal socket and with a dark brown band descending from each eye to the mandibles; cheeks ivory colored. Pronotum: dorsum very pale but muscle attachments plates light brown; lateral lobes ivory colored in anterior two-thirds and dark brown in posterior third. Forewings: dorsal field medium to dark brown, but pale from the harp veing to the M vein; lateral field brown to dark brown. Abdomen: anterior segments of dorsum entirely dark brown, last six segments variegated dark brown and ivory, but in a female has four rows of dark spots, two rows near the midline and two rows near the margins of the tergum. Fore- and midlegs: femora ivory with faint large brown markings on outer faces; tibiae uniformly pale brown. Hindlegs: femora pale with brown oblique stripes on upper and outer faces; these become darker posteriorly and coalesce to form a broad dark brown band at the two-thirds point, knees also brown.

Females: Similar to male in size and body color. Forewings consist of small hemicircular pads located on the shoulder of the mesonotum and not overlapping medially. In females the abdomen is largely pale but has four rows of dark spots on the tergum, two near the midline and two laterally. Ovipositor nearly 0.9 times as long as Hindfemora.

SONG. Not known. The surf was too loud to permit tape recordings of this species.

HABITAT. Collected along a small stream and along the stony shoreline among wet stones and debris.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratypes*: same data as holotype, 4M 1F, PHILADELPHIA and ANN ARBOR.

FIKOLA Gorochov

TYPE SPECIES: *Fikola fusca* Gorochov 1986.

RECOGNITION OF GENUS. The following description is taken from Gorochov (1986). "Forewings of female very short; rear border with characteristic curve, lateral field convex; forewing color black, with a white streak along the rear border. Foretibiae lacking a tympanal opening. Hindtibiae with four pairs of rather long spines. Ovipositor lacking noticeable serrations, but with narrow apical valves.

Fikola fusca Gorochov

Fikola fusca Gorochov 1986: 694. *Holotype* F, New Caledonia, Noumea (Mt. Koghi) 14 x 1977 (J. Balogh). HUNGARIAN MUSEUM.

RECOGNITION. The following description is from Gorochov (1986): Size not large. Body color dark brown, almost black. Head black, with two very bright streaks on the sides in the middle of the eye and with a yellow-orange triangle in the distal part of the frontal suture. On the rear borders of the tergites of the abdomen are some pale sections. Legs rust-colored, unicolorous. Ovipositor is 1.7 times shorter than the rear femur, slightly bent upwards. Measurements (mm): BL, 7; PL, 1.8; FWL, 0.7; FL, 5; ovipositor, 3.0.

SPECIMENS. *Holotype* F, HUNGARIAN MUSEUM. *Paratypes*: same data as holotype, 1F, HUNGARIAN MUSEUM; 1F, LENINGRAD.

ORINTIA Gorochov

TYPE SPECIES: *Orintia incrustata* Gorochov

RECOGNITION OF GENUS. Gorochov (1986) gives the following description of this genus: Body stocky. Forewings absent in females, hindwings represented by small blades at the sides. Head large, a little wider than other parts

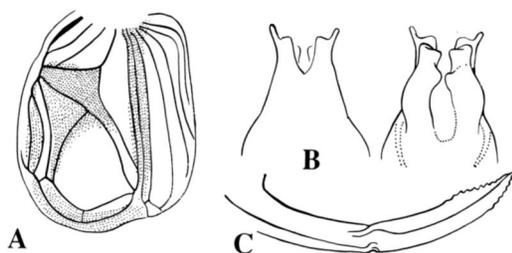


FIG. 19. *Anaxipha caledonica*. (holotype). A, male forewing. B, male genitalia (dorsal and ventral aspects). C, female ovipositor.

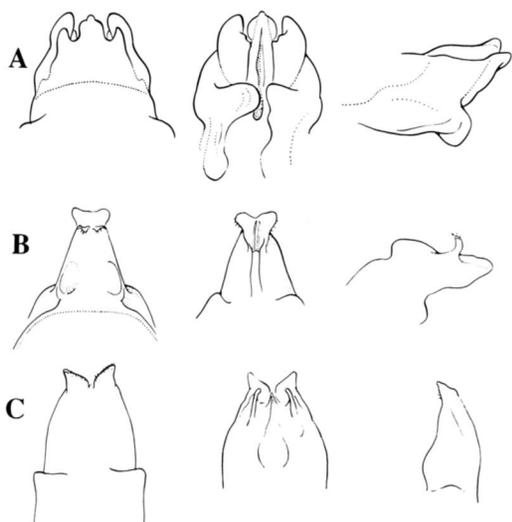


FIG. 20. Male genitalia (holotypes). A, *Caltathra paniki*. B, *Proturana subaptera*. C, *Aphonoidea ouveus*.

of the body. Legs rather short and thick. Front legs with small tympanal openings on the outer side. Hindlegs with three pairs of spurs. Spines on the hind basitarsus rather short. Ovipositor with narrow apical valves, rather long and more or less straight. Color variegated."

Orintia incrustata Gorochov

Orintia incrustata Gorochov 1986: 698. Holotype F, New Caledonia (no further data). LENINGRAD.

RECOGNITION. Gorochov gives the following description of the holotype: "Size small. Coloring of head chestnut brown and with characteristic markings of dark and greenish yellow spots above. Antennae are cinnamon colored, but the segments are white with two proximal sections of brown. Pronotal disc yellowish with two dark spots; lateral lobes dark brown. Legs pale, with dark spots. Color of hindleg shown in [his] fig. 28. Abdomen brown below, with scattered marks of dark and pale yellow spots above. [Measurements (mm)]: BL, 5.5; PL, 1.2; FL, 4.2; OL, 3.2."

SPECIMEN. Holotype M, LENINGRAD.

Table 3. Comparison of Nemobiinae species. See Methods for abbreviations.

TRIGONIDIINAE

This subfamily is very poorly represented in New Caledonia and we now know of only two genera and two species which inhabit the islands and one of these is widespread through the Pacific.

Trigonidomorpha sjöstedti Chopard

Trigonidomorpha sjöstedti Chopard 1925: 40. Holotype M, Australia, Queensland, Cedar Creek (Mjöberg). STOCKHOLM. Type examined.

This species is very widely distributed over in the Pacific islands. It is now known from New Guinea, Australia, Norfolk Island and Hawaii.

RECOGNITION. See Otte & Alexander 1983, p. 223 and accompanying figures.

SPECIMENS. Loc 4, 3M 1F; Loc 19, 3M 1F; Loc 29, 2M.

Metioche vittaticollis Stal

Chopard 1970: 287 records this species from: lower reaches of Tshamba River 16 vii 1965, Koh, 29 vii 1965. Noumea, 21 iii 1965. These specimens are probably *Trigonidomorpha sjöstedti*. See Otte and Alexander 1983 for description and figures.

Metioche flavipes Saussure

Chopard 1970:287 records this species from the coast near Dumbea, 17 vii 1965; Noumea 16 vii 1965; Koh 29 vii 1965. These specimens are probably *Trigonidomorpha sjöstedti*.

Anaxipha caledonica Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, grottoes area about 7 km west of Koumac, 7 iii 1983 (Alexander, Cade and Otte). PHILADELPHIA.

RECOGNITION. Fig. 19. Table 2. A pale green species with genitalia as figured.

Pale green in life (ivory colored when preserved in alcohol; dorsum of head and pronotum orange brown. Face entirely pale. Pronotum: dorsum pale over most of central portion, becoming darker brown towards all four sides; lateral lobes pale in lower half, brownish in upper half. Forewings: dorsal field dark brown along M vein and between mirror and stridulum; lateral field pale, with a dark stripe along the dorsal margin. Abdomen entirely pale green (in life). Foretibiae with only a large outer tympanum. All legs pale, unicolorous (green in life).

HABITAT. This species was singing during the day in the trees in a forested ravine near some grottoes. Some were singing in low trees others were higher in the trees.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratypes*: same data as holotype, 2M 1F, PHILADELPHIA and ANN ARBOR.

PHALANGOPSINAE

CALTATHRA Otte, n. gen.

TYPE SPECIES: *C. panaki* Otte, n. sp.

RECOGNITION OF GENUS. Entirely wingless. Body color mottled dark brown and ivory, legs strongly banded. Dorsum of head with brown bands; face dark brown with a white band descending from median ocellus to labrum. Pronotum: dorsum patterned; lateral lobes

mostly brown. Forewings and hindwings absent. Abdomen mottled with indistinct brown and ivory markings. Fore- and midfemora with 3 dark bands. Fore- and midtibiae with 2 and 3 apical spurs respectively. Hindfemora with patches of dark brown; tibiae with 4 dark bands; with 3 inner and 4 outer subapical spurs.

Caltathra panaki Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, road to Panaki from Koné, mountain forest above Koné, 7 iii 1983 (Alexander, Otte & Cade #30). ANN ARBOR.

RECOGNITION. Figs. 20A, 22C, 25D. Table 4. *Male*: Body color mottled dark brown and ivory, legs strongly banded. Head: dorsum with 8 longitudinal brown bands (2 median ones separated by a very thin pale line); forehead between the three ocelli dark brown, with bristles; face dark brown, with a white band descending from median ocellus to labrum; cheeks ivory colored behind eyes and a pale vertical streak extends and narrows from eye to base of mandible. Pronotum: dorsum patterned; lateral lobes mostly brown, but with a pale spot in lower front corner and a small spot in middle tope (adjacent to MAPs). Forewings and hindwings absent. Abdomen mottled with indistinct brown and ivory markings. Fore- and midlegs: femora with 3 dark bands, tibiae with 4 dark bands. Hindlegs: femora with 6 or 7 large patches of dark brown; tibiae with 4 dark bands; with 3 inner and 4 outer subapical spurs; on inner side all spines located above the spurs, on the outer side they are also located between the upper three spurs.

SPECIMENS. *Holotype* M, ANN ARBOR.

Caltathra dubia Chopard, n. comb.

Endacusta dubia Chopard 1915: 146. *Holotype* F, Yaté, 15 iii 1912. BASEL.

Endotaria steinmanni Gorochov 1986:699. *Holotype* F, New Caledonia (Mt. Koghi). HUNGARIAN MUSEUM. NEW COMBINATION. Type not examined.

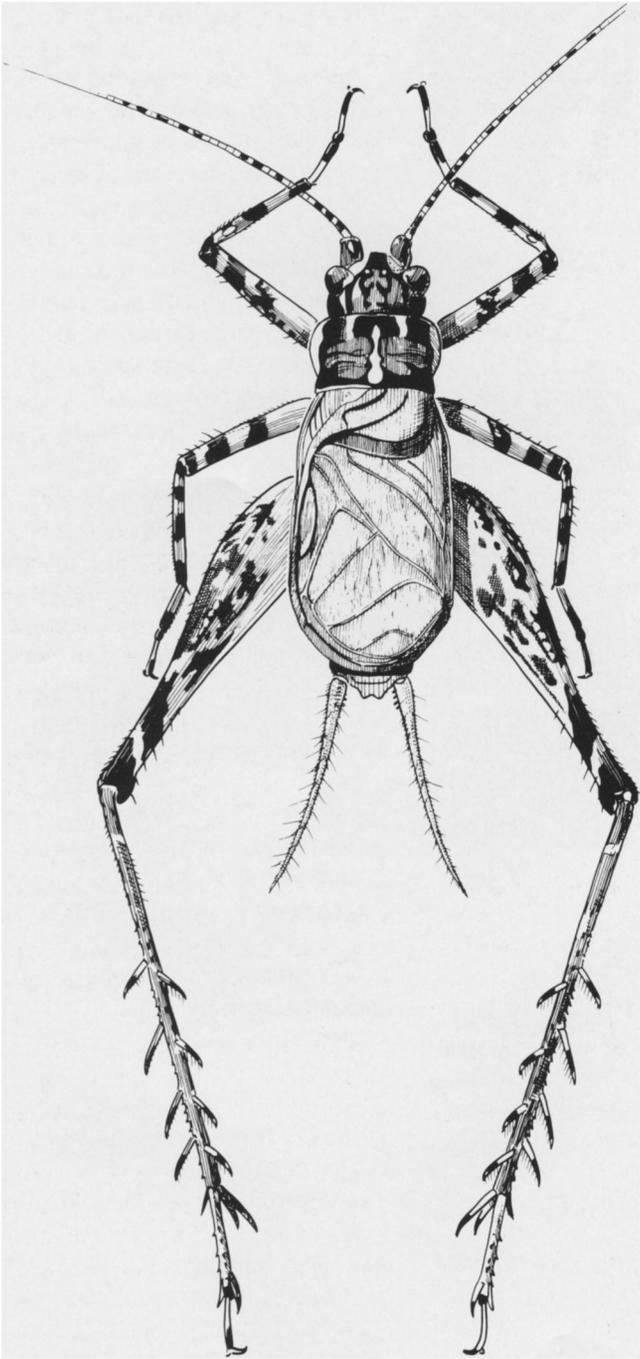


FIG. 21. *Tremellia alpha* male.

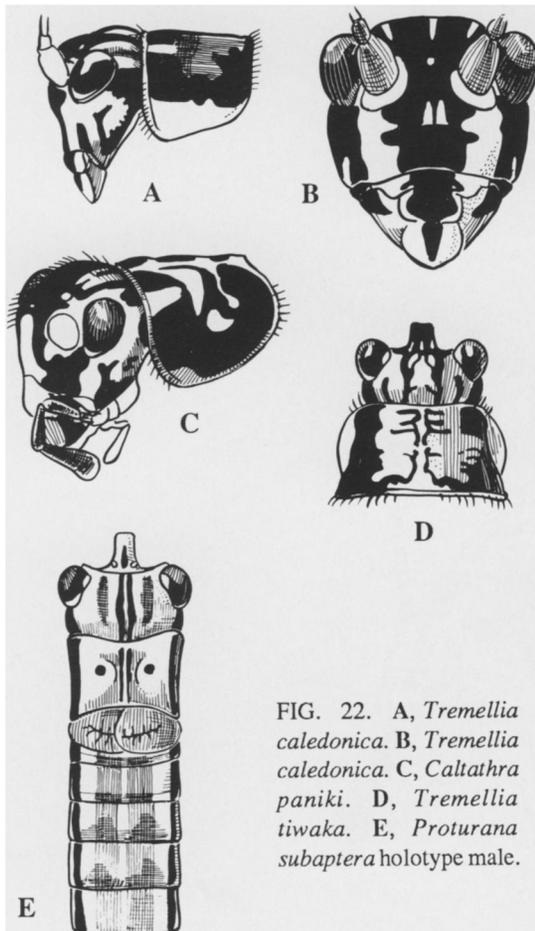


FIG. 22. A, *Tremellia caledonica*. B, *Tremellia caledonica*. C, *Caltathra paniki*. D, *Tremellia tiwaka*. E, *Proturana subaptera* holotype male.

Two females collected at Loc 5 are believed to belong to this species. Occiput with 4 broader pale longitudinal bands (plus a very narrow median pale line) which almost reach the pronotum; vertex with 4 pale bands. Otherwise coloration similar to *panaki*.

SPECIMENS. Loc 5, 2F, PHILADELPHIA & ANN ARBOR.

ITARINAE

TREMELLIA Stal

Tremellia Stal 1877: 47. Type species: *Tremellia spunca* Stal, Philippines, by monotypy.

Pseudotriconidium Chopard 1915:152. Type species: *Tremellia sarasini* (Chopard). New Caledonia. Syn-

onymized by Chopard 1968: 364.

RECOGNITION. Figs. 21-25, 45. Table 4. Dorsum of body dark brown, venter ivory, sides of body dark brown in upper half, ivory below. Pronotum: dorsum marked as in Fig. 21; lateral lobes blackish in upper half pale in lower half. Forewings: covered with fine pubescence; dorsum gray to dark brown, usually with a somewhat mottled appearance; lateral field pale to dark brown; area between R and M broad, with 10 or more regularly spaced cross veins—this area has a pearly white streak along its middle. Hindwings about one half to two thirds as long as forewings. Fore- and midlegs: Femora and tibiae banded somewhat as in Fig. 21; foretibiae with only an inner tympanum; with 2 and middle tibiae with 2 apical spurs. Hindfemora marked as in Fig. 21. Hindtibiae with 4 inner and 4 outer subapical spurs, and with 3 inner and 3 outer apical spurs.

Tremellia sarasini (Chopard)

Pseudotriconidium sarasini Chopard 1915:153. *Holotype* M, New Caledonia, Foret du Mont Panié, alt. 500 m, 27 vi 1911. BASEL. Type not examined but original figures adequate for diagnosis.

RECOGNITION. Lateral projection on male epiphallus as in Fig. 24H.

SPECIMENS. *Holotype* M, BASEL.

Tremellia tiwaka Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Loc 23, Tiwaka River, ca. 5 km west of main north-south road, near Poindimié, 3 iii 1983 (Alexander, Cade and Otte). PHILADELPHIA.

RECOGNITION. Figs. 22D, 23D,E, 24G, 45. Table 4. Easily distinguished from other species by the male genitalia. In the females the forewings are much longer than in *beta*.

Males: Head: face and cheeks similar to *alpha*.

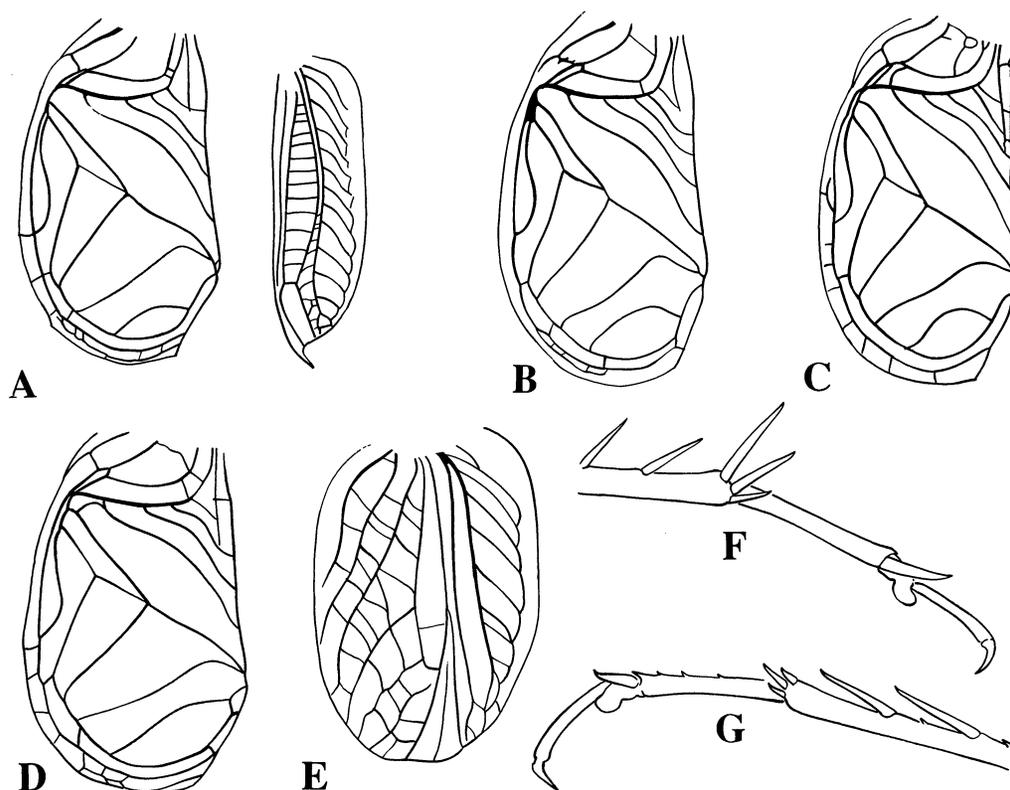


FIG. 23. *Tremellia*: holotypes: A-E, forewings; F, G, hind tibia and tarsus. A, *alpha* (dorsal and lateral aspects). B, *caledonica*. C, *beta*. D, *tiwaka*. E, *tiwaka* female. F, inner face. G, outer face.

Table 4. Comparison of *Tremellia* species. See Methods for abbreviations.

	No. file teeth	BL	FL	CL	FWL/PL	TL/FL	OL/FL
<i>Caltathra panaki</i>							
HM	0	13.5	11.2	10.0+	-	0.87	-
<i>Caltathra dubia</i>							
Loc 5 F	0	11.8	9.5	6.5	-	0.84	0.68
<i>Tremellia caledonica</i>							
HM	77	12	10	ca. 5	4.1	1	-
<i>Tremellia alpha</i>							
HM	76	10.2	9.7	5.2	3.9	1.04	-
<i>Tremellia beta</i>							
HM	80	13	10.5	6.5	3.5	1.03	-
PF	-	10	8.3	5.4	0.4	0.98	0.57
<i>Tremellia tiwaka</i>							
HM	70	11.5	9.5	-	4.5	-	-
PM	-	10	8.5	4.9	-	-	-
PF	-	9		4.9	2.9	-	0.43

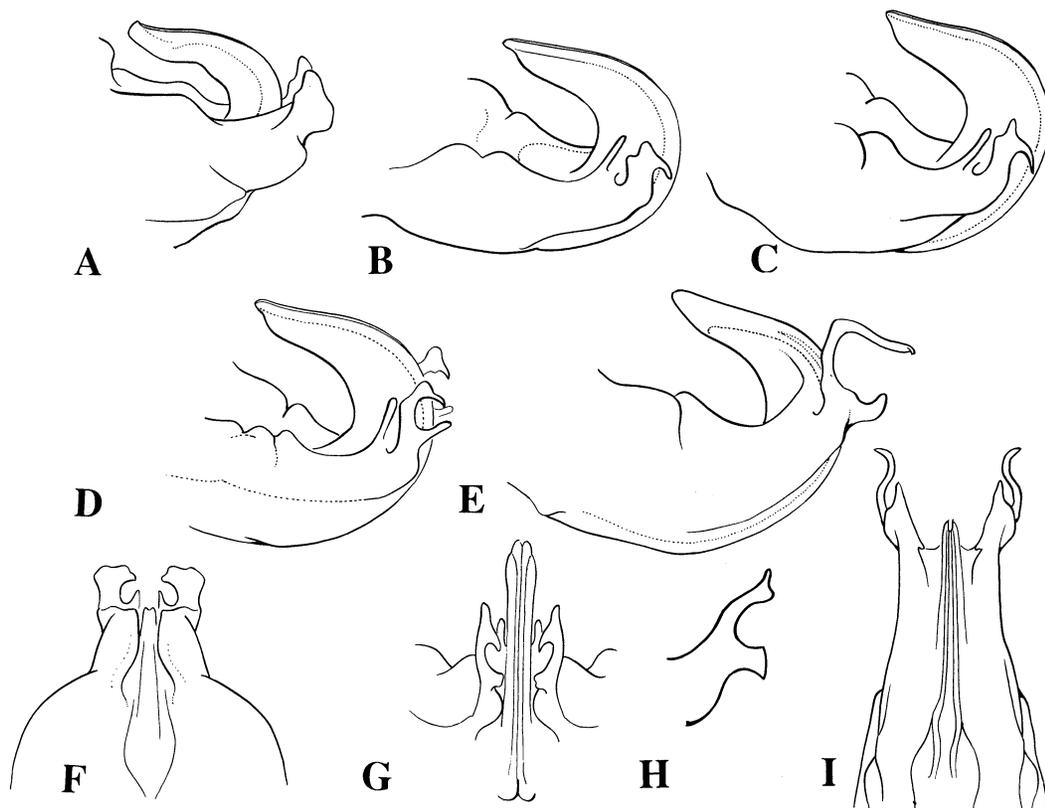


FIG. 24. *Tremellia* male genitalia (mainly lateral aspect)(holotypes). A, *beta*. B, *tiwaka* holotype. C, *tiwaka* loc 30. D, *alpha*. E, *caledonica*. F, *beta* (ventral aspect). G, *tiwaka* (ventral aspect). H, *sarasini* (from Chopard). I, *caledonica* (ventral aspect).

Pronotum: Dorsum as figured; lateral lobes black above, pale below. Forewings: dorsum pale brown, somewhat mottled; lateral field pearly white between the R and M veins; the latter veins are dark brown, other veins pale. Abdomen: dorsum variegated brown and ivory; venter with two rows of faint brown spots.

Females: marked like males; hindwings about 0.66 times length of forewings; antennae ca. 105 mm long.

SPECIMENS. *Holotype* M, PHILADELPHIA. Loc. 30, 3M 1F, PHILADELPHIA & ANN ARBOR.

Tremellia alpha Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Loc. 16, ca. 40 km west of Houailou, hillside forest, 2 iii

1983 (Alexander, Cade, and Otte). PHILADELPHIA.

RECOGNITION. Figs. 21, 23A, 24D. Table 4. Distinguished from other species by the male genitalia.

Males: Dorsum of body dark brown, venter ivory, sides of body dark brown in upper half, ivory below. Head: dorsum banded as in Fig. ; face with a broad median dark band descending face onto ldabrum; frons above bottom of antennal sockets entirely dark, otherwise ivory. Pronotum: dorsum marked as in Fig. 21; lateral lobes blackish in upper half pale in lower half. Forewings covered with fine pubescence dorsum dark brown with a somewhat mottled appearance; lateral field dark brown but area between R and M broad, with 10 or more regularly spaced

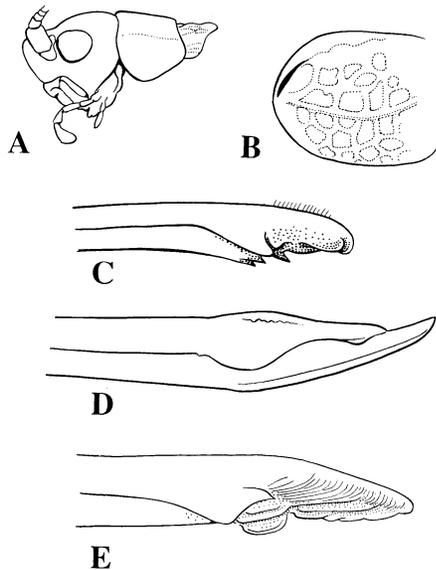


FIG. 25. A, *Proturana subaptera* head, pronotum and forewing. B, *Proturana subaptera* forewing. C, *Tremellia tiwaka* ovipositor. D, *Caltathra paniki*. E, *Matuanus elegans*.

cross veins—this area has a pearly white streak along its middle. Abdomen: dorsum mostly dark brown with regular pattern of paler spots. Fore- and midlegs: femora and tibiae banded dark brown and ivory. Hindfemora: banded dark brown and ivory, outer face with 3-4 horizontal bands made up of smaller oblique stripes. Cerci pale brown. Hind tibiae: outer margin with numerous small spines, inner one only above the first spur. Hind basitarsus with no inner spines on dorsal face and with 4 outer spines on dorsal face.

Females not known.

SPECIMENS. *Holotype* M, PHILADELPHIA.

Tremellia beta Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Loc. 5, Mt Koghi, west slope of Mt Bouo, tall rainforest, 27 ii 1983 (Alexander, Cade, and Otte). PHILADELPHIA.

RECOGNITION. Figs. 23C, 24F, 45. Table 4. Males differ from other males in the male genitalia.

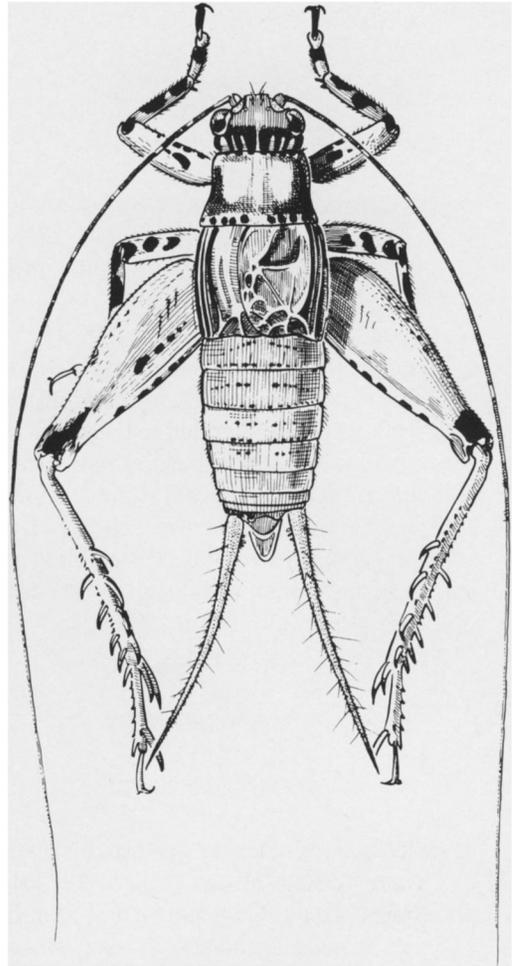


FIG. 26. *Agnotecous obscurus* male.

lia. Females with forewings shorter than pronotum and located on side of body (possibly nymphal?).

Males: Very similar to *alpha* but differing in male genitalia. Head: similar to *caledonica*, but stripes broader; face similar to *caledonica*. Side of forewings generally pale brown.

Females: The only female we have examined has very short forewings located on the side of the body. Because they are so small compared to those of *tiwaka* there remains the possibility that she is a nymph. Her hardened ovipositor, however, suggests that she is an adult.

SPECIMENS. *Holotype* M, PHILADELPHIA.
Paratypes: Loc. 5, 1M 1F, ANN ARBOR.

Tremellia caledonica Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Loc. 5, Mt Koghi, west side of Mt Buou, tall rainforest, 27 ii 1983 (Alexander, Cade, and Otte). PHILADELPHIA.

RECOGNITION. Figs. 22B, 23B, 24E, 45. Table 4. Distinguished from other species by the male genitalia. Head: Dorsum mostly dark brown but with 3 narrow pale longitudinal streaks. Face with broad median dark band, a pale band descending from each antennal socket and a dark band descending from each eye; cheeks blackish below eye, light brown with dark marbling below that and with a granular appearing brown band descending from lower front of eye.

SPECIMENS. *Holotype* M, PHILADELPHIA.

ENEOPTERINAE

AGNOTECOUS Saussure

TYPE SPECIES: *Agnotecous tapinopus* Saussure

RECOGNITION OF GENUS. Figs. 26-29. Table 5. Forewings of males quite unlike any other genus of Eneopterinae, the dorsal field being very small relative to the lateral field and the entire region posterior to the stridulum highly modified and abbreviated.

Males: Fig. 26. Medium to large crickets; body color reddish brown to dark brown, usually much darker on sides of body; large hindfemora; forewings not extending beyond middle of abdomen; dorsal field of forewings relatively small; hindwings absent. Head: occiput with longitudinal pale stripes, sometimes largely pale brown, with 2 to 4 dark stripes; with 3 ocelli, median ocellus located at front of rostrum; face dark brown; cheeks mostly brown or dark brown with pale areas as figured. Pronotum: dorsum widening posteriorly, lighter than lateral lobes, scattered with fine dark spots; lateral lobes dark brown to

black. Forewings: dorsal field very narrow relative to lateral field; mirror obsolete; chords and diagonal veins weakly to strongly modified, with one or no harp veins; lateral field with numerous parallel veins. Hindwings absent. Abdomen with fine spots often arranged in transverse rows. All tarsi with adhesive pads. Fore- and midlegs: femora reddish brown to dark brown with prominent black markings; tibiae darker than femora, with two broad black bands; foretibiae with only an outer tympanum and with 3 apical spurs; midtibiae with 4 apical spurs. Hindlegs: femora orange-brown to dark rusty brown with oblique rows of small dark spots; tibiae with 4 inner and 4 outer subapical spurs and with 3 inner and 3 outer apical spurs; inner subapical spurs longer than outer and strongly bent. Cerci medium to long, usually blotchy in color. Ovipositor laterally compressed, with serrations on dorsal margin, dorsal valves longer than ventral; with two small processes above base.

BIOLOGY. We collected *Agnotecous* on leaf litter on the forest floor; after dark many were found walking about on foliage a few feet above the ground, some on green leaves. All were found in dense wet or mesic forests both in lowlands and mountains. Although males possess a stridulum we never heard them sing. Males have a large number of file teeth in relation to the length of the stridulum, so we suspect that the sounds they make are supersonic. Conceivably the stridulatory movements transmit vibrations through the substrate.

DISTRIBUTION. This genus is presently known only from New Caledonia, but related genera occur in the Solomon Islands and in Palau (Otte and Alexander in prep.).

Agnotecous obscurus (Chopard)

Lebinthus obscurus Chopard 1970: 287. *Holotype* M, New Caledonia, Col Boa, Niaouli Forest, 11 viii 1965 (Austrian Expedition). VIENNA. Type examined.

Table 5. Comparison of Agnotecous species. Abbreviations given in Methods section.

	BL	FL	OL	CL	FWL/PL	FL/TL	FL/FL	No. file teeth
<i>obscurus</i>								
HM	19	13.2	-	11.5	1.33	0.91	0.32	168
PM Loc.22	18.5	13.2	-	12.2	1.5	-	-	136
PF Loc.22	19	14.5	15.2	14	0.44	-	-	-
PF Loc.33	20	14.8	21.3	13.5	0.69	-	-	-
<i>yahoue</i>								
HM	16.5	11.2	-	10	1.33	0.85	0.36	158
PF Loc.5	16	11	10	9.0+	0.28	-	-	-
PF Loc.4	18.7	12.5	12.4	10.6	0.27	-	-	-
PF Loc.4	17.6	11.5	12	10.5	0.4	-	-	-
PF Loc.4	18	11.9	10.5	10	0.33	-	-	-
<i>koghi</i>								
HT	24	15.5	-	13.5	1.45	-	-	129
PM Loc.4	23	14.3	-	13.8	1.63	-	-	151

RECOGNITION. Figs. 26, 27, 29B. Table 5. Distinguished from other species by the male genitalia and the forewing venation.

Males: Dorsum of body reddish brown, side of body darker. Head: dorsum with 7 longitudinal pale streaks, one along midline, those behind eyes are broadest; face dark brown above clypeus, ivory with brown markings on clypeus and labrum; forehead pale in specimens from Loc 33 and dark in those from Loc 22. Pronotum: dorsum reddish brown with scattered darker spots; spots largest along posterior margin; lateral lobes dark brown with a pale area in lower anterior corner. Forewings dark brown. Hindwings absent. Abdomen: dorsum reddish brown, pubescent, with faint row of dark spots along posterior margins of tergites. Forelegs as in Fig. 27; midlegs similar to forelegs. Hindfemora: orange brown with numerous small dark spots on outer and upper faces and with a line of large dark spots along lower margin. Cerci dark brown.

Females: Forewings hemicircular, nearly meeting at midline (Loc 22) or slightly overlapping (Loc 33). Ovipositor of the female from Loc 22 slightly longer than hindfemora; that from Loc

33 is 1.44 times as long. Possibly these two females belong to different species.

BIOLOGY. Collected in a lowland forest. Found perched on leaves a few feet above the ground.

SPECIMENS. *Holotype* M, VIENNA. *Paratypes*: (PHILADELPHIA & ANN ARBOR). Loc 16, 1F. Loc 17, 1F 1FN. Loc 22, 2M 1F 1MN. Loc 23, 1F. Loc 33, 2M 1F.

Agnotecous yahoue Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Loc. 4, Yahoué, forest along stream, 27 ii 1983 (Alexander, Cade, and Otte). PHILADELPHIA.

RECOGNITION. Figs. 28A, D, 29A. Table 5. Distinguished from other members of the genus by the male genitalia.

Males: Dorsum of body more or less unicolorous reddish brown; side of body dark brown. Head: dorsum mostly unicolorous but occiput with two short brown stripes near median and two lateral stripes; face dark brown, ivory on clypeus and labrum. Pronotum: dorsum unicolorous

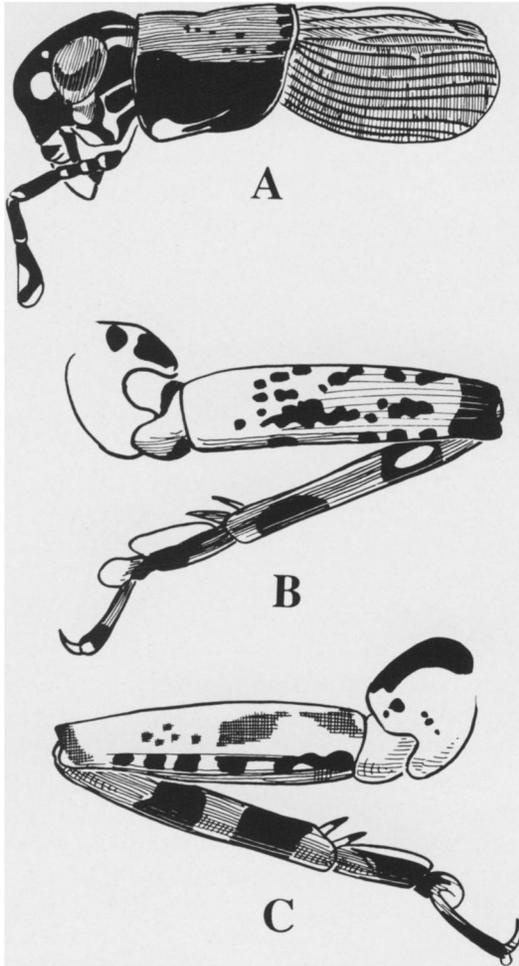


FIG. 27. *Agnotecous obscurus*. A, male head pronotum and forewing. B, foreleg (outer face). C, foreleg (inner face).

orous; lateral lobes distinctly darker. Forewings: reddish brown, cross veins on lateral field darker than rest of wing. Abdomen: unicolorous red-brown. Fore- and midlegs: femora with some darker marking on inner and outer faces, similar in position to *amoia*, but not as contrastingly marked. Hindfemora: orange-brown with regular oblique rows of small dark spots.

Females: colored like males. Three females from Loc 4 have blackish fore- and midlegs and

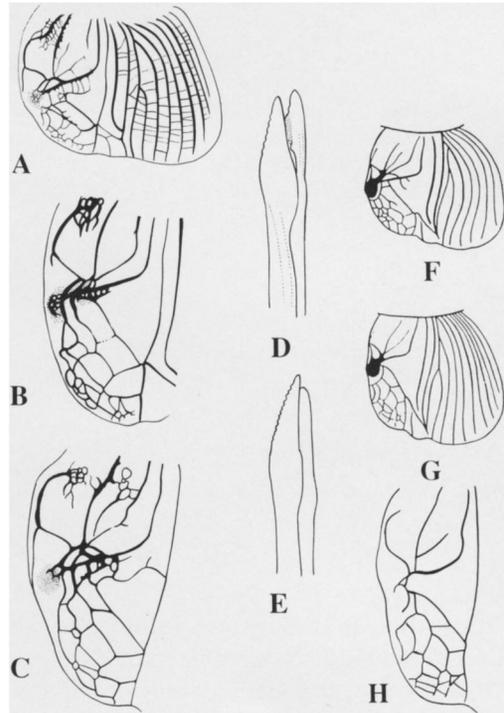


FIG. 28. *Agnotecous* forewings and ovipositors. A, *yahoue*. B, *obscurus*. C, *tapinopus*. D, *yahoue*. E, *obscurus*. F, G, forewings of *brachypterus* and *tapinopus* (from Gorochov 1986). H, *tapinopus* (from Saussure 1878).

black sides on head and pronotum, and have 6 brown bands on vertex of head. A female from Loc 5 is much lighter in color and resembles more the holotype male. Forewings much smaller than in *obscurus*, with a wide gap separating the left and right forewings.

BIOLOGY. We collected the members of this species mainly along oatmeal trails which we laid through the forest. It is our impression that they wander over the ground to forage. But their tarsal

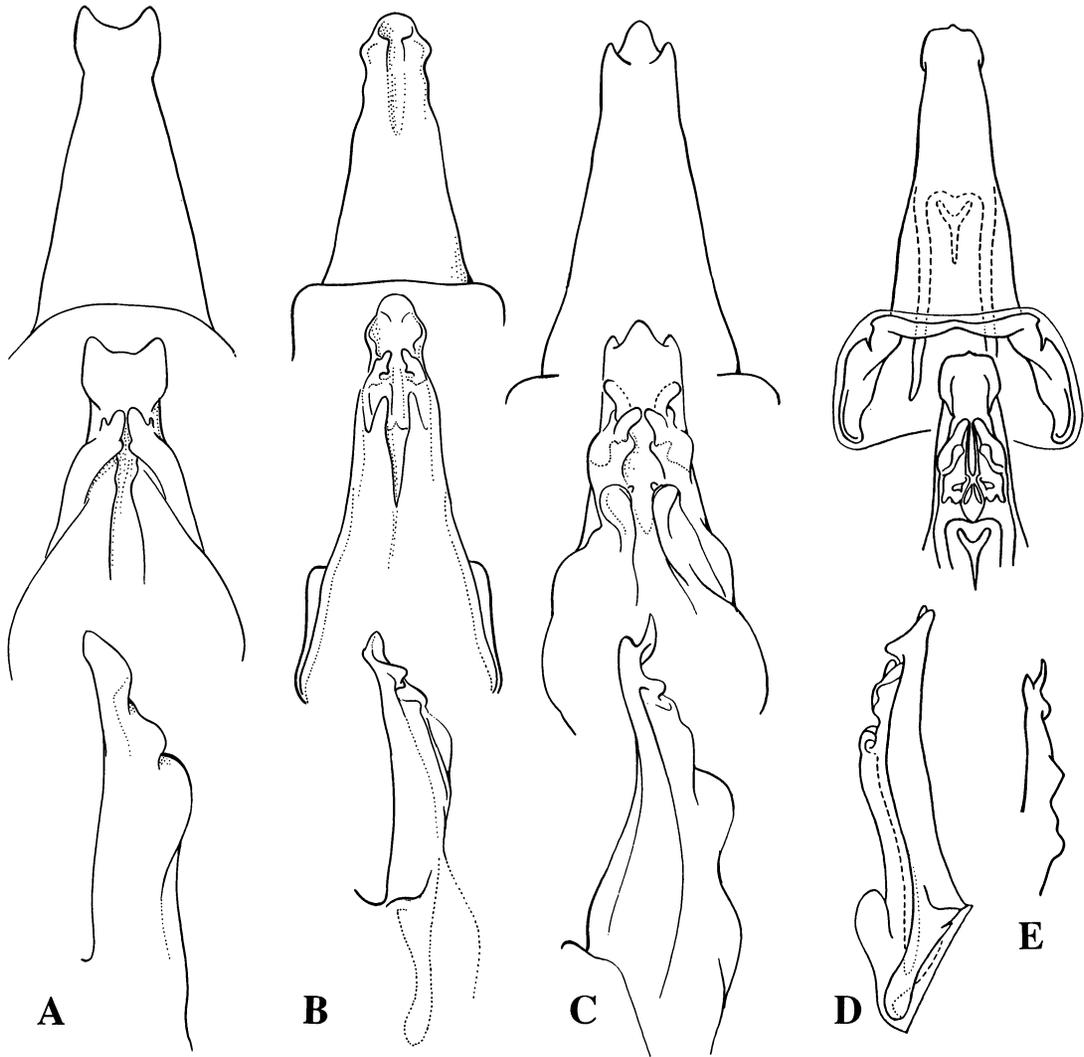


FIG. 29. *Agnotecous* male genitalia (holotypes)(from top to bottom: upper, lower and lateral views).
 A, *yahoue*. B, *obscurus*. C, *tapinopus*. D, *brachypterus* (from Gorochove 1986). E, *tapinopus* (from Saussure 1878).

adhesive pads suggest that they also climb onto vegetation as does *amoa*.

SPECIMENS. *Holotype* M, PHILADELPHIA.
Paratypes: (PHILADELPHIA & ANN ARBOR). Loc 4, 1M 6F. Loc 5, 1M 4F.

***Agnotecous tapinopus* Saussure**

Agnotecous tapinopus Saussure 1878:407. *Holotype*

M, New Caledonia (no other data). (Brunner de Wattenwyl, No. 5960) VIENNA. Type requested but not found, perhaps lost.

RECOGNITION. Figs. 28C, G, H, 29C, E. Table 5. Differs from other members of the genus by the male genitalia. Also considerably larger than *yahoue* and *obscurus*.

Males: Head: dorsum dark brown with 7 pale longitudinal lines, median one is very thin, lateral ones are widest; face blackish; cheeks mostly dark, with pale areas similar to *obscurus*. Pronotum: dorsum yellow brown in anterior lateral quarter, darkest in posterior third, with many small dark spots; lateral lobes black. Forewings: dorsum reddish brown; lateral field reddish brown, but veins dark brown. Fore- and midlegs: femora mostly dark brown, somewhat speckled; tibiae banded as in *obscurus*, but darker overall. Hindfemora rusty red, becoming dark brown around knees.

Females: Head dark reddish brown on dorsum, black on side of head and pronotum. Forewings slightly overlapping at midline.

BIOLOGY. We collected this species along oatmeal trails laid through tall rainforest.

SPECIMENS. Loc 4, 2M 1F; Loc 5, 1F (PHILADELPHIA & ANN ARBOR).

***Agnotecous brachypterus* Gorochov**

Agnotecous brachypterus Gorochov 1986:701.

Holotype M, New Caledonia (J. Bulogh)(no other data). HUNGARIAN MUSEUM. Typenot examined.

RECOGNITION. Figs. 28G, 29D. This species is readily distinguishable from other species on the basis of the male genitalia.

SPECIMEN. *Holotype* M, HUNGARIAN MUSEUM.

***Agnotecous novaecaledoniae* Gorochov**

Agnotecous novaecaledoniae Gorochov 1986:701.

Holotype F, New Caledonia, Mt. Rembai (J. Balogh). HUNGARIAN MUSEUM. Type not examined.

RECOGNITION. Unfortunately the type of this species is a female. It will be very difficult to separate this species from others until a male is collected.

***Agnotecous robusta* (Chopard) n.comb.**

Eurepa robusta Chopard 1915: 149. *Holotype* F, New Caledonia, Foret du Mont Panié, alt 500 m, 27 vi 1911. BASEL.

Chopard illustrated this species profusely. It is clearly a member of Saussure's *Agnotecous*.

CARDIODACTYLUS Saussure

Chopard 1915:149 records *Cardiodactylus novae-guinea* De Haan from Oubatche. We also collected this species and it appears to be a new species which will be treated in a forthcoming revision of *Cardiodactylus*.

EUSCYRTINAE

PROTURANA Otte, n. gen.

TYPE SPECIES: *Proturana subapterus* (Chopard).

RECOGNITION OF GENUS. Foretibiae without tympana. Forewing very small, wider than long, stridulum with very tiny teeth.

***Proturana subapterus* (Chopard)**

Euscyrtes subapterus Chopard 1970: 288. *Holotype* M, New Caledonia, Dumbea, near shore, 17 vii 1965. VIENNA. Type examined.

RECOGNITION. Figs. 20B, 22E, 25A, B. A small pale cricket with a broad dark stripe running along sides of body. Head: dorsum as figured; face entirely pale, subgnathous; cheeks pale and with a post-ocular dark band. Pronotum: dorsum as figured; lateral lobes with a dark band in upper half (dorsad this band changes gradually from pale brown to blackish). Forewings tiny, wider than long, with a stridulum. File with 209 very small teeth. Abdomen: dorsum with a faint dark central band which fades posteriorly; venter en-

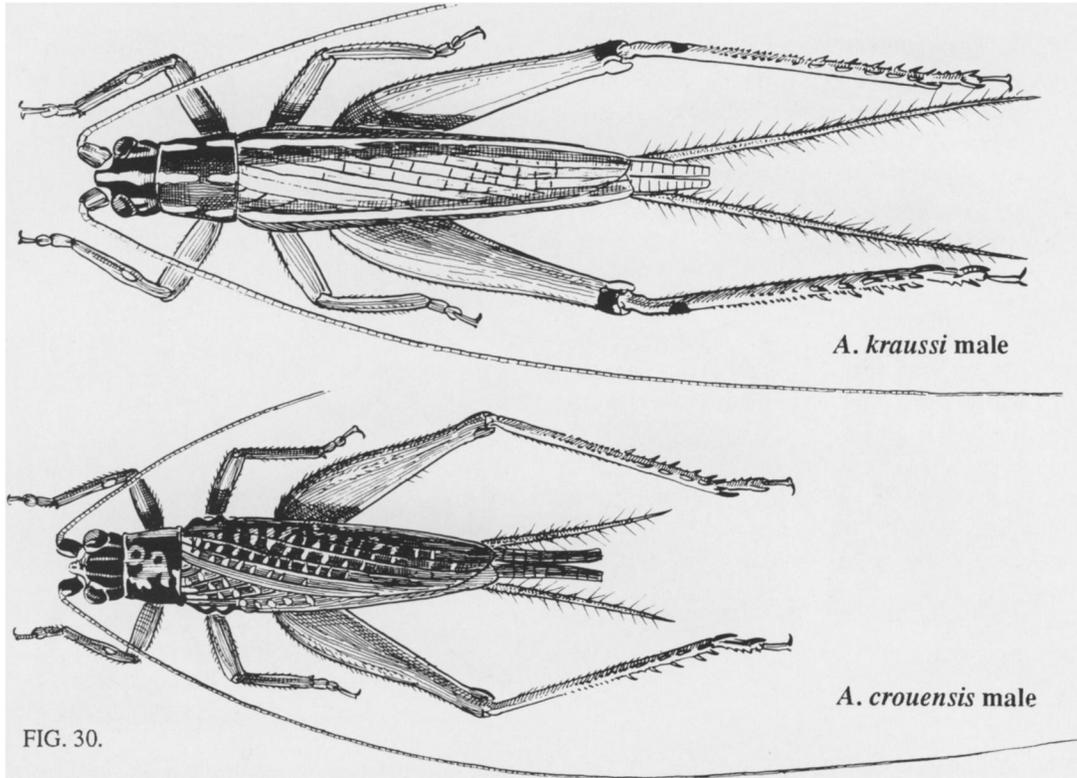


FIG. 30.

tirely pale. Fore- and midfemora pale. Hindfemora with pale brown oblique markings on outer face. Cerci pale brown. Fore- and middle tibiae each with 3 apical spurs; two innermost spurs very closely spaced. Hind tibiae with 9 inner and 11-12 outer subapical spurs and with 3 inner and 3 outer apical spurs. Hind basistarsus without inner dorsal spines before apex.

HABITAT. The only male of this species was caught by sweeping through vegetation at the margin of a lowland forest on the west slope of the main range.

SPECIMENS. *Holotype* M, VIENNA. Loc 4, 1M, PHILADELPHIA.

PODOSCIRTINAE
ADENOPTERUS Chopard

Adenopterus Chopard 1951: 511. Type species: *Adenopterus norfolkensis* Chopard, by original designation.

Peltia Gorochov 1986: 704. Type species: *P. roseola* Gorochov 1986: 704. NEW SYNONYM.

RECOGNITION OF GENUS. Figs. 30-37. Table 6. Males: Like *Archenopterus* the members of this genus possess a gland on the forewing (forewing gland) and a very long and pointed male subgenital plate, but they differ in lacking a stridulum. In some species the forewing gland has evidently been lost secondarily, for the venation retains some similarities to that in species with well-developed glands—specifically, the R and M veins are joined near the anterior ends of the forewings. Forelegs: tympanal openings on both inner and outer faces, large and oval, nearly equal in size. Fore- and midtibiae with 2 and 3 apical spurs respectively. Hind tibiae with 5 inner and 5 outer subapical spurs and 3 inner and 3 outer apical spurs. Spurs o-1 to o-4 all small and clustered at apex.

BIOLOGY. *Adenopterus* have been collected by sweeping through low herbage and low trees in and around forests. We have found them walking about on top of vegetation at night. Some specimens have been collected at lights, others in

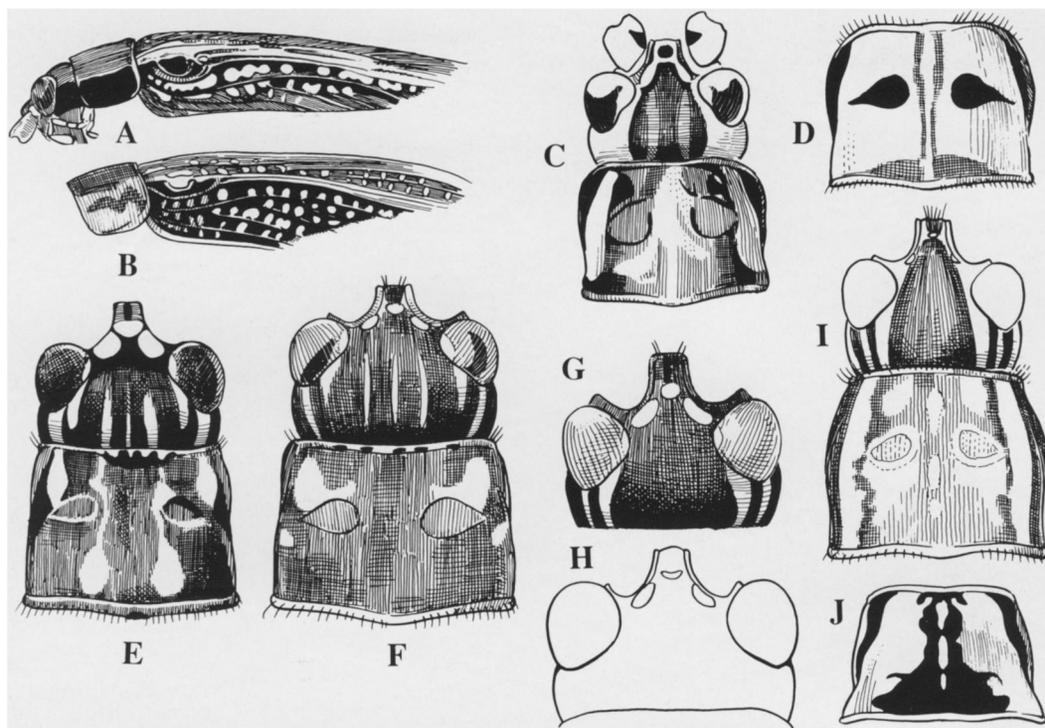


FIG. 31. *Adenopterus*. A, *lifouensis* male. B, *crouensis* male. C, *perplexus*. D, *admirandus*. E, *yahouensis*. F, *tchambicus*. G, *sarrameus*. H, *lifouensis*. I, *sylvaticus*. J, *Archenopterus bouensis* holotype pronotum.

malaise traps. Quite possibly the members of this genus are common on tree tops, but these areas have not been sampled.

DISTRIBUTION. The genus is presently known only from New Caledonia, the Loyalty Islands, and Norfolk Island.

Kraussi Group

Adenopterus kraussi Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Col des Roussettes, 300 m, 5 - 6 ii 1963, malaise trap (Yoshimoto and Krauss). HONOLULU.

RECOGNITION. Figs. 30A, 32C, 34B. Table 6. Differs from the similar *perplexus* as follows: Pronotal disc with an interrupted pale band along the lateral margins; dark streak along inner side of Cu_1 vein wide.

Males: Body mostly straw yellow, but with dark brown streaks. Head: dorsum as figured; face entirely pale; cheeks pale with dark stripe behind upper margin of eyes. Forewings: M vein only slightly modified in the forewing gland

area; R vein joins M vein about one pronotal length posterior to pronotum; pale below and reddish brown above. Hindwings extending beyond ends of forewings. Abdomen straw yellow. Fore- and midlegs: femora straw yellow with a few scattered darker spots. Hindfemora: straw yellow with a few small darker spots; knees black on upper face and on crescents.

Female: very similar to male but larger. Females from Mt Panié and Col d'Amieu have relatively longer ovipositors.

SPECIMENS. *Holotype* M, HONOLULU. *Paratypes:* Same data as type, 1F, HONOLULU. Mt Panié, forest, 500 m, 27-29 vii 1971 (Gressitt) 1F, HONOLULU. Col d'Amieu, 650 m, 21 iii 1968 (Gressitt and Maa) 1F, PHILADELPHIA.

Adenopterus sylvaticus Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Mt. Koghi, west slope of Mt Bouo, ii 1983 (Alexander, Cade, and Otte). PHILADELPHIA.

RECOGNITION. Figs. 31I, 32F, 33K, L, 34A. Table 6. Differs from the similar *euperplexus*

Table 6. Comparison of *Adenopterus* species. See Methods section for abbreviations. V, number of parallel longitudinal veins on dorsal surface of forewings, other than Cu1.

	BL	FL	OL	CL	FWL/PL	OL/FL	V
<i>kraussi</i>							
HM	17	9.3	-	8.0+	4.9		7
PF Amieu	15	10.5	9		5	0.86	
PF Yahoue	16	10.1	7.2	10	-	0.71	10
PF Panie	16	10.2	8.8	11.5	5.3	0.86	9
<i>sylvaticus</i>							
HM	15	8	-	11	4.15	-	6
PM	14	8.2	-	-	5.27	-	6
<i>sarasini</i>							
HM	14.5	-	-	-	3.77	-	6
PF Amieu	13	9	7.2	-	4.17	0.85	
PF Panie	12	8.3	7	8+	3.53	0.84	6
<i>rouxi</i>							
HM	12	-	-	-	3.9	-	6
<i>caledonicus</i>							
HM	14	7	7	-	6.3	0.92	7
<i>dumbeus</i>							
HM	-	8.54	7	-	4.8	0.83	7
PF	13.5	9	7.5	10.5	4.3	0.83	7
<i>confixus</i>							
HT	14	9.5	8.5	-	6	0.89	8
<i>dubius</i>							
HT	20	13	16	18	5.5	1.23	7
<i>perplexus</i>							
HT	17	10	7	-	6.2	0.7	10
PF Yahoue	13	9.5	7.3	-	6.2	0.77	9
PF Yahoue	15	9.8	7.2	-	6.3	0.73	9
PF Koghi	17	10.5	7.3	-	6.4	0.7	9
PF Koghi	15	10.5	7.2	10	6.3	0.69	10
<i>paraperplexus</i>							
HT	14	9	7.3	9	6.7	0.81	11
<i>euperplexus</i>							
HT	11	8.1	7	9.9	6.9	0.86	9
PF	13	8.8	7.1	8.5	6.4	0.81	9
<i>sarrameus</i>							
HT	15	9.5	-	-	4.8	8	
PF	14-17	10.0-11.2	13.5-15.5	-	4.4-4.7	1.3-1.4	8-9
<i>yahouensis</i>							
HM	12	8.3	-	-	4.8	-	7
9PF Yahoue	14-17	10.0-11.0	12.8-15.0	12.0-13.5	4.3-4.7	1.28-1.36	8-9
3PF Thy	14-16	10	13	-	-	-	8
1PF Pines	16	10.1	13.2	11	4.1	1.31	8
<i>tchambicus</i>							
HM	13	9	-	6.0+	4.6	-	8
<i>admirandus</i>							
HM	17	11.3	17	18	4.4	1.5	10
4PF Mt Koghi	15-17	11.0-11.5	17.0-18.0	17.0-18.0	4.3-4.8	1.48-1.6	9-10

Table 6 (continued)

	BL	FL	OL	CL	FWL/PL	OL/FL	V
<i>crouensis</i>							
HM	12	7.8	-	8	5.7	-	7
2PM Timbia	11, 10	6.8,6.7	-	6.0,5.5	6.3,5.5	-	6, 7
PM Noumea	10	7.8	-	-	6.1	-	6
PM La Crouen	11	7.7	-	-	5.7	-	7
2PM Yahoue	10, 12	6.5,7.0	-	6.0,7.0	5.5,6.0	-	6, 7
PF Timbia	12	9	11	11	5.9	1.22	7
PF Noumea	13	8	10	10	5.7	1.25	6
PF Thy	14	8.7	10.5	-	5.6	1.21	7
PF La Crouen	13	9	11.2	-	5.4	1.24	6
PF Dumbea	11	8	9.5	-	5.8	1.19	7
PF La Coulee	14	9	10	-	5	1.11	7
<i>lifouensis</i>							
HM	12	6.5	-	-	5.4	-	5
PM	11	6.5	-	-	-	-	-
PF	12	8.2	8.2	-	-	1	6
<i>noumeus</i>							
HM	11	7	-	6.2	5.4	-	6
4PF	12-11.3	7.2-8.5	8.2-9.0	8.5-9.0	5.2-5.5	1.09-1.14	6-7

and *paraperplexus* in having only 6-7 dorsal parallel veins on the forewings (vs 9-11). Last abdominal tergite modified into a large plate which extends over the bases of the cerci.

Males: Body color uniform pale orange-brown. Head: dorsum pale brown, banded with darker stripes; area between eyes and ocelli may be dark brown. Face light brown at top of forehead, otherwise ivory colored; cheeks ivory, but with 2 brown stripes emerging from posterior margin of eye. Pronotum patterned as figured; lateral lobes light brown. Forewings: forewing gland similar to that of *kraussi*; dorsal field straw colored to orange-brown, with slightly reddish veins; with a few cross veins; lateral field orange brown above, becoming yellowish ventrad. Hindwings extending about one pronotal length beyond forewings. Abdomen: dorsum pale brown; Fore- and midlegs: ivory with small brown spots on upper face. Hindfemora pale, with a single longitudinal row of spots on upper face, and with numerous pale brown oblique

stripes on outer face; knees with black crescents. Cerci pale with 4 - 5 short dark crossbands.

Females: Similar to males. On the forewings the R vein (which does not join the M vein) defines the forewing angle. Last tergite of abdomen not modified as in male.

SPECIMENS. *Holotype* M, PHILADELPHIA. *Paratypes:* Mt Koghi, 400 - 600 m, i 1969 (Krauss) 1M, HONOLULU.

Adenopterus sarasini (Chopard)

Podoscirtus sarasini Chopard 1915: 160. *Holotype* M, New Caledonia, Canala, 1911 (Dr. S. R.). **BASEL.** *Munda sarasini*, Chopard 1968: 412. **NEW COMBINATION.** Type examined.

RECOGNITION. Figs. 33F, 35B. Table 6. Very similar to *sylvaticus* but differing in having shorter ectoparameres, and in the venation associated with the wing gland (see figures). Differs

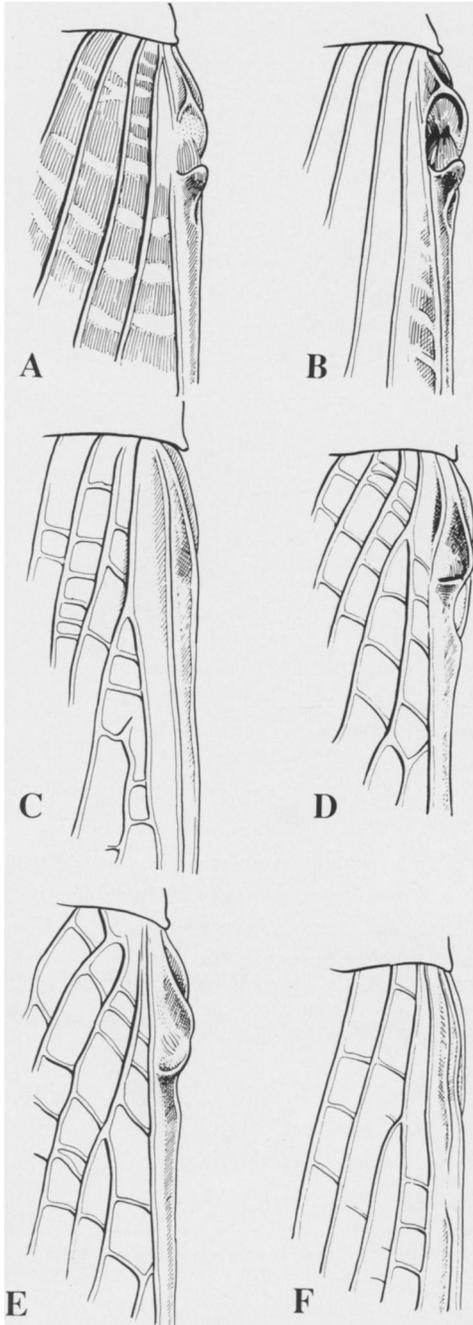


FIG. 32. *Adenopterus* male forewing showing forewing gland or traces of the gland. A, *crouensis* B, *lifouensis*. C, *kraussi*. D, *tchamicus*. E, *yahouensis*. F, *silvaticus*.

from *caledonicus* in the shape of the male epiphallus.

SPECIMENS. *Holotype* M, BASEL. *Paratypes*: Col d'Amieu, 750 m, 3 iii 1960 (Gressitt) 1F, HONOLULU. West of Ponerihouen, 29 vii 1971 (Gressitt) 1F, PHILADELPHIA. Mt Panie, 700 m, 27 vii 1971 (Gressitt) 1F, HONOLULU.

Adenopterus rouxi (Chopard)

Podoscirtus rouxi Chopard 1915: 160. *Holotype* M, New Caledonia, Mt. Panié, 1400 m, 28 vi 1911 (Dr. S. R.). BASEL. *Munda rouxi*, Chopard 1968: 412. NEW COMBINATION. Type examined.

RECOGNITION. Figs. 33C, 35A. Table 6. Differs from *sylvaticus*, *sarasini*, and *caledonicus* in the shape of the male genitalia and the venation of the forewings (see figures).

SPECIMENS. *Holotype* M, BASEL.

Adenopterus roseola Gorochov, n. comb.

Peltia roseola Gorochov 1986:704. *Holotype* M, New Caledonia, Noumea (J. Bulogh). HUNGARIAN MUSEUM. NEW COMBINATION. Type not examined.

RECOGNITION. Fig. 34C.

Adenopterus caledonicus Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Yahoue, west slope of Mt. Bouo, 26 ii 1983 (Alexander, Cade & Otte). ANN ARBOR.

RECOGNITION. Figs. 36C. Table 6. Males with no trace of forewing gland.

Male: Body color yellowish with ivory legs. Head: dorsum uniformly yellowish with large ocelli; face and cheeks ivory. Pronotum: dorsum yellowish with two ivory pale longitudinal pale marks along each lateral margin; lateral lobes ivory in lower two-thirds, orange in upper third

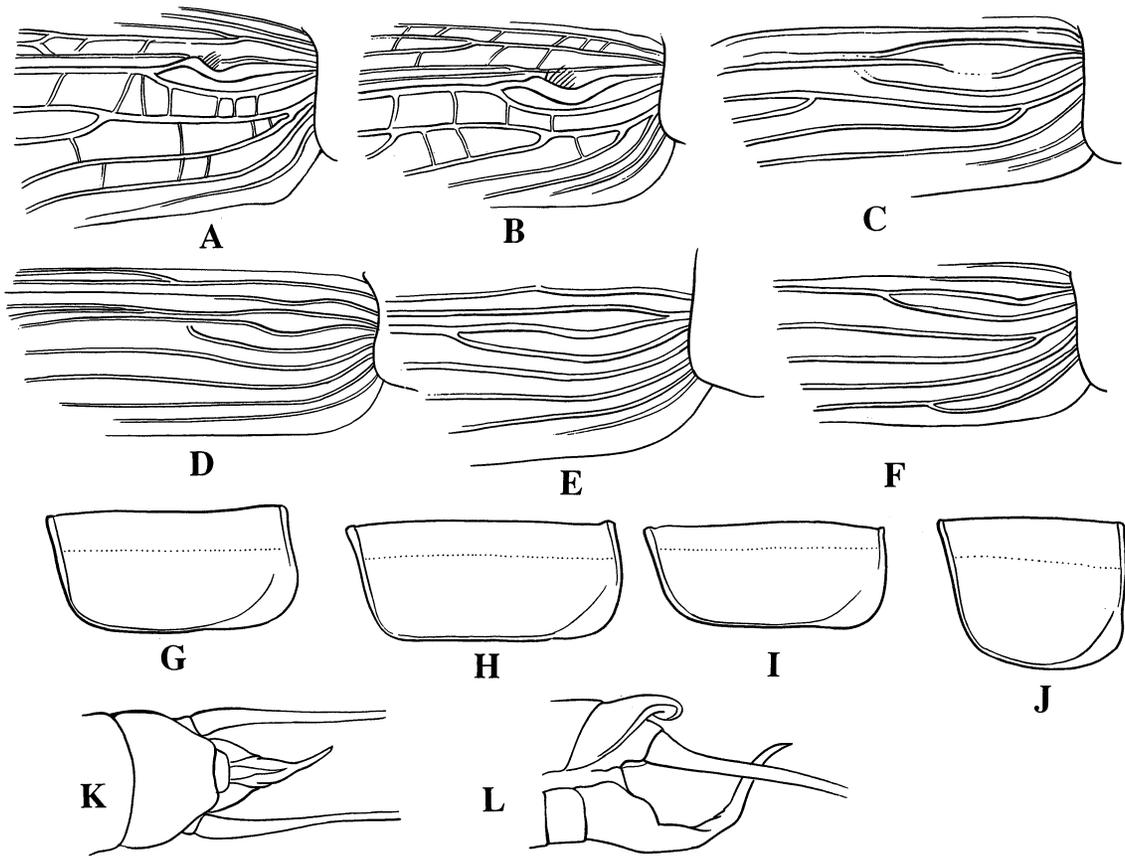


FIG. 33. *Adenopterus*. A-F, lateral aspect of forewing showing venation associated with forewing gland. A, *sarrameus*. B, *yahouensis*. C, *rouxi*. E, *sylvaticus*. F, *sarasini*. G-J, lateral aspect of pronotum. G, *sylvaticus*. H, *sarasini*. I, *rouxi*. J, *euperplexus*. K, L, dorsal and lateral aspects of male *sylvaticus* showing development of the last abdominal tergite and the elongate subgenital plate.

and with two longitudinal pale patches along upper margin. Forewings: without any trace of a forewing gland; membrane yellow to ivory, veins all reddish brown; with 7 longitudinal veins; lateral field yellowish with brownish veins. Hindwings: extending about one pronotal length beyond forewings. Abdomen: ivory colored, but last sternite before subgenital plate with a small dark brown mark on each side. Foretibiae with a brown area on upper face between the tympana. Legs all ivory colored. Hind tibiae with a small black area at base of each spur.

HABITAT. Collected in foliage at the forest edge by sweeping.

SPECIMENS. *Holotype* M, ANN ARBOR.

Adenopterus dumbeus Otte, n. sp.

TYPE. *Holotype* F, New Caledonia, Dumbea, Uferregion [coastal region] 12 viii 1965 (Österreichische Neukaledonien Expedition, 1965). VIENNA.

RECOGNITION. Table 6. Forelegs without tympana (this feature is unique for crickets which are capable of flight).

Females: Unlike all other *Adenopterus* or *Archenopterus* species this species lacks any trace of tympana. This is a highly unusual condition, for no other species of cricket that possesses flying hindwings lacks tympana. This feature could have arisen if both front legs were

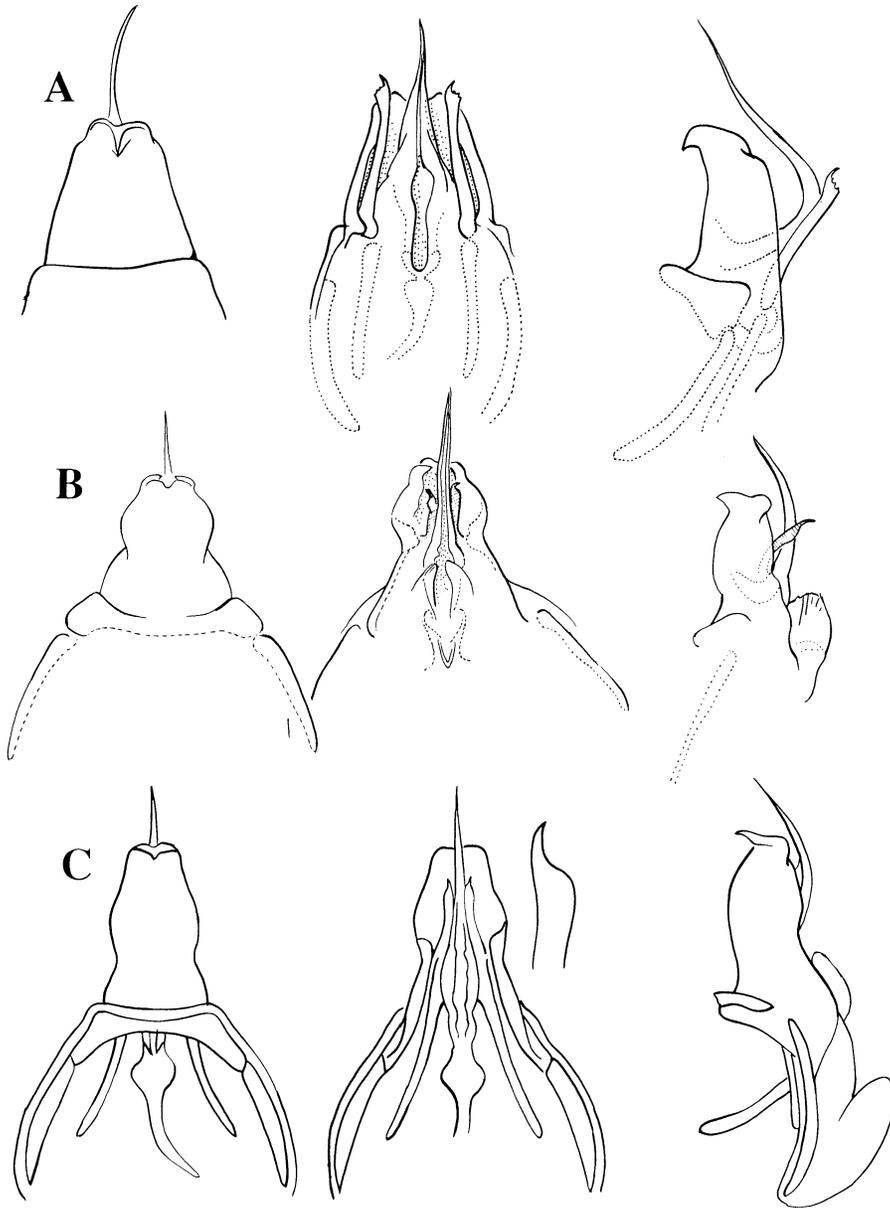


FIG. 34. *Adenopterus* male genitalia (holotypes). A, *sylvaticus*. B, *kraussi*. C, *roseola* (from Gorochov 1986).

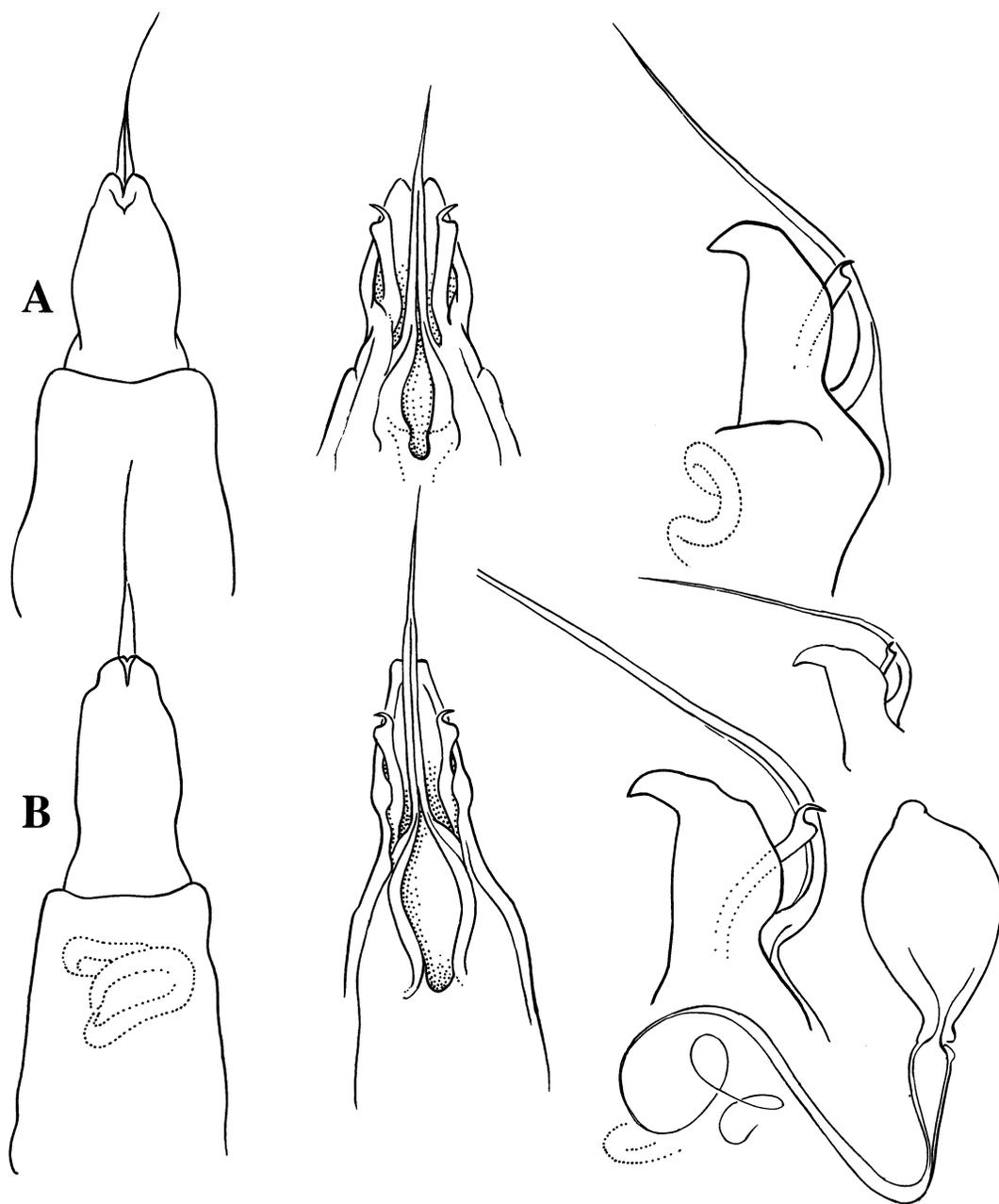


FIG. 35. *Adenopterus* male genitalia (holotypes). A, *rouxi*. B, *sarasini*.

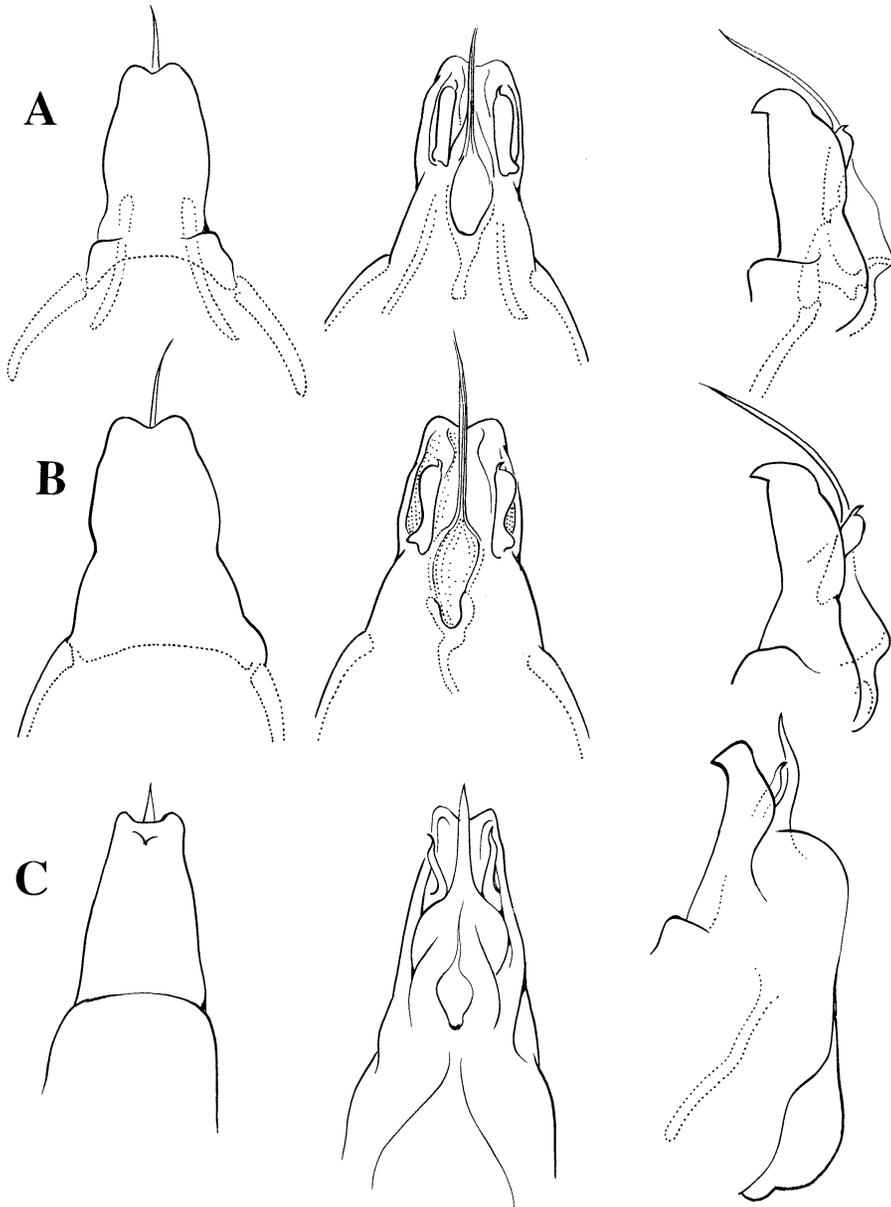


FIG. 36. *Adenopterus* male genitalia (holotypes). A, *yahuensis*. B, *sarrameus*. C, *caledonicus*.

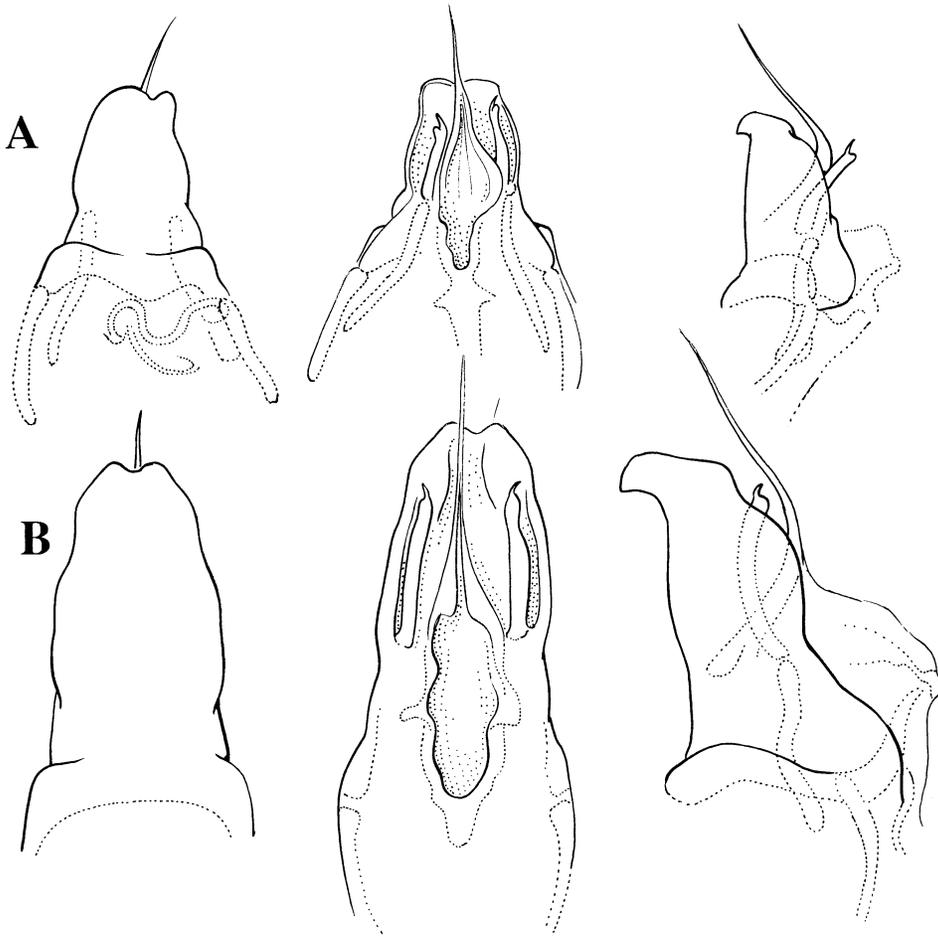


FIG. 37. *Adenopterus* male genitalia (holotypes). A, *crouensis*. B, *lifouensis*.

lost during nymphal stages and were regenerated. Because of the close similarity between females of *Adenopterus* and *Archenopterus* there is some doubt as to which genus this female belongs to. We place it here because *Archenopterus* males still possess stridula while males of *Adenopterus* do not. It seems more likely therefore for the latter to more readily lose their tympana.

Body color dark reddish brown, almost purple (but forewings grayish) and without any pale markings. Head: entirely dark reddish brown except for labrum which is yellow; with 3 small

ocelli. Pronotum entirely dark reddish brown. Forewings gray with dark veins; dorsal field with 7 parallel veins (not including Cu_1). Hindwings extending about 1.5 pronotal lengths beyond forewings. Legs all dark reddish brown. Hind tibiae with 5 inner and 6 outer subapical spurs.

Males: not known.

SPECIMENS. *Holotype* F VIENNA. *Paratype*: New Caledonia, Mt. Mou, 3 ii 1963 (Krauss) HONOLULU.

***Adenopterus confixus* Otte, n. sp.**

TYPE. *Holotype* F, New Caledonia, Plateau do Dogny, 29 iii 1968 (Gressitt and Maa). HONOLULU.

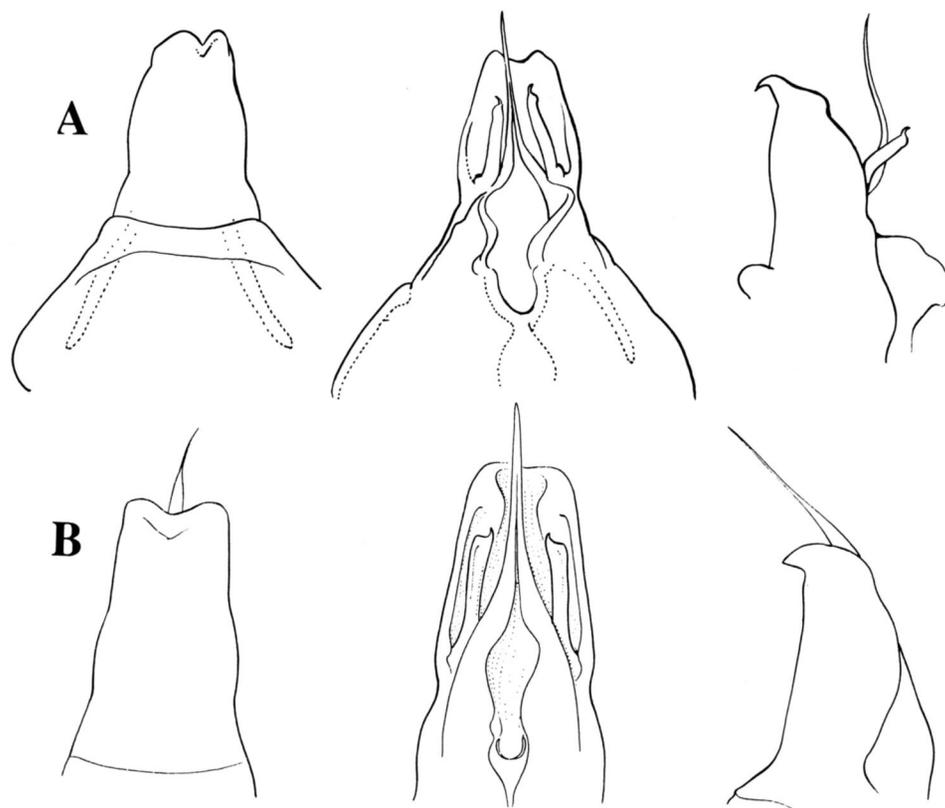


FIG. 38. *Adenopterus* male genitalia (holotypes). A, *saussurei*. B, *tchambicus*.

RECOGNITION. Table 6. Cu_1 vein dark brown in anterior half of forewings; hind knees black (in *sylvaticus*, *euperplexus* and *paraperplexus* Cu_1 veins is pale brown or yellow, and the hind knees are not black).

Females: Body color pale brown but with dark brown pronotum and head; dorsal field of forewings with a thin dark brown streak along each side. Head: Dorsum dark brown, lateral ocelli huge, meeting at midline; median ocellus very small; face yellow; cheeks yellowish below, turning rusty-red dorsad. Pronotum: dorsum dark reddish brown, darkest in anterior lateral quarters, MAPs paler than surrounding areas, lateral lobes dark reddish-brown in upper two thirds, yellowish in ventral third. Forewings: pale brown, but with dark streaks along lateral margins (along R, M, and Cu_1 veins, anteriorly

the dark streak runs between and includes the Cu_1 and Cu_2 veins; the Cu_2 vein itself is the darkest portion, but it is dark only in the basal half of the wing; lateral field pale brown. Hindwings extend about 1.5 pronotal lengths beyond the forewings. Abdomen: dorsum pale reddish brown, venter yellowish. Fore- and midlegs: pale brown; tibiae with a large black dorsal spot in the proximal third—on the foretibiae the spot is located at the upper end of the tympanum. Foretibiae with 2 and middle tibiae with 3 apical spurs. Hindfemora very pale, but knees black; hind tibiae with 5 dark brown spots located along the posterior margin between the spines — 3 in the proximal half and 2 in the distal half; with 5 inner and 5 outer subapical spurs.

Males: not known.

SPECIMENS. *Holotype* M, HONOLULU.

Adenopterus dubius Otte, n. sp.

TYPE. *Holotype* F, New Caledonia, Col de Roussettes, 6 ii 1963 (Krauss). HONOLULU.

RECOGNITION. Table 6. Forewings with R, M, and Cu₁ veins blackish through most of their length.

Females: Body color gray, dark brown, and black, with brown Hindfemora. Head: dorsum dark brown to blackish, lighter posterior to eyes; lateral ocelli large, median one very small. Pronotum: dorsum and lateral lobes dark brown to blackish. Forewings: mostly gray, but pale brown at anterior lateral corners and along pronotal margin, black along forewing angle (R, M, and Cu₁ are yellowish at their base and then turn black for the remainder of their lengths. Vein Cu₂ black at the base then turning yellowish or pale brown as it enters gray area of the forewing. Hindwings black as they emerge from the forewings. Abdomen: brown to dark brown. Fore- and midlegs: femora brown to reddish-brown, midfemora with a broad black streak on the inner face. Hindfemora: pale brown with black knee crescents.

Males: Not known.

SPECIMENS. *Holotype* F, HONOLULU.

Adenopterus perplexus Otte, n. sp.

TYPE. *Holotype* F, New Caledonia, Mt Koghis, 400 - 600 m, i 1969 (Krauss). HONOLULU.

RECOGNITION. Fig. 31C. Table 6. Most similar to *sylvaticus* but larger and more contrastingly marked, especially in the vicinity of the ocelli, and forewings with distinct pale and dark veins at the lateral edge of the dorsal field.

Females: Head: In some specimens MAPs darker than surrounding area; face and cheeks yellowish. Pronotum: dorsum marked as in Fig. and with continuous lateral yellow bands; lateral lobes dark reddish brown in lower three-quarters and yellow across the dorsal quarter. Forewings: with a narrow dark brown streak running along inner side of Cu₁ vein; veins variable in color —

Sc pale, Sc branches brownish; R dark brown; M thick and yellow in basal half, turning pale brown in distal half; Cu₁ brownish in basal quarter, yellow in remainder; Cu₂ brown, somewhat sinuous. Hindwings extending 2 pronotal lengths beyond forewings. Fore- and midlegs pale brown with dark brown area on inner and outer faces; tibiae pale brown but darker brown on upper face through most of the central portion. Hindfemora yellowish, sometimes with small black spots on outer face.

Males: not known.

SPECIMENS. *Holotype* F, HONOLULU. *Paratypes*: (HONOLULU) Mt Koghis, 25 i 1962 (Krauss) 1F. ii 1963 (Krauss) 1F. ii 1973 (Krauss) 1F. Yahoue, 20 ii 1963 (Yoshimoto) 1F. Yahou, i 1963 (Krauss) 1F.

Adenopterus paraperplexus Otte, n. sp.

TYPE. *Holotype* F, New Caledonia, Plateau du Dogny, 29 iii 1968 (Gressitt). HONOLULU.

RECOGNITION. Table 6. Similar to *perplexus* but differs as follows: dorsum of head not banded; with a shallow transverse groove running between eyes and posterior to lateral ocelli (in *perplexus* the head slopes continuously and gradually from the vertex onto the rostrum); Sc vein darker than R vein; R and M veins similar in color (pale brown); dorsal field with 11 parallel veins (9 - 10 in *perplexus*); dorsal field without a brown streak running along the inner side of the Cu₁ veins; ovipositor relatively longer.

Females: Body color pale brown.

Males: not known.

SPECIMENS. *Holotype* F, HONOLULU.

Adenopterus euperplexus Otte, n. sp.

TYPE. *Holotype* F, Baie du Prony, west side, 0 - 10 m, 14 viii 1979 (Gagne). HONOLULU.

RECOGNITION. Fig. 33J. Table 6. Very similar to *perplexus* and *paraperplexus*. Differs from *perplexus* in body proportions (body smaller,

forewings and ovipositor relatively longer), and coloration (lateral lobes of pronotum not pale brown; Sc vein darker than R vein; dorsal field of forewings without a dark streak along the inner side of the Cu₁ vein). Differs from *paraperplexus* in having 9 parallel veins on dorsal field of forewings; in lacking the pronounced shallow groove which runs transversely between the eyes. Hindwing extends 1.5 - 2 pronotal lengths beyond the forewings. Body color pale brown.

Males: not known.

SPECIMENS. *Holotype* F, HONOLULU. *Paratypes*: Yate, 25 iii 1968 (Gressitt and Maa) 1F, HONOLULU. Poindimie, 11 ii 1963 (Krauss) 1F, HONOLULU.

Sarrameus Group

Adenopterus sarrameus Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Sarramea, 70-150 m, ii 1971 (Krauss). HONOLULU.

RECOGNITION. Figs. 31G, 33A, 36B. Table 6. Very similar to *yahouensis*, but with smaller ocelli, and different genitalia.

Males: Head: dorsum reddish brown; face dark reddish brown above clypeus, ivory on clypeus and labrum; cheeks reddish brown with a yellowish spot along lower margin of eye. Pronotum: like *yahouensis*. Forewings: dorsum gray with dark reddish veins, yellow anterior to glandular area. Hindwings extending one pronotal length beyond forewings. Abdomen: 9th tergite black; venter yellowish, black at base of subgenital plate. Legs: similar to *yahouensis*.

Females: similar to males in color. Largely indistinguishable from *yahouensis*.

SPECIMENS. *Holotype* M, HONOLULU. *Paratypes*: Sarramea, ii 1971 (Krauss) 1M 1F, PHILADELPHIA; 3F, HONOLULU. La Crouen, 12 iii 1961 (Sedlacek) 1F, HONOLULU. Col d'Amieu, 650 m 31 iii 1968 (Gressitt) 2F, HONOLULU.

Adenopterus yahouensis Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Yahoué, iii 1978 (Krauss). HONOLULU.

RECOGNITION. Figs. 32E, 33B, 36A. Table 6. Very similar to *sarrameus*, but with huge ocelli.

Males: Head, thorax and legs reddish, forewings gray, but white at anterior-lateral shoulders. Head: dorsum reddish-brown, ocelli extremely large, lateral ones touching median one; face brown above clypeus, ivory on clypeus and labrum, palps ivory; cheeks reddish brown with a yellow area along lower posterior margin of eye. Pronotum: lateral lobes reddish brown, darker in upper half. Forewings: membrane gray, with dark reddish veins, yellow at anterior lateral shoulders. Fore- and midlegs: femora dark reddish-brown on inner and outer faces, ivory with dark spots on upper face; tibiae dark reddish brown. Hindfemora: dark markings on dorsal face joining into 3 brownish bands, knees also dark, outer face with a brown band below middle, ivory along dividing line, with rows of dark spots above line and brown blotches above that.

Female: Very similar to males.

SPECIMENS. *Holotype* M, HONOLULU. *Paratypes*: Yahoué, 11 1980 (Krauss) 1M, HONOLULU; 1M, PHILADELPHIA. Yahoué, 12 ii 1962, i 1963, 2 iii 1976 (Krauss) 9F, HONOLULU; 1F, PHILADELPHIA. 6 km north of Païta, 25 i 1963 (Yoshimoto) 1F, HONOLULU. Foret de Thi, 100 - 200 m, 10 iii 1961 (Sedlacek) 2F, HONOLULU. Foret de Thy, 550 m, 1 iii (Sedlacek) 1F, HONOLULU. Isle of Pines, iii 1959 (Krauss) 1F, HONOLULU.

Adenopterus tchambicus Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Tchamba River, east of Tchamba, near Ponérihouen, 3 iii 1983 (Alexander, Cade, and Otte). PHILADELPHIA.

RECOGNITION. Figs. 31F, 32D, 38B. Table 6. Head and pronotal patterns similar to *yahouensis* but as dark, and ocelli much smaller, more like *sarrameus*.

Males: Very similar to *sarrameus* and *yahouensis*. Forewing glands similar to *sarrameus*. Hindwings extend one pronotal length beyond

forewings. Abdomen: dorsum dark brown on last two tergites; venter yellow, black at base of subgenital plate

Females: not known.

BIOLOGY. Collected in a hillside forest by sweeping through the underbrush.

SPECIMENS. *Holotype* M, PHILADELPHIA.

***Adenopterus admirandus* Otte, n. sp.**

TYPE. *Holotype* F, New Caledonia, Foret de Thy, 550 m, 1 iii 1960 (Gressitt). HONOLULU.

RECOGNITION. Fig. 31D. Table 6. Body color pale yellowish brown with a dark brown head and with two dark brown patches on the yellowish pronotal disc.

Females: Head: dorsum dark brown with a pale stripe running from posterior inner margin of the eye to pronotum and with yellowish bands running from inner front margins of eyes through lateral ocelli and along lateral margins of rostrum. Rostrum with a median dark brown stripe (widest just anterior to median ocellus) and interrupted at median ocellus, but continuing posteriorly to Y-shaped suture located between the lateral ocelli; exterior margins of rostrum dark brown. Pronotum: dorsum yellowish, with dark brown MAPs; lateral lobes mostly dark reddish brown, palest along anterior and posterior margins. Forewings pale brown with yellowish veins. Hindwings dark brown, extending 0.5 pronotal lengths beyond forewings. Fore- and midlegs reddish brown. Hindfemora pale brown in basal half, turning reddish brown in distal half, knees yellow; hind tibiae reddish brown. Cerci reddish brown.

Males: Not known.

SPECIMENS. *Holotype* F, HONOLULU. *Paratypes*: Mt. Koghi, i 1963 (Krauss) 1F, HONOLULU; 15 ii 1963 (Yoshimoto) 1F, HONOLULU; ii 1963 (Krauss) 1F, PHILADELPHIA; i 1969 (Krauss) 1F, HONOLULU.

Crouensis Group

***Adenopterus crouensis* Otte, n. sp.**

TYPE. *Holotype* M, New Caledonia, La Crouen, 150 - 250 m, ii 1973 (Krauss). HONOLULU.

A member of Saussure's type series of *Podoscirtus insularis* from New Caledonia belongs to this species. That specimen, numbered 4734, was designated as a variety by Saussure 1878: 640.

RECOGNITION. Figs. 32A, 37A. Table 6. Body color dark reddish brown to purple, with rows of white spots on forewings; with a row of white spots between all veins. The similar *A. lifouensis* lacks white spots between the central veins.

Males: Head: dorsum dark reddish brown, shiny, size of ocelli similar to *sarrameus*; face and cheeks shiny black. Pronotum: entirely dark reddish brown with long silvery pubescence. Forewings: gland large and deep; membrane gray, veins dark reddish brown, cross veins white and oval. Hindwings extending nearly 2 pronotal lengths beyond forewings. Legs reddish brown.

SPECIMENS. *Holotype* M, HONOLULU. *Paratypes*: *Syntype* F of *Podoscirtus insularis* Saussure, New Caledonia (Brunner Collection No. 4734) VIENNA. Yahoue, iii 1978 (Krauss) 1M, HONOLULU; 1M, PHILADELPHIA. Oua Tom, 20 ix 1940 (FXW) 1M, HONOLULU. 2 km SE of Timbia, Ngoue 0 - 5 m, 20 ix 1979 (Gagne) 2M 2F, HONOLULU. Noumea, 1 1962 (Krauss) 1F, HONOLULU; vii 1950 (Krauss) 1M, HONOLULU. Foret de Thi, 100 - 200 m, 10 iii 1961 (Sedlacek) 1F, HONOLULU. La Crouen, 31 i 1963 (Yoshimoto & Krauss) 1M, HONOLULU; 20 iii 1968 (Gressitt & Maa) 1F, PHILADELPHIA. Dumbea Valley, vi 1950 (Krauss) 1F, HONOLULU. La Coulee, 23 i 1963 (Yoshimoto) 1F, HONOLULU. La Foa, 20 i 1945 (Milliron) 1F, HONOLULU.

***Adenopterus lifouensis* Otte, n. sp.**

TYPE. *Holotype* M, Loyalty Islands, We, Lifou Island, 16 - 18 ii 1963 (Yoshimoto). HONOLULU.

RECOGNITION. Figs. 31H, 32B, 37B. Table 6.

A dark reddish brown species with white spots mainly along the sides of the forewings.

Males: Head: dorsum dark brown, with large yellow ocelli; face and cheeks reddish brown. Pronotum: dorsum dark brown with long golden pubescence; lateral lobes black in lower half. Forewings: gland large and deep; dorsum brown centrally and with a wavy white band along the margins; lateral field with rows of white spots. Legs uniformly reddish brown. Hindlegs: femora brown, tibiae darker than femora.

SPECIMENS. *Holotype* M, HONOLULU. *Paratypes:* Same data as holotype, 1M, PHILADELPHIA. Same locality but ii 1962 (Krauss) 1F, HONOLULU. Lifou Island, 1 km W of Doueoulou, 5 - 35 m, 19 viii 1979 (Gagne) 1F, HONOLULU.

Adenopterus saussurei Chopard

RECOGNITION. Fig. 38A. Table 6. Nearly identical to *lifouensis*, but differing in the shape of the male epiphallus. Forewing glandular pits similar to *lifouensis*. We treat these specimens as distinct from *lifouensis* because more than 100 km of water separates them and differences exist in the epiphalli (more pointed in *noumeus*).

Females: very similar to females of *lifouensis*.

SPECIMENS. New Caledonia, Noumea, light trap, 20 ii 1963 (Yoshimoto & Krauss). 1M, 4F, HONOLULU & PHILADELPHIA.

Adenopterus baloghi Gorochov

Adenopterus baloghi Gorochov 1986:706. Isle of Pines, New Caledonia, 10 i 1977 (J. Balogh). HUNGARIAN MUSEUM. Type not examined.

The type is a female from the Isle of Pines.

ARCHENOPTERUS n. gen.

TYPE SPECIES: *Archenopterus gressitti* Otte, n. sp.

RECOGNITION OF GENUS. Figs. 39-44. Table 7. Medium sized for subfamily: BL 13 - 19 mm. Forewings with a stridulum, also with a forewing gland at anterior end of M vein (size and depth of organ varies among species). Head: with 3 ocelli, median one usually smaller than lateral ones, in one species very tiny. Maxillary palps with a short, wide, ultimate segment. Pronotum widening strongly posteriorly in species with wide forewings. Inner chord connecting to diagonal vein and not to outer two chords. Harp with 5 - 10 veins. Sc vein with 6-10 branches. Hindwings extending beyond forewings. Subgenital plate elongate and pointed at apex (as in *Adenopterus*). Foretibiae with both inner and outer tympana, these are large and nearly equal in size. Foretibiae with 2 and midtibiae with 3 apical spurs. FW/FL, 0.20 - 0.27. Hindtibiae with 5 inner and 5 outer apical spurs (all located in distal half) and with 3 inner and 3 outer apical spurs. Spurs o-1 to o-4 small, closely spaced at apex. Cerci long and slender.

Archenopterus gressitti Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Mt Koghi, 28 viii 1968 (Gressitt and Maa). HONOLULU.

RECOGNITION. Figs. 39B, 40A, 41B, 42A. Table 7. *Males:* Body color pale brown, forewing glands large and deep. Head: median ocellus distinctly smaller than lateral ones; vertex and occiput pale brown, becoming dark brown on forehead between ocelli; face and cheeks pale brown. Pronotum: entirely pale brown. Forewings: dorsum pale brown, covered with fine pubescence; Sc with 8 branches. Hindwings: extending 2 pronotal lengths beyond forewings. Legs all uniformly pale brown.

Females: not known.

Table 7. Comparison of *Archenopterus* species.

	BL	FL	OL	CL	FWL/ PL	TL/ FL	No. file teeth
<i>hemipteroides</i>							
HM	19	11	-	-	5.1	0.9	230
PF Rousettes	19	13	11.5	-	5.4	0.91	-
PF Amieu	17	12.3	11	16	5.8	-	-
<i>bouensis</i>							
HM	20	12	-	-	5.4	0.92	298
<i>gressitti</i>							
HM	17	11.1	-	-	5	0.92	209
<i>amoensis</i>							
HM	13.3	7.7	-	15	5.7	0.96	-
<i>maai</i>							
HM	13.5	8.5	-	8	6	0.99	220
<i>hemiphonus</i>							
HM	12	8.5	-	-	5.8	-	28

SPECIMENS. *Holotype* M, HONOLULU.

Archenopterus maai Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Mt Koghi, 18 viii 1968 (Gressitt and Maa). HONOLULU.

RECOGNITION. Figs. 39C, 40E, 41C, 43A. Table 7. *Males*: Dorsum of body patterned as figured. Head: dorsum with a single broad band behind each eye, and with a yellow stripe running from inner margin of eye through the lateral ocelli and onto forehead; face straw yellow, but with two small dark stripes descending from dorsum onto upper face; cheeks mostly reddish brown posterior to eyes, yellowish below eyes. Pronotum: dorsum reddish brown with lateral yellow stripes; lateral lobes pale brown. Forewings: dorsum gray with dark brown veins, with a narrow ivory stripe along forewing angle; lateral field pale brown, dark brown between Sc and R veins and along forewing glands. Hindwings extending about 3 pronotal lengths beyond forewings. Fore- and midlegs pale reddish brown.

Hindfemora pale brown with rows of scattered spots along its length. Cerci pale.

Females: Not known.

SPECIMENS. *Holotype* M, HONOLULU. *Paratypes*: Yahoue, 60 - 100 m, ii 1980 (Krauss) 1M, PHILADELPHIA. Mt. Koghis, 400 - 600 m, i 1969 (Krauss) 1M, HONOLULU.

Archadenopterus hemipteroides Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Mt Panie, 500 - 1000 m, 11 x 1967 (Sedlacek). HONOLULU.

RECOGNITION. Figs. 39A, 40B, 41A, 42B. Table 7. *Males* with broad shoulders on forewings, pronotum widening strongly posteriorly, and with a narrow head.

Males: Blackish on shoulders of forewing, sides of pronotum and top of head. Head: dorsum dark brown becoming black cephalad between ocelli and rostrum, lateral ocelli large, median ocellus small, almost obsolete; face and cheeks straw yellow. Pronotum: dorsum mostly pale reddish brown, turning black at margins; lateral

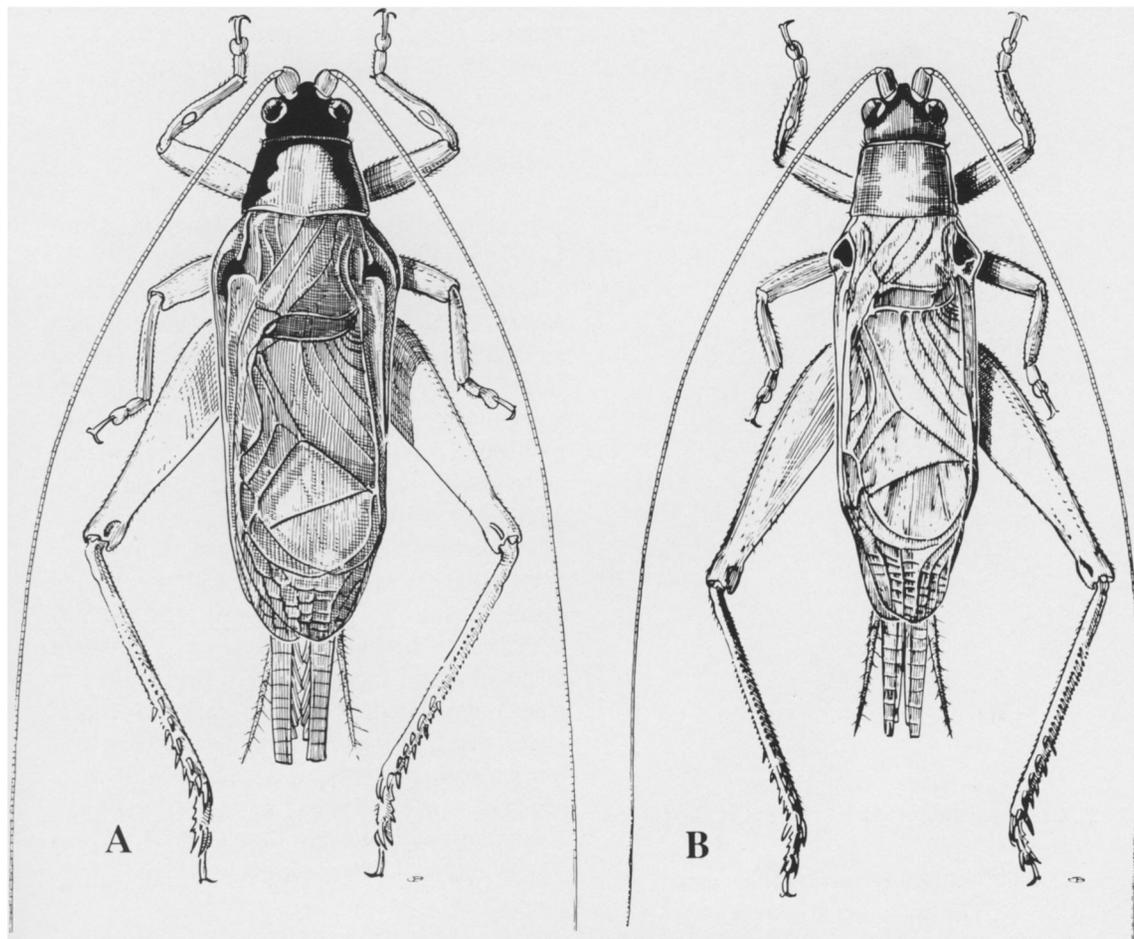


FIG. 39. *Archenopterus*. A, *hemipteroides* male. B, *gressitti* male.

lobes black in upper two thirds, pale along lower margin. Forewings: dorsum with huge forewing glands, very broad, pale brown on most of dorsal surface, dark brown to black anterior to glands; lateral field with 9 branches of Sc vein. Hindwings extending 1.5 pronotal lengths beyond forewings. All femora and cerci uniformly pale brown.

Females: body much narrower than in males, especially through the forewings. Body color pale brown, but black on top of head and sides of pronotum. Head: black from vertex onto rostrum; lateral ocelli large, median one very small, almost invisible; face and cheeks pale brown.

Pronotum: dorsum pale brown, lateral lobes black in upper half, pale brown in lower half. Legs all pale. Abdomen pale brown.

SPECIMENS. *Holotype* M, HONOLULU. *Paratypes*: Col des Rousettes, 450 - 550 m, 4 ii 1963 (Gressitt) 1F, HONOLULU. Col d'Amieu, 650 m, 31 iii 1968 (Gressitt and Maa) 1F, PHILADELPHIA.

***Archenopterus bouensis* Otte, n. sp.**

TYPE. *Holotype* M, New Caledonia, Mt. Koghi, forest on west slope of Mt. Bouo, 26 ii 1983 (Alexander, Cade & Otte). ANN ARBOR.

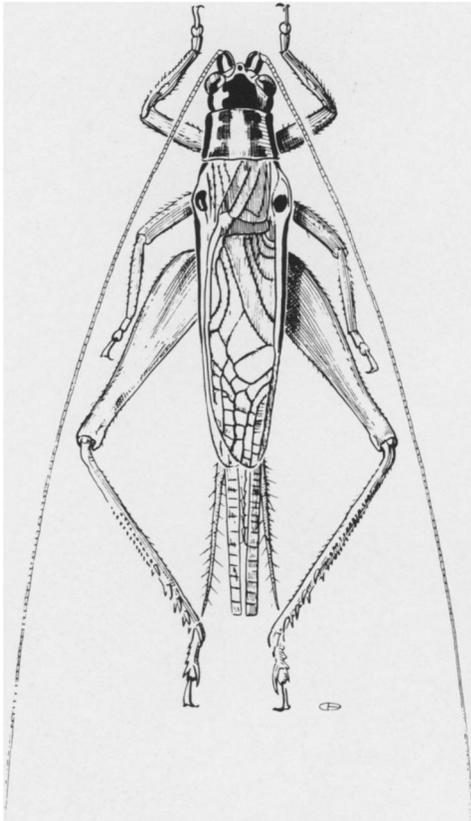


FIG. 39C. *Archenopterus maai* male.

RECOGNITION. Figs. 40F, 41D, 44B. Table 7.

Male: Large for genus, very pale in color but with distinctive dark markings on pronotum and forewings. Head: dorsum reddish brown; scape yellow; face yellowish on frons, pearly white on clypeus and labrum; cheeks ivory. Pronotum: dorsum marked as in figure; lateral lobes ivory in lower quarter, dark brown in middle half, and yellow in upper quarter. Forewings: with huge forewing gland; color generally pale and translucent, but with dark brown veins; lateral field pale, dark brown around forewing gland. Hindwings extending approximately 1.5 pronotal lengths beyond forewings. Abdomen entirely pale. Legs all ivory colored.

SONG. Fig. 45.

HABITAT. Collected in forest undergrowth about 10 feet above the ground.

SPECIMENS. *Holotype* M, ANN ARBOR.

***Archenopterus amoensis* Otte, n. sp.**

TYPE. *Holotype* M, New Caledonia, Amoa Valley, 7 ii 1963 (Krauss). HONOLULU.

RECOGNITION. Figs. 40D, 41E, 43B. Table 7. **Males:** Body pale, straw-colored. Head: dorsum reddish brown, with two pale stripes extending from rear margin of eyes to pronotum, also with a pale band running from inner margins of eye past lateral ocelli to level of median ocellus; face and cheeks pale. Pronotum: dorsum pale brown with ivory stripes along lateral margin; lateral lobes slightly darker than dorsum. Forewings: dorsum pale brown with large shallow forewing gland; lateral field pale brown, Sc with 6 branches. Hindwings extending 2 pronotal lengths beyond forewings. All legs uniformly pale brown. Hindfemora with black crescents of knee. Hind basitarsus with an extremely long inner apical spur, about as long as third tarsal segment.

Females: not known.

SPECIMENS. *Holotype* M, HONOLULU.

***Archenopterus hemiphonus* Otte, n. sp.**

TYPE. *Holotype* M, New Caledonia, Col d'Amieu, 650 m, 21 iii 1968 (Gressitt). HONOLULU.

RECOGNITION. Figs. 41F, 44A. Table 7. **Males:** Body color gray-brown with yellow postocular stripe which continues on the pronotum and the forewings. Head: dorsum dark brown with a narrow yellow stripe from posterior inner margin of eye to pronotum and a yellow stripe running from the anterior inner margin of the eye through all three ocelli; face and cheeks pale, yellowish. Pronotum: dorsum dark brown, with yellow lateral bands; MAPs paler than surrounding areas; lateral lobes brown

to dark brown. Forewings: gray with dark brown veins; with yellow stripe at lateral margins which is interrupted by the forewing gland and again at the midpoint of the forewing. Sc and R veins brown; M vein yellow before and after the forewing gland, then brown posterior of the point where it joins the R vein. Cu_1 brown to midpoint of wing, then yellow. Cu_2 not fully developed as a stridulum and with about 28 small teeth. Hindwings extend about two pronotal lengths beyond the forewings.

Females: not known.

SPECIMENS. *Holotype* M, HONOLULU.

APHONOIDES Chopard

Aphonoides Chopard 1940: 203. Type species: *Gryllus (Eneoptera) punctatus* Haan 1942: 232. Designated by Chopard 1968: 399.

This genus is known mainly from Australia and New Guinea. *Aphonoides ouveus* is thus far the only known member of the genus from this region of the Pacific. See Otte and Alexander (1983) for a discussion of this genus.

Aphonoides ouveus Otte, n. sp.

TYPE. *Holotype* M, Loyalty Islands, Ouvea, Fayaoue, 0 - 50 m, i 1969 (Krauss). HONOLULU.

RECOGNITION. Fig. 20C. *Males:* Body color pale straw-yellow. Head: Ocelli all large, nearly equal in size. Scape 2.0 times as wide as front of rostrum. Face and cheeks straw yellow. Pronotum, forewings, and legs straw yellow; dorsal field of forewings with 7 parallel veins besides Cu_1 vein. Hindwings extend 1.5 pronotal lengths beyond forewings. Foretibiae with 2 and midtibiae with 3 apical spurs; hind tibiae with 6 inner and 5 outer subapical spurs. Foretibiae with a large inner and no outer tympanal opening. Measurements of holotype and paratype (mm): BL, 12, 14; FL, 8.2, 9.0; FWL/PL, 6.0, -; TL/FL, 0.92, -.

Females: Not known.

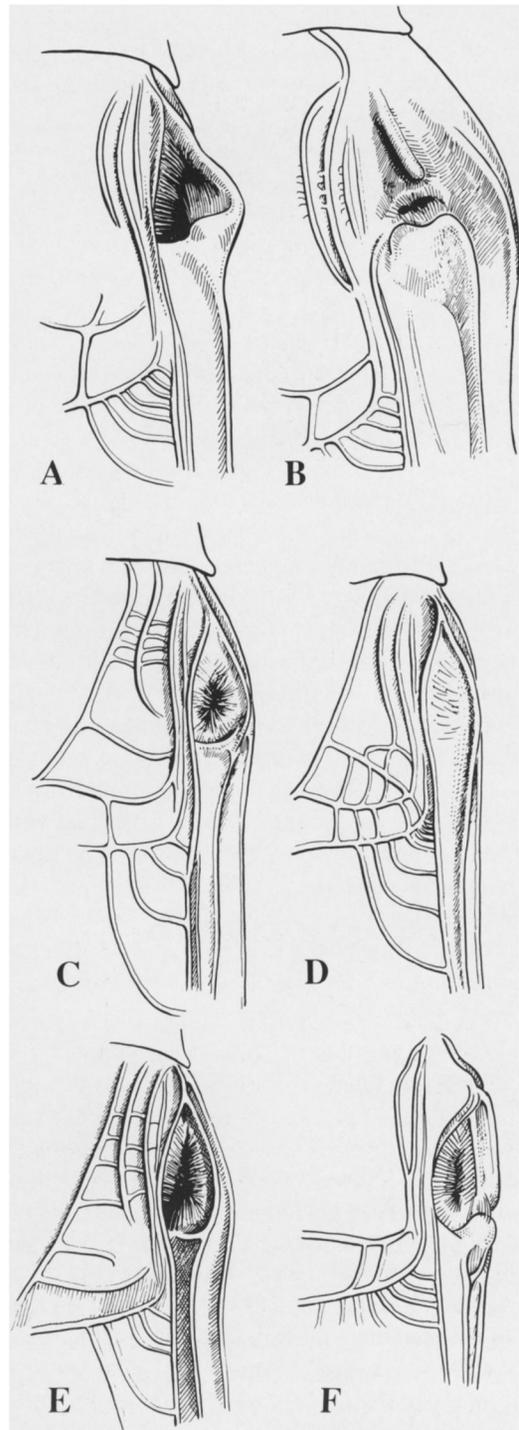


FIG. 40. A-F, *Archenopterus* male forewings showing forewing gland. A, *gressitti*. B, *hemipteroides*. C, *maai*. D, *amoensis*. E, *maai*. F, *bouensis*. G. A. *bouensis* holotype pronotum.

SPECIMENS. *Holotype* M, HONOLULU. *Paratype*: same locality but ii 1963 (Krauss) 1M, PHILADELPHIA.

CALSCIRTUS n. gen.

TYPE SPECIES: *Caledoscirtus amoa* Otte, n. sp.

RECOGNITION OF GENUS. Figs. 46-50. Table 8. Body slender, color pale brown to straw yellow. Rostrum very narrow. Fore- and midfemora very broad. Median ocellus tiny or obsolete. Head and pronotum covered with medium to dense pubescence. Pronotum appearing longer than wide, actually slightly wider than long; MAPs distinctly triangular; pronotal margins without very large bristles, but may have a dense growth of finer setae. Forewings extending beyond end of abdomen. Males with a stridulum and a well-developed mirror. Hindwings extending beyond forewings. Subgenital plate elongate but not coming to a narrow point as in *Adenopterus*. Tympanal openings on inner and outer faces, nearly equal in size. Foretibiae with 3 and midtibiae with 4 apical spurs. Hind tibiae with 5 inner and 5 outer subapical spurs and with 3 inner and 3 outer apical spurs. Spurs begin above middle of tibiae (they begin at or below this point in *Adenopterus* and *Archenopterus*).

Calscirtus amoa Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Amoa River, 3 km west of main road, near Poindimié, 3 iii 1983 (Alexander, Cade, and Otte). ANSP.

RECOGNITION. Figs. 47D, 48F, 49C, 50B. Table 8. Apical area of forewing shorter than mirror. Inner and outer subapical spurs on hind tibiae extending into apical half of tibia. Epiphallus deeply grooved at apex.

Males: Head: dorsum unpatterned, area between eyes and ocelli flat or slightly convex (not concave as in *timbiensis*; face and cheeks very pale. Pronotum: dorsum variegated pale brown and ivory; lateral lobes entirely pale. Abdomen:

dorsum and venter pale brown; subgenital plate dark gray-brown, emarginate at distal end. Forewings: dorsal field lateral field. Hindwings extending one half PL beyond forewings. Legs: pale brown, Hindfemora with numerous pale brown oblique stripes; hind tibiae with 5 inner subapical spurs (*paniensis* with 3); hind basitarsus with 2 inner and 3 outer dorsal spines, two at apex. Cerci pale at base, dark brown through most of basal half, then pale.

BIOLOGY. Collected in a tree in a riverine forest.

SPECIMENS. *Holotype* M, PHILADELPHIA.

Calscirtus paniensis Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, Loc 27, ca. 17 km east of Oubatche, coastal forest, 6 iii 1983 (Alexander, Cade, and Otte). PHILADELPHIA.

RECOGNITION. Figs. 47F, 48C, 49A, 50A. Table 8. Epiphallus extremely wide; ectoparameres symmetrical.

Males: Head: dorsum slightly concave between eyes and lateral ocelli. Differing from other species mainly in size and by the male genitalia and in possessing only 3 inner subapical spurs. Subgenital plate dark brown. Hindwings extending about one pronotal length beyond forewings. Hind basitarsus with one inner and two outer dorsal spines.

BIOLOGY. Collected in low foliage of a 30 foot tree in a northeastern coastal forest. Other males were singing in higher trees.

SPECIMENS. *Holotype* M, PHILADELPHIA.

Calscirtus timbiensis Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, 2 km southeast of Timbia, Ngoue, 0 - 5 m, 20 ix 1979 (Gagné, Nishida, and Samuelson). HONOLULU.

RECOGNITION. Figs. 46, 47A, B, 48A, 49B, 50C, D. Table 8. Epiphallus very wide at base, then narrowing strongly at apex, with a small U-shaped apical notch; ectoparameres highly

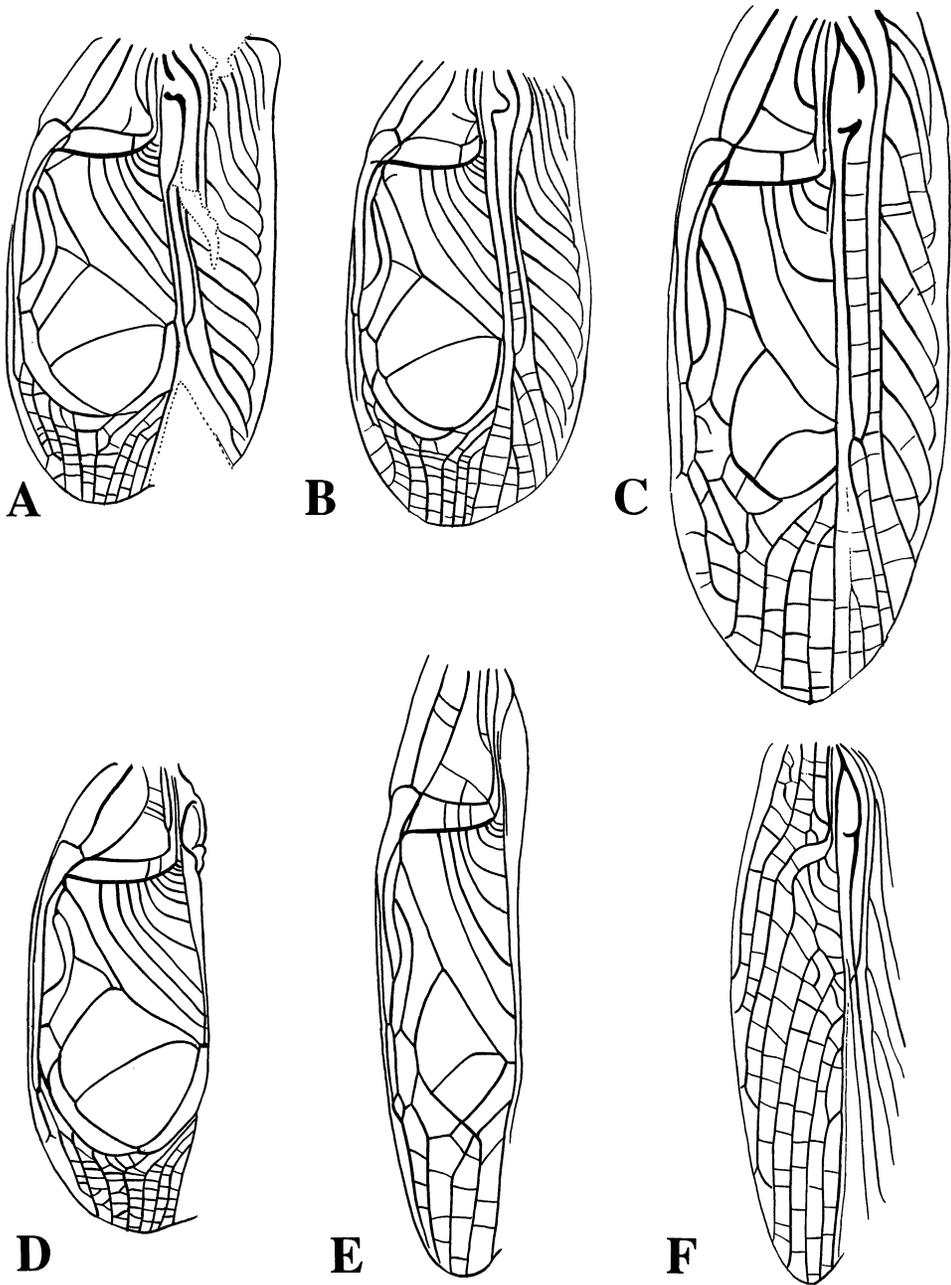


FIG. 41. *Archenopterus* male forewings. A, *hemipteroides*. B, *gressitti*. C, *maai*. D, *bouensis*. E, *amoensis*. F, *hemiphonus*.

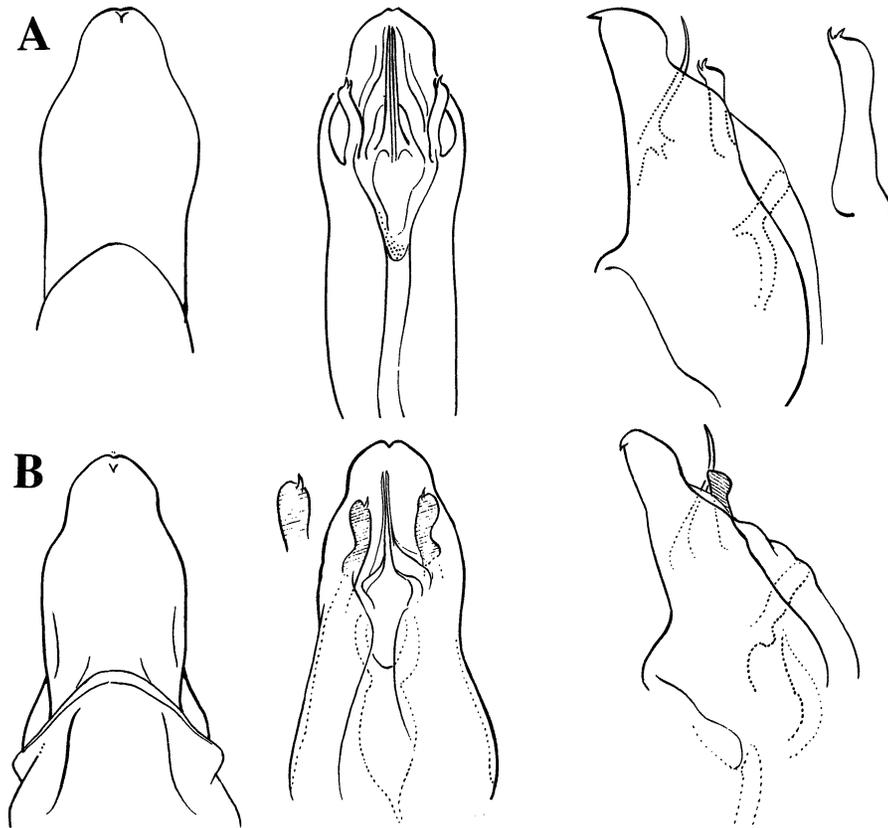


FIG. 42. *Archenopterus* male genitalia (holotypes). A, *gressitti*. B, *hemipteroides*.

Table 8. Comparison of *Calscirtus* species (see Methods for abbreviations).

	BL	FL	CL	FLW/PL	No. subapical spurs inner/outer
<i>paniensis</i>					
M	33	17	10.3	2.3	3/5
<i>timbiensis</i>					
M	24	13.3	10	4.4	5/5
M	23	12.6	10	4.7	5/5
<i>koghi</i>					
M	22	11.8	ca. 8.0	3.9	5/5

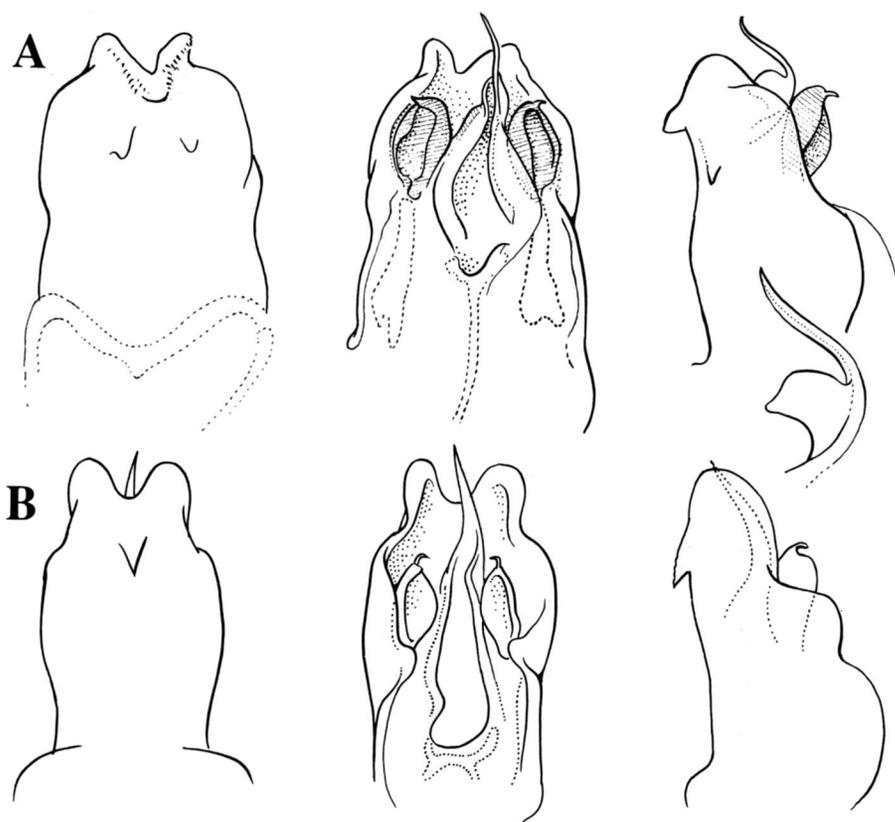


FIG. 43. *Archenopterus* male genitalia (holotypes). A, *maai*. B, *amoensis*.

asymmetrical with only right one developed into a spine.

Males: Head distinctly concave in region bounded by eyes and lateral ocelli. Hind tibiae with ca. 21 outer and 15 inner tibial spines. Hind basitarsus with 2 inner and 2 outer dorsal spines.

BIOLOGY. Collected in coastal forest.

SONG. Not known.

SPECIMENS. *Holotype* M, HONOLULU. *Paratypes:* La Foa, 3 ii 1945 (Milliron) 1M, HONOLULU. Mt Koghi, 420 m, 21 ix 1979 (Gagne, Nishida, and Samuelson) 1M, HONOLULU.

MATUANUS Gorochov

TYPE SPECIES: *Matuanus priapus* (Saussure)

RECOGNITION OF GENUS. Figs. 25E, 51-53. Table 8. Male genitalia symmetrical, epiphallus elongate, upturned at apex and coming to two small apical points; ectoparameres hinged at base, slender, and capable of moving ventrally or laterally with respect to epiphallus, terminating in a small hook; virga very stout. Forewings usually without a stridulum (if a stridulum is present the wing is otherwise simplified, showing loss of the mirror, harp and chords, e.g., *elegans*).

Body slender; male forewings without a mir-

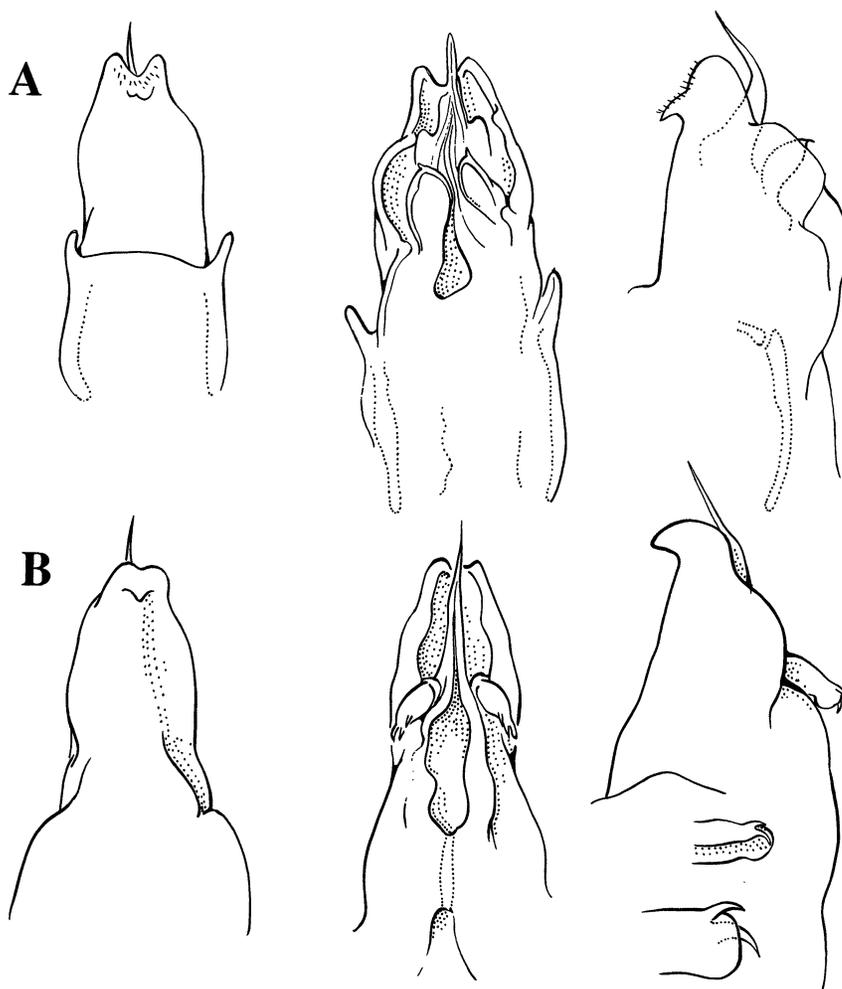


FIG. 44. *Archenopterus* male genitalia (holotypes). A, *hemiphonus*. B, *bouensis*.

ror; in one species (*elegans*) the male possesses a stridulum, in the other (*roussettes*) it does not. Rostrum relatively broad: 0.63 - 0.75 times width of antennal scape. Large tympanal openings on both inner and outer faces. Foretibiae with 3 and midtibiae with 4 apical spurs. Hind tibiae with 5 inner and 5 outer subapical spurs and 3 inner and 3 outer apical spurs. Subgenital plate tapering to a point, but not nearly as long as in *Adenopterus* or *Archenopterus*. TL/FL, 0.93 - 0.95; FW/FL, 0.26 - 0.28.

Matuanus priapus (Saussure)

Podoscirtuspriapus Saussure 1877: 648. Types M and F, New Caledonia (Brunner de Wattenwyl, No. 5964). VIENNA. The types were not seen; they were requested but could not be located. The illustrations of *priapus* are from Gorochov (1986) and are presumed to be of this species.

Munda priapus, Chopard 1968: 411.

RECOGNITION. Fig. 52C.

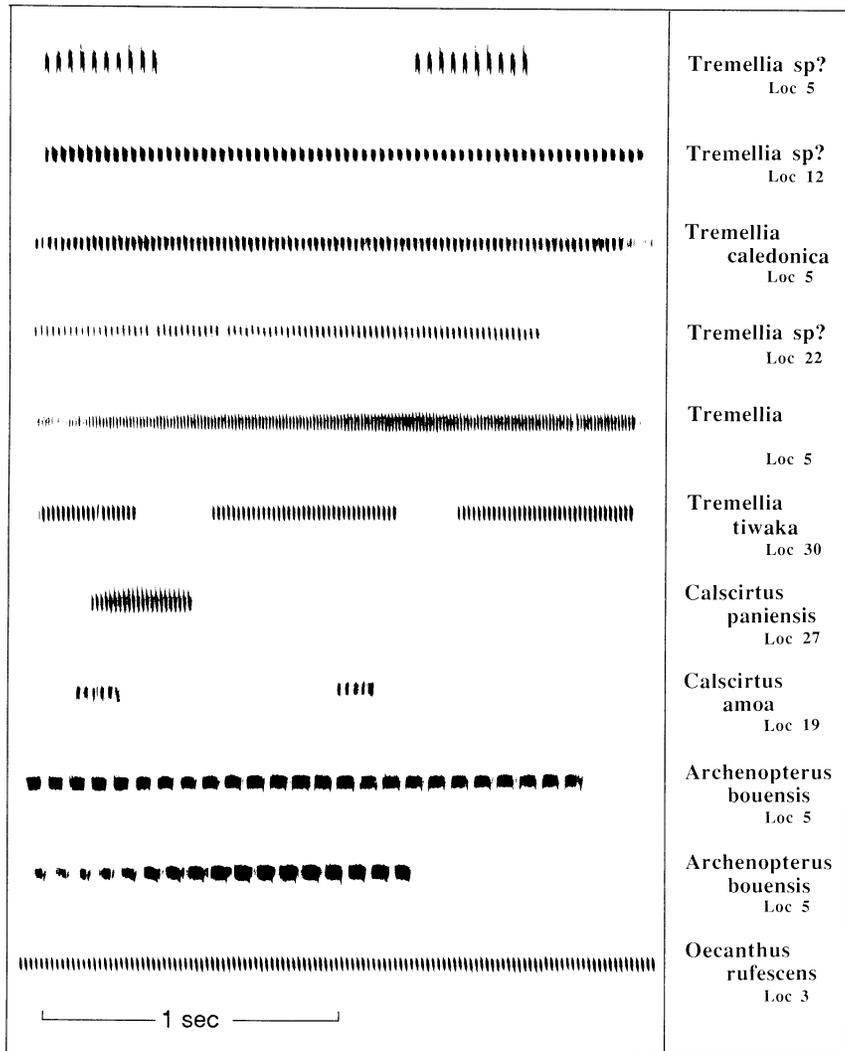


FIG. 45. Songs of *Tremellia*, *Calscirtus*, *Archenopterus* and *Oecanthus* species (Loc, locality).

Matuanus caledonicus (Saussure)

Aphonus caledonicus Saussure 1878: 658. *Holotype* F, New Caledonia (Brunner collection). VIENNA. *Aphonomorphus*, Kirby 1906: 105. *Aphonoides*, Chopard 1968: 401. Type examined. NEW COMBINATION.

RECOGNITION. Fig. 52B. Table 9. Virga of male genitalia extending beyond epiphallus, very

wide and open at apex (most similar to *flavomaculatus* but apex of virga much wider and apex of ectoparameres more like a corkscrew).

Males: A dark reddish brown with pale line along the lateral margins of forewings. Head: dorsum rusty brown then black from midpoint of eyes to median ocellus; face reddish brown; cheeks rusty colored with a small yellow mark along lower-posterior margin of the eye; median ocellus very small. Forewings: dorsum with 9 or

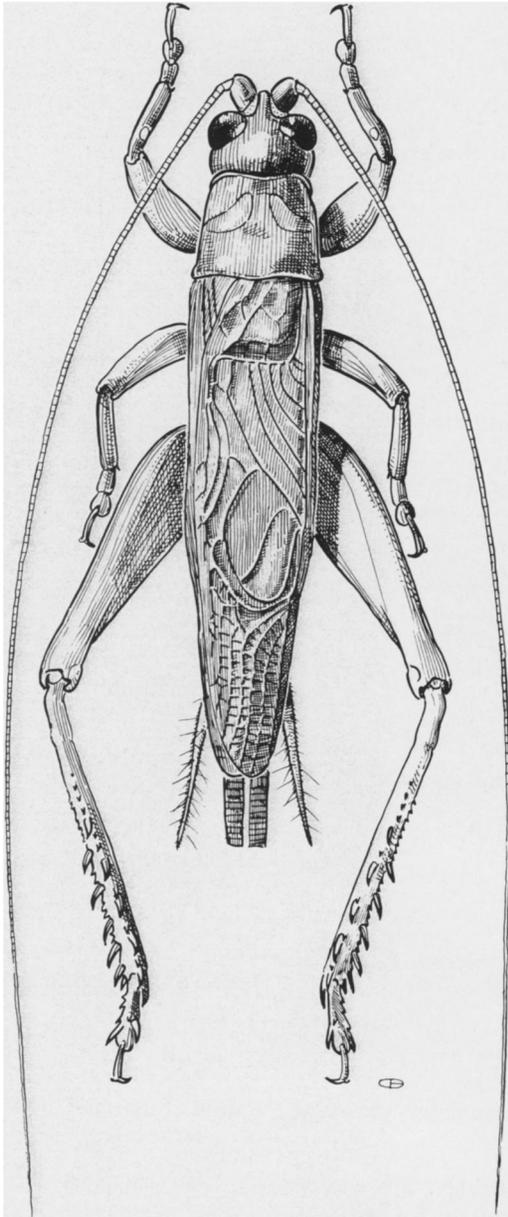


FIG. 46. *Calscirtus timbiensis* male.

10 parallel veins excluding Cu_1 ; veins dark brown, except pale brown to yellow along margins of dorsal field; lateral field blackish. Sc vein dark; R and M veins yellow throughout their length (R brown in *flavomaculatus*); Cu_1 vein brown in basal sixth, then yellow throughout remaining length; Cu_2 though about basal third. Hindwings extending about two pronotal lengths beyond forewings. All legs yellowish brown. Abdomen: subgenital plate tapering to a point, though not as long as in *Adenopterus*.

Females: very similar to males in color but larger.

SPECIMENS. *Holotype* M, VIENNA. *Paratypes*: Col des Roussettes, 450 - 550 m, 4 - 6 ii 1963 (Krauss) 1M, HONOLULU. Yiambi, NE, 0 - 50 m, 15 x 1967 (Sedlacek) 1F, HONOLULU. Valle de Thy, 250 - 500 m, 28 iii 1981 (Gressitt and McPherson) 1F, HONOLULU. Sarramea, 12 ii 1963 (Yoshimoto) 1M, HONOLULU. 25 km W of Canala, forest, 1 iii 1983 (Alexander, Cade, and Otte) 1F, PHILADELPHIA. Above Koné, road to Panaki, forest, 7 iii 1983 (Alexander, Cade & Otte #30) 1F, PHILADELPHIA. West of Ponerihouen, Mt Aopinie, 550 m, 30 vii 1971 (Gressitt) 1M, HONOLULU. Mokoue to Dothio, 150 - 500 m, 20 iii 1968 (Gressitt) 1F, HONOLULU. Hienghene, 0 - 100 m, i 1971 (Krauss) 1F, HONOLULU.

Matuanus elegans Otte, n. sp.

TYPE. *Holotype* M, New Caledonia, 25 km from Col de Roussettes, 6 ii 1963 (Krauss) PHILADELPHIA.

RECOGNITION. Figs. 25, 51, 52A. Table 9. Body patterned as figured. Virga long and tubular and with a tuft of hairs at the apex.

Males: Head: dorsum black posterior to median ocellus; face ivory colored, with a broad brown band descending to the clypeus. Pronotum: dorsum rusty colored; lateral lobes rusty colored in upper half, ivory in lower half. Forewings: with a stridulum but without a mirror; dorsal field with a row of ivory spots on black background along Cu_1 vein; spots located at junc-

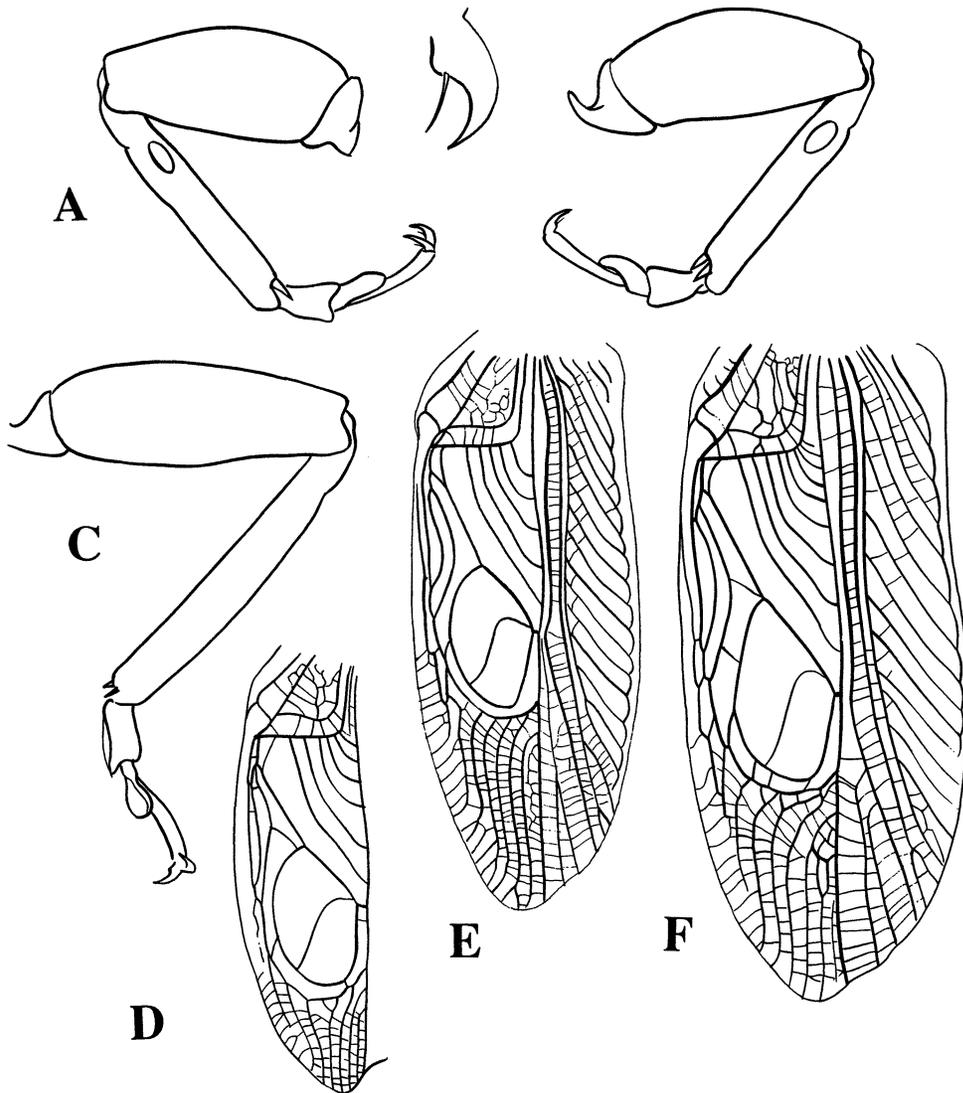


FIG. 47. *Calscirtus*. A, B, *timbiensis* foreleg (left, inner; right, outer). C, *timbiensis* midleg outer. D, *amoa*. E, *timbiensis*. F, *paniensis*.

tion of Cu_1 branches; also ivory along pronotal margin. Hindwings extending one half a pronotal length beyond forewings. Legs marked as in Fig. 51.

Females marked as in males. Occiput with 2 short pale longitudinal lines one either side of medial line. Posterior portion of pronotal disc

becoming dark brown.

SPECIMENS. *Holotype* M, HONOLULU. *Paratypes*: Yahoue, 20 ii 1963 (Yoshimoto) 1M, HONOLULU; 60 - 100 m ii 1980 (Krauss) 1M, PHILADELPHIA. Col de Pitehikara, 300 - 450 m, 8 i 1969 (Krauss) 1M, HONOLULU. Mt. Panie, 8 ii 1963 (Krauss) 1M, HONOLULU. Pouebo, 26 i 1964

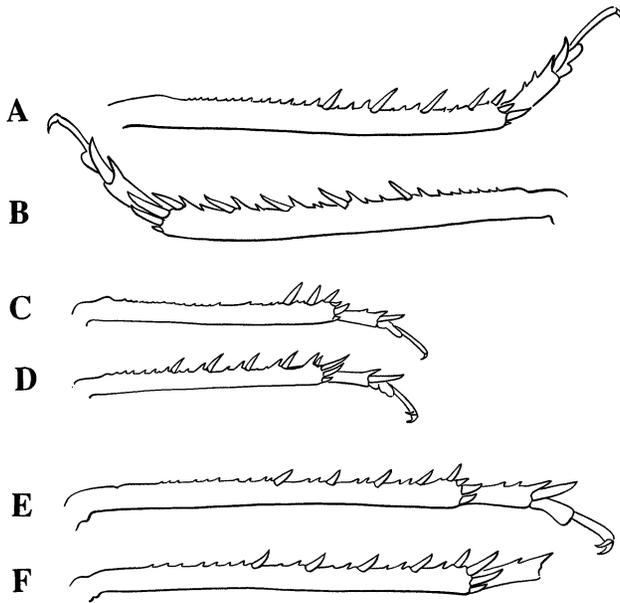


FIG. 48. *Calscirtus* hind tibiae. A, *timbiensis* outer; B, inner. C, *paniensis* outer; D, inner. E, *amoia* outer; F, inner.

(Straatman) 1M, HONOLULU. Col d'Amieu, 650 m 31 iii 1968 (Gressitt and Maa) 1M, HONOLULU. Col de Rousettes, 450 - 550 m, 4 ii 1963 (Krauss) 1M, HONOLULU. Mt Koghi, 27 i 1963 (Yoshimoto) 1M, HONOLULU; ii 1962 (Krauss) 1M HONOLULU; i 1969 (Krauss) 1M, HONOLULU; 26 i 1963 (Yoshimoto and Krauss) 1M, PHILADELPHIA; ii 1973 (Krauss) 1F, PHILADELPHIA; 5 iii 1960 (Gressitt) 1F, HONOLULU; i 1969, 1F HONOLULU; 27 i 1963 (Yoshimoto) 1F HONOLULU; ii 1973 (Krauss) 1F, HONOLULU. Foret de Thi (or Thy), 100 - 200 m, 10 iii 1961 (Sedlacek) 1M PHILADELPHIA; 550 m, 6 iii 1960 (Gressitt) 1F HONOLULU; 100 - 300 m, 25 iii 1961 (Sedlacek) 1F, HONOLULU. Poindimie, 11 ii 1963 (Krauss) 1M HONOLULU. Col d'Amieu, 750 m, 3 iii 1960 (Gressitt) 1F, HONOLULU. 25 km from Col de Rousettes, 6 ii 1963 (Krauss) 1F, HONOLULU. Col de Pirogue, 14 ii 1963 (Krauss) 1F, HONOLULU. Col de Rousettes, 4 ii 1963 (Krauss) 1F, HONOLULU. La Foa-Canala saddle, 480 - 500 m, 30 i 1963 (Yoshimoto) 1F, HONOLULU. Koné,

Table 9. Comparison of *Matuanus* species. V, number of parallel veins on dorsum of forewings (not including Cu1). See Methods for abbreviations.

	BL	FL	CL	FWL/PL	OL/FL	V
<i>caledonicus</i>						
5M	14-18	11-12	8-9	5.7-6.4	-	8-10
6F	18-21	12-14	11.5-13.5	6.3-6.7	0.89-0.97	9
<i>flavomaculatus</i>						
HM	14	9.4	7	5.9	-	8
PM Plum	14.5	10.2	8	6.3	-	8
PM Plum	13	8.2	-	6	-	9
PF Paita	17	-	12	6.6	-	10
PF I. Pines	17.3	12.1	12	6	0.93	9
PF Koghi	18	11.7	11.1	7.3	0.98	8
PF Yahoue	17	13	12	6.4	0.96	9
PF Mt Mou	17	11.5	-	5.9	1.07	8
<i>neoplumas</i>						
HM	14	-	-	5.9	-	9
<i>rufidulus</i>						
HF	11.7	-	5	0.79	-	
<i>elegans</i>						
5M	18-21	13-14	11-12	5.8-6.4	-	10-14
5F	23-27	15-17	12-16	6.2-6.3	0.76- 0.87	

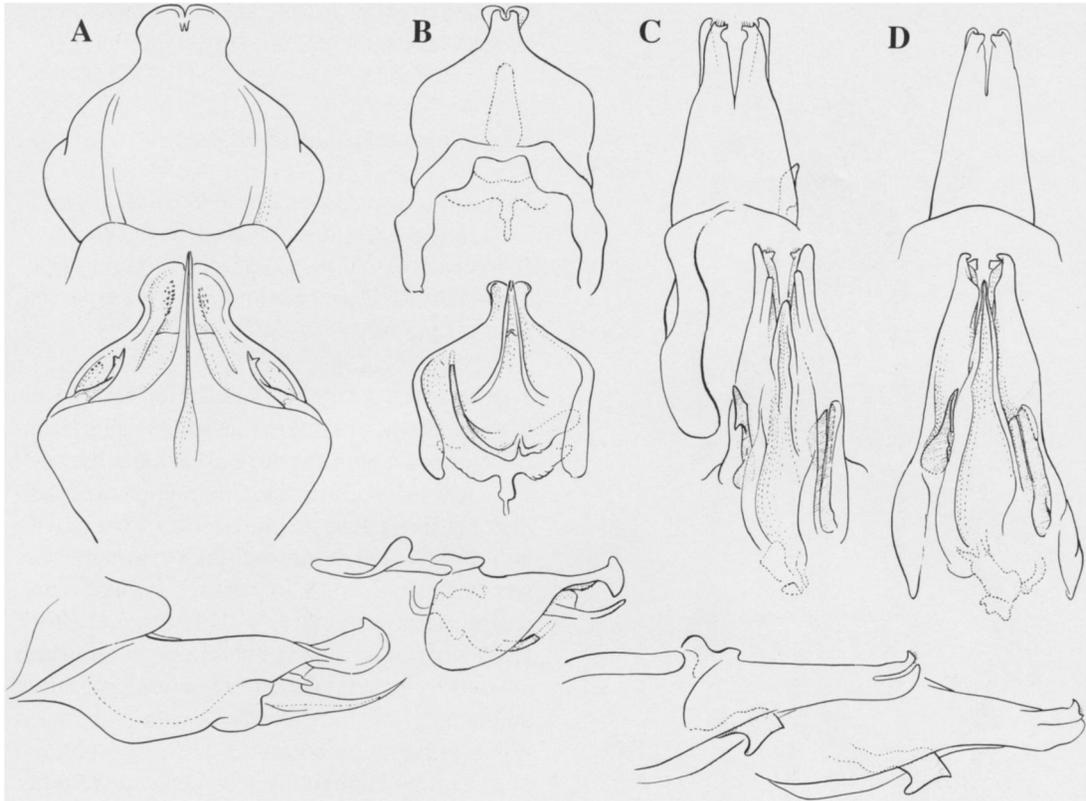


FIG. 49. *Calscirtus* male genitalia (holotypes). A, *paniensis*. B, *timbiensis*. C, *amoa*.

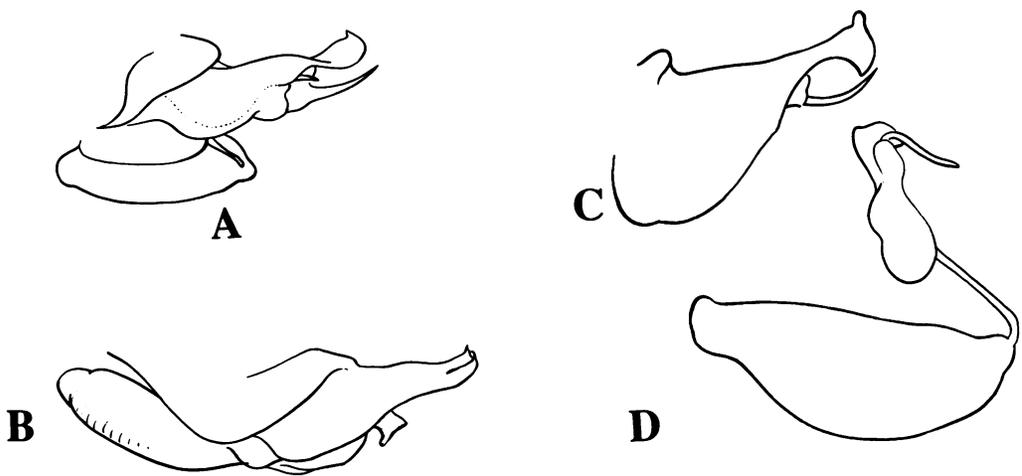


FIG. 50. *Calscirtus*. A, *paniensis* male genitalia showing position of spermatophore. B, *amoa* genitalia showing position of spermatophore. C, D, *timbiensis* showing angle of spermatophore before it is removed.

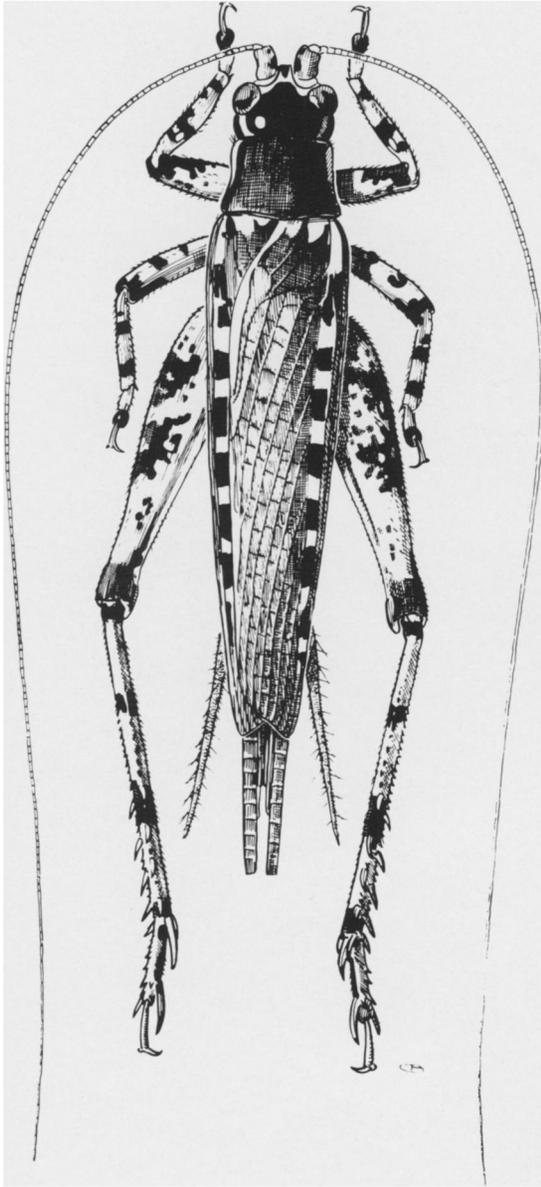


FIG. 51. *Matuanus elegans* male.

mountain forest, road to Panaki, 7 iii 1983 (Alexander, Cade and Otte) 1F, PHILADELPHIA.

***Matuanus rufidulus* (Saussure)**

Podoscirtus rufidulus Saussure 1878: 648. *Holotype* F, La Nouvelle-Calédonie (Collect. de M. Brunner de Wattenwyl). VIENNA. *Podoscirtus*, Kirby 1906: 104. *Munda*, Chopard 1968: 411. Type examined. NEW COMBINATION.

NOTES ON HOLOTYPE. Table 9. Body color pale orange brown; pronotum reddish. Head: dorsum orange brown with slightly darker areas between eyes and on rostrum; face orange-brown, with dark markings at upper end of frons; cheeks with a dark area near lower margin. Pronotum: dorsum reddish; lateral lobes orange-brown. Forewings uniform in color, with 10 parallel veins. Hindwings extending about one pronotal length beyond forewings. Foretibiae with large inner and outer tympana. Foretibiae with 3 and mid-tibiae with 3 apical spurs. Legs uniform pale orange-brown. Hind tibiae with 5 inner and 5 outer subapical spurs. Crescents of hind knees black.

***Matuanus flavomaculatus* Gorochov**

Matuanus flavomaculatus Gorochov 1986: 705. *Holotype* F, New Caledonia, Mt. Koghi. LENINGRAD.

RECOGNITION. Fig. 52. Table 9. Virga of male genitalia extending to end of epiphallus, but narrow and pointed at apex; (apex of virga narrow and apex of ectoparameres more like a small beak).

Males: Similar to *caledonicus*. Body color dark reddish brown, legs paler. Dorsal field of forewings yellow at base and along margins. Head: dorsum reddish brown, black between vertex and median ocellus; with narrow yellow stripe running from posterior of eyes to pronotum; face reddish brown, with two yellow markings between lower margins of antennal

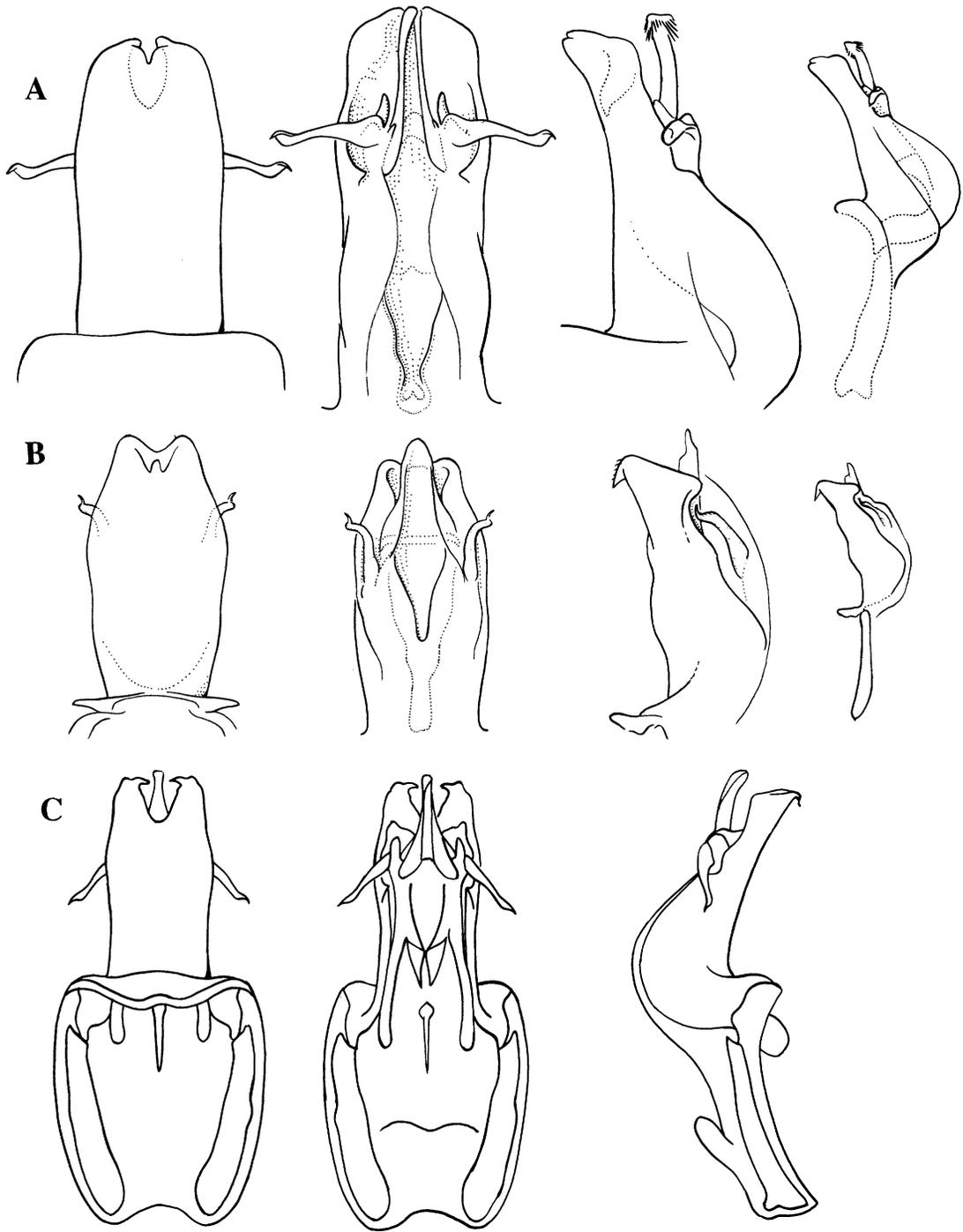


FIG. 52. *Matuanus* male genitalia (holotypes). A, *elegans*. B, *caledonicus*. C, *priapus*.

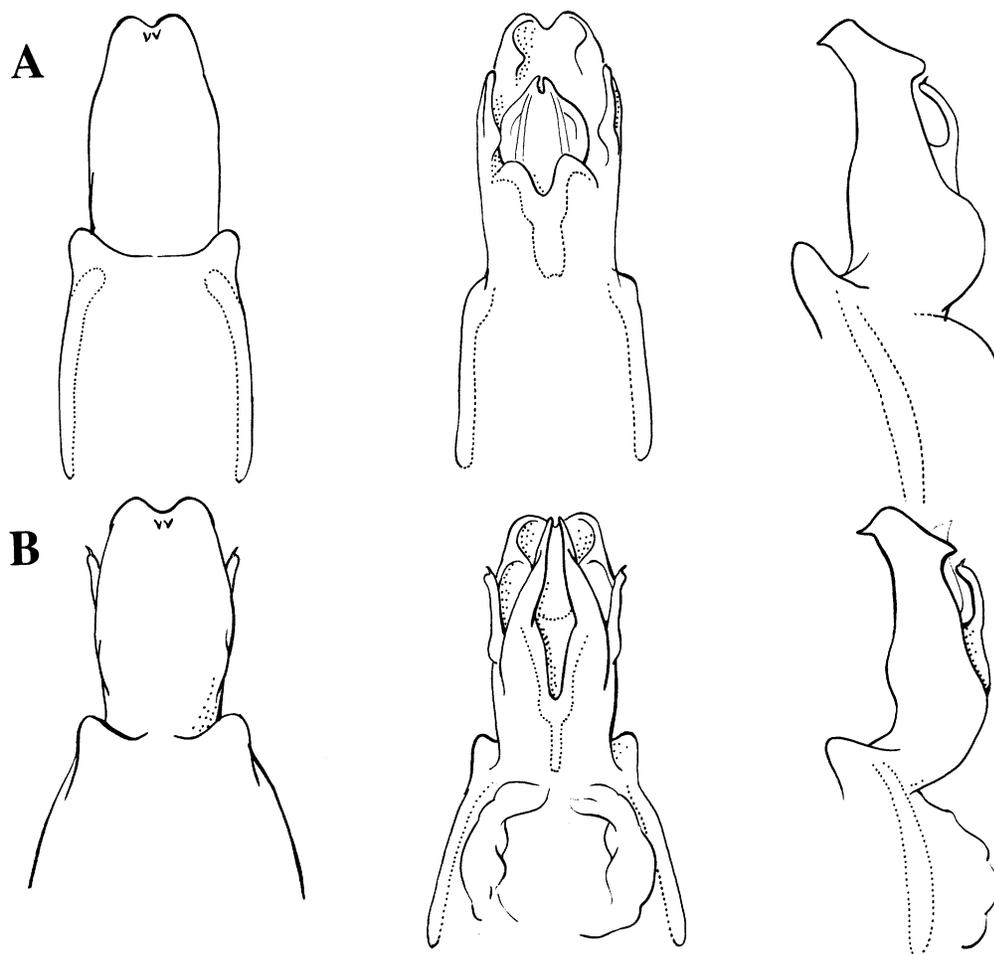


FIG. 53. *Matuanus* male genitalia (holotypes). A, *neoplumus*, B, *flavomaculatus*.

sockets and with a yellow marking along lower posterior margin of the eyes. Pronotum: unicolourous dark reddish brown. Forewings: dorsum dark brown, each forewing with a large yellow marking at base (includes bases of Cu_2 , 1A, 2A, and 3A veins), and with a yellow streak along the lateral margins. Sc vein brown, Sc branches also brown at base then becoming yellow ventrally in some specimens; R vein brown, M vein and area between R and M yellow; Cu_1 vein brown in basal sixth, then yellow. Legs all orange-brown. Hindfemora orange-brown, darker on knees. Foretibiae with 3 and middle tibiae with 4 apical

spurs; hind tibiae with 5 inner and 5 outer subapical spurs.

Females: very similar to males, but larger.

SPECIMENS. *Holotype* M, LENINGRAD. New Caledonia, St. Louis Valley, 17 iii 1945 (H. E. Milliron) 1M, HONOLULU. Between Plum and Yati, 25 iii 1968 (Gressitt) 1M, PHILADELPHIA. 6 km north of Paita, 25 i 1963 (Yoshimoto) 1F, HONOLULU. Isle of Pines, iii 1959 (Krauss) 1F, HONOLULU. Mt Koghi, 500 m, 27 x 1967 (Sedlacek) 1F, HONOLULU. Yahoue, 60 - 100 m, ii 1969 (Krauss) 1F, HONOLULU. Mt Mou, 11 ii 1962 (Krauss) 1F, HONOLULU. Mt. Koghi, Foret de

Thi, 530 m, 8 iii 1961 (Sedlacek) 1F, HONOLULU. La Coulee, 23 i 1963 (Krauss) 1F, HONOLULU. St. Louis, viii, 1M, HONOLULU. 10 km NW Plum, 24 iii 1968 (Gressitt and Maa) 1M, HONOLULU.

Matuanus neoplumus Otte, n. sp.

TYPE. *Holotype* M, Yahoue, 22 i 1963 (Yoshimoto). HONOLULU.

RECOGNITION. Fig. 52. Table 9. Very similar to *caledonicus* but virga short and wide, not extending beyond the ectoparamers.

Males: Body color dark reddish brown, with yellow lateral stripes. Head: occiput reddish brown, black from vertex to median ocellus; with a narrow yellow stripe behind each eye; median ocellus about one third the size of the lateral ocellus; face reddish brown; cheeks with a small yellow spot at lower posterior margin of eyes. Pronotum uniform reddish brown. Forewings: dorsum gray brown with darker veins; anterior end with large yellow patch at bases of Cu₂, 1A, 2A, and 3A. Sc and R veins brown, M vein bright yellow in basal third, then less bright over remaining length. Cu₁ vein brown in basal quarter then yellow through remainder. Fore- and midlegs orange-brown. Hindlegs lost. Hindwings extending two pronotal lengths beyond the forewings.

Females: not known.

SPECIMENS. *Holotype* M, HONOLULU.

LITERATURE CITED

- BALLANCE, P. F. (ed.). 1980. Plate tectonics and biogeography in the southwest Pacific: the last 100 million years. *Paleogeography, Paleoclimatology and Paleoecology* 31(2-4): 101-372.
- CHOPARD, L. 1915. Gryllidae de la Nouvelle-Calédonie et des Iles Loyalty. F. Sarasin & J. Roux (ed) Nova Caledonia, Zoologie Vol. II, No. 8. C. W. Kreidels Verlag, Wiesbaden.
- CHOPARD, L. 1967. *Orthopterorum Catalogus*. Pars 10. W. Junk, Gravenhage
- CHOPARD, L. 1968. *Orthopterorum Catalogus*. Pars 12. W. Junk, Gravenhage
- CHOPARD, L. 1970. Ergebnisse der Österreichischen Neukaledonien-Expedition 1965. Neue und wenig bekannte Orthopteren aus Neukaledonien. II. Gryllodea. *Ann. Naturhistor. Mus. Wien* 74: 285-288.
- GOROCHOV, A. V. 1986. New and little known crickets (Orthoptera, Gryllidae) from Australia and Oceania. *Revue d'Entomologie de l'URSS* 65 (4): 692-708.
- GRESSITT, J. L. 1961. Problems in the zoogeography of Pacific and Antarctic insects. *Pacific insects Monograph* 2: 1-127.
- HOLLOWAY, J. D. 1979. *A survey of the Lepidoptera, Biogeography and Ecology of New Caledonia*. Dr. W. Junk, The Hague.
- KROENKE, L. W. 1984. Cenozoic tectonic development of the Southwest Pacific. U.N. ESCAP, CCOP/SOPAC Technical Bulletin 6: 1-123.
- COLEMAN, P. J. 1980. Plate tectonics background to biogeographic development in the Southwest Pacific of the last 100 million years. *Paleogeography, Paleoclimatology and Paleoecology* 31(2-4): 105-122.
- OTTE, D. AND R. D. ALEXANDER. 1983. *The Australian Crickets*. Academy of Natural Sciences Monograph 22: 1-477.
- OTTE, D. AND D. C. RENTZ. 1985. The crickets of Lord Howe and Norfolk Islands (Orthoptera, Gryllidae). *Proceedings of the Academy of Natural Sciences of Philadelphia* 137(2): 79-101.
- SAUSSURE, H. DE. 1878. *Mélanges orthoptérologiques*, 6^e fasc., *Mém. Soc. Genève*, XXV: 369-696.
- THORNTON, I. W. B. 1980. Plate tectonics and the distribution of the insect family Philotarsidae (Order Psocoptera) in the Southwest Pacific. *Paleogeography, Paleoclimatology and Paleoecology* 31(2-4): 251-266.