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Crickets of New Caledonia (Insecta, Orthoptera, Grylloidea): a key to genera, with diagnoses of extant genera and descriptions of new taxa

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ABSTRACT

Crickets (Insecta, Orthoptera, Gryllidea) are amongst the most abundant and diverse insects in New Caledonia: 40 genera are recorded today from the Archipelago and 180 cricket species have been reported; 19 genera and more than 90% of the species are endemic. Owing to this diversity, crickets prove an interesting model to test evolutionary hypotheses about New Caledonia and its fauna. They also reveal useful ecological indicators to survey and manage New Caledonian biodiversity. Both research and conservation developments need however that crickets are properly identified. In the present paper, an illustrated key to the identification of New Caledonian cricket genera is proposed, based on specimen examination; an emended diagnosis is given for each genus, using general morphology, coloration and the main traits of male genitalia, together with available data on habitat and biology. The genus *Paora* Gorochov, 1986 n. stat. is restored from its synonymy with *Apteronomobius* Chopard, 1929, *Trigonidomorpha* Chopard, 1925 n. stat. is restored as a valid genus, not a subgenus of *Trigonidium* Rambur, 1839, and one new genus and five new species are described: *Archenopterus adamantus* Desutter-Grandcolas, n. sp. (Gryllidae, Podoscirtinae), *Caledonina* Desutter-Grandcolas, n. gen., with *Caledonina chopardi* Desutter-Grandcolas, n. gen., n. sp. as the type species, *Koghiella minima* Desutter-Grandcolas, n. sp. and *Orintia cornuta* Desutter-Grandcolas, n. sp. (Trigonidiidae, Nemobiinae), and *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp. (Gryllidae, Gryllinae).

KEY WORDS

Orthoptera,
Grylloidea,
Oceania,
identification key,
new species,
new genus.

RÉSUMÉ

Les grillons de Nouvelle-Calédonie (Insecta, Orthoptera, Grylloidea): clé d'identification des genres, diagnoses des genres existants et description de nouveaux taxons.

Les grillons (Insecta, Orthoptera, Grylloidea) sont parmi les insectes les plus abondants et les plus divers en Nouvelle-Calédonie : 40 genres sont répertoriés aujourd'hui dans l'Archipel et 180 espèces y ont été signalées ; 19 genres et plus de 90 % des espèces sont endémiques. Du fait de cette diversité, les grillons constituent un excellent groupe modèle pour tester des hypothèses évolutives sur la Nouvelle-Calédonie et sa faune. Ils se sont aussi révélés des indicateurs écologiques utiles pour caractériser et suivre la biodiversité en Nouvelle-Calédonie. Cependant tant la recherche, que les actions de conservation, demandent que les grillons soient correctement identifiés. Dans cet article, nous proposons une clé illustrée d'identification des genres de grillons présents en Nouvelle-Calédonie, clé construite à partir de l'observation de spécimens ; pour chaque genre, nous donnons également une diagnose actualisée, établie sur les caractères de morphologie générale, la coloration et les traits principaux des genitalia mâles, ainsi que les informations disponibles sur son habitat et sa biologie. Le genre *Paora* Gorochov, 1986 n. stat., mis en synonymie avec *Apteronemobius* Chopard, 1929, est restauré, *Trigonidomorpha* Chopard, 1925, n. stat. est restauré en tant que genre valide, et non plus comme un sous-genre de *Trigonidium* Rambur, 1839, et un nouveau genre et cinq nouvelles espèces sont décrits : *Archenopterus adamantus* Desutter-Grandcolas, n. sp. (Gryllidae, Podoscirtinae), *Caledonina* Desutter-Grandcolas, n. gen., dont l'espèce type est *Caledonina chopardi* Desutter-Grandcolas, n. gen., n. sp., *Koghiella minima* Desutter-Grandcolas, n. sp. et *Orintia cornuta* Desutter-Grandcolas, n. sp. (Trigonidiidae, Nemobiinae), et *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp. (Gryllidae, Gryllinae).

MOTS CLÉS
Orthoptera,
Grylloidea,
Océanie,
clé d'identification,
espèces nouvelles,
genre nouveau.

INTRODUCTION

As a result of its geological history and environmental properties (Myers *et al.* 2000; Pelletier 2006; Grandcolas *et al.* 2008; Mittermeier *et al.* 2011; Cluzel *et al.* 2012), New Caledonia is characterized by a very high level of endemism of its fauna and flora and a strong disharmony at the regional scale. The archipelago is considered both a hotspot of biodiversity and a laboratory of evolution.

The cricket fauna (Insecta, Orthoptera, Grylloidea) of New Caledonia fits the general pattern, as it is both highly endemic and strongly disharmonic. Following the pioneering work of Chopard (1915), it has been well-studied in the recent decades (Chopard 1970; Gorochov 1986a; Otte *et al.* 1987; Desutter-Grandcolas 1997a, b, c, d, 2002; Desutter-Grandcolas & Robillard 2006; Robillard & Desutter-Grandcolas 2008; Robillard *et al.* 2010; Desutter-Grandcolas *et al.* 2014; Anso *et al.* 2016a). 180 species are currently known from Grande Terre and the nearby islands, and most of them are microendemic (Nattier *et al.* 2012; see Anso *et al.* 2016b).

Thanks to their diversity and state of knowledge, crickets can be used as a model group to test hypotheses about the evolution of New Caledonian biotas. Three successive colonization events were for example put in evidence in the gryllid subfamily Eneopterinae, each colonization being characterized by a certain amount of diversification, habitat specialization and endemism (Desutter-Grandcolas & Robillard 2006). Using phylogenetic tools, the origin of the clade comprising *Agnotecous* Saussure, 1878 and *Pixibinthus* Robillard & Anso, 2016 was dated just after the re-emergence of New Caledonia, some 34 Myr ago, and the diversification of *Agnotecous* toward forest habitats and *Pixibinthus* toward shrubland vegetation from about 20 Myr (Anso *et al.* 2016b).

High abundance in the natural environments, and a key role in food chain and ecosystem functioning (Prather *et al.* 2013) also give the cricket model a most promising value for ecological studies and environmental surveys. For example, at a small scale of observation, the vegetation gradient between maquis shrubland and rainforest in Southern New Caledonia has been characterized by different cricket communities, revealing specific specialisation in habitat use and species replacements along forest regeneration (Anso 2016). Crickets finally reveal an efficient tool for habitat survey using bioacoustics (i.e. in ecoacoustic applications, see Sueur & Farina 2015), as cricket advertisement calls are good evidence to attest the presence of individual species and follow variations in species abundance (Anso 2016). This method has been applied to detect the early presence of invasive ants in natural environments (Anso 2016), and could be particularly useful in a general context of forest contraction in New Caledonia (Ibanez *et al.* 2013).

The future developments of all these kind of studies require however that both knowledge and expertise on crickets are easily available for ecological and evolutionary studies.

In this aim, we propose a key to identify crickets at the generic level. The species level is still not attainable for the moment, given that several tens of species are still awaiting formal descriptions (LDG, pers. obs.); moreover, congeneric species can be characterized mostly by male genitalia, coloration, size and calling songs, characters which are not easily used in a dichotomic identification key. An emended diagnosis for each genus, based on morphology and the main traits of male genitalia, is also given. Both the key and the diagnoses have been built after direct examination of collection specimens, except for few monospecific genera known by one, or very few specimens: many characters are

thus described here for the first time, and most diagnostic characters are illustrated. Pictures of endemic genera are given; habitat and acoustic specialisation are also documented when possible.

From a taxonomic point of view, several statements needed to be made: the genus *Paora* Gorochoy, 1986 n. stat. is restored from its synonymy with *Apteronomobius* Chopard, 1929. The genus *Trigonidomorpha* Chopard, 1925 n. stat. is restored as a valid genus, not a subgenus of *Trigonidium* Rambur, 1839. One new genus and five species new to science are described, i.e. *Archenopterus adamantus* Desutter-Grandcolas, n. sp., *Caledonina chopardi* Desutter-Grandcolas, n. gen., n. sp., *Koghiella minima* Desutter-Grandcolas, n. sp., *Orintia cornuta* Desutter-Grandcolas, n. sp. and *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp.

Finally, the relationships of New Caledonian cricket genera are discussed in the general frame of the molecular phylogeny (Fig. 17) proposed by Chintauan-Marquier *et al.* (2016) for the whole cricket clade.

MATERIAL AND METHODS

Emended diagnoses have been built using the cricket collections of the Muséum national d'Histoire naturelle, Paris, which have been enriched with New Caledonian taxa thanks to successive research programs since more than 25 years. For three monospecific genera (*Amonemobius* Otte, 1987, *Ignambina* Otte, 1987, *Ionemobius* Otte, 1987) and *Aphonoides ouveus* Otte, 1987 no specimen could be observed and diagnoses were based solely on the literature, including original descriptions.

Calling songs were recorded with a microphone (Seinheiser K6/ME62, frequency range: 20-20 kHz \pm 2.5 dB), placed at 40 cm from the calling male, connected to a Field memory recorder Fostex FR-2LE (48 kHz sampling frequency, stereo). Time of day, temperature and calling site were noted for each calling male. Songs were recorded in "wav" format, and deposited in the Sound Library of the MNHN (where they can be found using their unique reference number: MNHN-SO-[YEAR]-XXXX).

Calling songs were analyzed with the computer software Avisoft-SASLab Pro (version 5.2.06, Specht 2012). Automatic analyses were performed under human supervision to avoid aberrant measurement. Temporal characteristics (syllable lengths, intra-syllable silences) and spectral characteristic (dominant frequency) were collected with "automatic train". Songs were described and analyzed according to the terminology of Ragge & Reynolds (1998). One syllable is the elementary unit of the singing call and corresponds to one opening-closure cycle of the male forewings. A repeated group of syllables is called an echeme, and a group of echemes is called an echeme-sequence.

Photos in the field were taken by Jérémy Anso (JA), Laure Desutter-Grandcolas (LDG), Philippe Grandcolas (PG), Sylvain Hugel (SH) or Hervé Jourdan (HJ).

ABBREVIATIONS AND SYMBOLS

Specimens

fn field number.

Male genitalia

Membranous parts are figured with dots. In the legends, structures seen by transparency through the membranes are designated with dotted lines. Structures are named after Desutter (1987) and Desutter-Grandcolas (2003):

a.l.	apical lobe of pseudepiphallal sclerite;
arc	ectophallic arc;
d. cav.	dorsal cavity;
ec. a.	ectophallic apodeme;
ec. f.	ectophallic fold;
E.E.I.	epi-ectophallic invagination;
en. a.	endophallic apodeme;
en. s.	endophallic sclerite;
gl	paired gland of ejaculatory duct;
l. l.	lateral lobe of pseudepiphallal sclerite;
m. l.	median lobe of pseudepiphallal sclerite;
ps.	pseudepiphallal sclerite;
ps. a.	pseudepiphallal apodeme;
ps. p.	pseudepiphallal parameres;
r.	ramus;
v. v.	ventral valve.

General morphology

I, II, III	anterior, median, posterior (leg, tarsomere);
ai1, 2, 3	tibial inner apical spur 1 (ventral), 2 (median) or 3 (dorsal);
ao1	tibial outer apical spur 1 (ventral), 2 (median), 3 (dorsal);
DD, LL	dorsal disc, lateral lobe of pronotum;
FW	forewing;
HW	hindwing;
sai1, 2, 3	tibial inner subapical spur 1 (most apical), 2 or 3;
sao1, 2, 3	tibial outer subapical spur 1 (most apical), 2 or 3.

Wing venation

Named after Desutter-Grandcolas (2003) and Robillard & Desutter-Grandcolas (2004):

A1	first anal vein (bearing the stridulatory file);
CuA, P	anterior, posterior cubital vein;
M	media vein;
R	radial vein;
Sc	subcostal vein.

Acoustic data

dB	decibel;
kHz	kilohertz;
ms	millisecond;
s	second.

Repository

MNHN Muséum national d'Histoire naturelle, Paris.

Database

OSF, Orthoptera Species File online (<http://orthoptera.speciesfile.org>).

Specimens deposited in the MNHN collections have a unique inventory number, MNHN-EO-ENSIFXXXX, and can be found in the collection data base of the MNHN at the following address: <https://science.mnhn.fr/institution/mnhn/collection/eo/search>

Measurements (in mm)

iod	intra-ocular distance;
FIII	length of hind femur;
FIIIw	width of hind femur;
FWL	forewing length;
FWw	median forewing width, measured at the level of mirror anterior angle unless noticed;
PronL	pronotum length;
PronWa/p	anterior / posterior pronotum width;
TIIIL	length of hind tibia.

LIST OF STUDIED GENERA

Valid taxa are in bold. Symbols: (*), genera that cannot presently be ascertained as monophyletic; (1), taxa mentioned for the first time from New Caledonia.

Adenopterus Chopard, 1951 (*);
Agnotecous Saussure, 1878;
Amonemobius Otte, 1987;
Amusurgus Brunner von Wattenwyl, 1893 (1);
Anaxipha Saussure, 1874 (*);
Aphonoides ouveus Otte, 1987;
Archenopterus Otte, 1987 (*);
Bobilla Otte & Alexander, 1983;
Bullita Gorochov, 1986a;
Caledonina Desutter-Grandcolas, n. gen.;
Calscirtus Otte, 1987;
Caltathra Otte, 1987;
Cardiodactylus Saussure, 1878;
Ectatoderus Guérin-Méneville, 1847 (*, S. Ingrisch, pers. comm.);

Fikola Gorochov, 1986a;
Grylloides Saussure, 1874;
Gryllotalpa Latreille, 1804;
Ignambina Otte, 1987;
Ionemobius Otte, 1987;
Kanakinemobius Desutter-Grandcolas, 2016;
Koghiella Otte *et al.*, 1987;
Lebinthus Stål, 1877;
Lepidogryllus Otte & Alexander, 1983;
Matuanus Gorochov, 1986a;
Metioche Stål, 1877 (*);
Myrmecophilus Berhold, 1827;
Notosciobia Chopard, 1915;
Oecanthus Serville, 1831;
Orintia Gorochov, 1986a;
Ornebius Guérin-Méneville, 1844;
Paniella Otte *et al.*, 1987;
Paora Gorochov, 1986a n. stat.;
Parendacustes lifouensis Desutter-Grandcolas, 2002;
Pixibinthus Robillard & Anso, 2016;
Pixipterus Desutter-Grandcolas, 2016;
Protathra Desutter-Grandcolas, 1997;
Proturana Otte, 1987;
Pseudotrignidium Chopard, 1915;
Tapinopus platyceps Saussure, 1878 *nomen dubium* (Otte *et al.* 1987);
Teleogryllus Chopard, 1961;
Thetella Otte and Alexander, 1983 (1);
Trigonidomorpha Chopard, 1925 (*).

KEY TO THE CRICKET GENERA OF NEW CALEDONIA

The key has been built for males and females, but only for adults; juveniles may be difficult to identify, even at the generic level. The genera that cannot presently be ascertained as monophyletic are identified in the key below with an asterisk (*).

1. Front leg adapted to burrowing. Head small and triangular. Occurrence not ascertained in New Caledonia *Gryllotalpa* Latreille, 1804
 — Front leg not adapted to burrowing. Head not triangular 2
2. Body size less than 3 mm long; globular species with multiarticulated cerci strongly divergent from the body. Species living in symbiosis with ants exclusively. *Myrmecophilus* Berhold, 1827
 — Body size larger, shape more elongated, cerci unarticulated and prolonging the body. Species not associated with ants 3
3. Body covered with scales. Head dorsally flattened, face bulged. Size small to medium 4
 — Body without scales. Head rounded or not so flattened, face not bulged. Pronotum transverse, variable in size, not covering part of abdomen and FWs 5
4. Pronotum moderately produced backwards in males, leaving a large part of the tegmina uncovered (see Ingrisch 2006: figs 31-40) *Ornebius* Guérin-Méneville, 1844
 — Pronotum strongly produced backwards in male (see Ingrisch 2006: figs 46, 47) *Ectatoderus* Guérin-Méneville, 1847*
5. Head prognathous. Pronotum narrow, longer than wide. Coloration light green. Male: FWs very wide compared to body width; stridulum with a wide mirror separated into two wide cells. Cerci short and thick *Oecanthus* Serville, 1831 (Fig. 15B)
 — Head orthognathous. Pronotum never as narrow, wider than long (except in *Pseudotrignidium*). Species coloration different. Male: FWs not as wide; mirror not separated into two large cells. Cerci long and thin 6
6. Tarsomeres 2 widened and flat (Fig. 1A) 24
 — Tarsomeres 2 cylindrical, not flat (Fig. 1B) 7



FIG. 1. — Details of morphological characters: **A, B**, Tarsomeres 2 in *Amusurgus* sp. (Trigonidiinae) (**A**), and in *Kanakinemobius mandjelia* Desutter-Grandcolas, 2016 (Nemobiinae) (**B**); **C-E**, head dorsum in *Notosciobia minoris* Anso & Desutter-Grandcolas, 2016 (Gryllinae) (**C**), frontal view, *Pseudotrignididium ana* Anso & Desutter-Grandcolas, 2016 (**D**), and *Protathra centralis* Desutter-Grandcolas, 2014 (Phalangopsidae) (**E**), frontal (**D**) and fronto-lateral (**E**) views; **F, G**, Male FWs in *Koghiella flammea* Anso & Desutter-Grandcolas, 2016 (Nemobiinae) (**F**), and *Protathra gigantea* Desutter-Grandcolas, 1997 (**G**); **H-J**, habitus female of (**H**) *Bullita fusca* Gorochov, 1986 (Nemobiinae), (**I**) *Koghiella flammea* (Nemobiinae), and (**J**) *Kanakinemobius mandjelia*; **K**, male genitalia of *Koghiella flammea*, dorsal view; **L**, Tarsal claws of *Anaxipha* sp. (Trigonidiinae), frontal view; **M**, Male tegminal gland in *Adenopterus octolineatus* Desutter-Grandcolas, 2016 (Podoscirtinae); **N**, Tegminal pubescence in *Amusurgus* sp. Scales bars: 1 mm.

7. Head dorsum rounded, without setae between antennal scapes (Fig. 1C) 8
- Head dorsum not rounded, with strong setae between antennal scapes (Fig. 1D) 11

8. Body ochre brown, pubescent. Median ocellus reduced or lacking. Pronotum only slightly longer than wide, often narrowed posteriorly; LL with a distinctive longitudinal groove in posterior third. Males: FWs most often covering between half and complete abdomen. Stridulum complete, but mirror ill-defined from apical field and often partly filled with cells. Females: FWs flap-like or lacking. Ovipositor very short. Male genitalia: pseudepiphallic sclerite transverse, with two short lateral lobes and no median process; ectophallic fold short, dorsal cavity low. Species living in rain forest *Notosciobia* Chopard, 1915 (Fig. 10A)
- Body brown or tawny, shining. Median ocellus present, sometimes smaller than lateral ocelli. Pronotum clearly transverse. LL without a groove in posterior third. Males: FWs covering most or completely the abdomen, except in *Grylloides* Saussure, 1874; stridulum complete with a well-defined mirror. Females: FWs well-developed, except in *Grylloides* Saussure, 1874; ovipositor well-longer. Species living in open, often man-induced, environments, even cities 9

9. Head dorsum with an alternation of clear and brown transverse bands. Pronotum light yellow, except for the posterior margin and a round dot on LL black brown. Male FWs reduced, covering about half abdomen; apical field very short. Female ovipositor very long *Grylloides* Saussure, 1874 (Fig. 10E)
- Head dorsum with faint longitudinal yellowish lines; suture or a wide band between lateral ocelli yellow. Pronotum either well-marked with brown, or wholly dark. Males: FWs longer than half abdomen. Females: ovipositor not as long 10

10. Pronotum DD and LL dark brown. Male genitalia: pseudepiphallic sclerite elongate and narrow, broadly triangular at apex, with the median process longer than the lateral ones; ectophallic fold long; dorsal cavity high *Teleogryllus* Chopard, 1961 (Fig. 10B)
- Pronotum DD either yellow abundantly marked with brown, or black brown; LL lower half always light yellow. Male genitalia: pseudepiphallic H-shaped with long disto-lateral lobes, and with or without a short median process *Lepidogryllus* Otte & Alexander, 1983 (Fig. 10C, D)

11. Size small to very small. Legs short with wide FIII. Body and head with long and thick setae. TIII not serrulated. When males have a stridulum, mirror reduced and not clearly separate from apical field cells (Fig. 1F) 12
- Size much bigger. Legs much more elongate. Body and head without such big setae. TIII serrulated between and above subapical spurs. When males have a stridulum, mirror present and well delimited (Fig. 1G) 22

12. TIII with four inner subapical spurs 13
- TIII with two or three inner subapical spurs 18

13. Very small species (body length less than 5 mm). Pronotum very transverse, about half as long as wide. Males: TIII fourth (most basal) inner subapical spur glandular (short, thick, blunt apically, as in Figs 8D, 9E) *Caledonina* Desutter-Grandcolas, n. gen. (Fig. 9A)
- Size bigger. Pronotum never as transverse. Males: TIII inner subapical spurs not glandular 14

14. TI with a large outer tympanum (except in *Koghiella minima* Desutter-Grandcolas, n. sp.). DD transverse with subparallel margins. Male FWs well developed (shorter in *K. minima* Desutter-Grandcolas, n. sp.), with a functional stridulatory file and a harp 15
- TI without a tympanum or with a very small outer one. DD posterior margin distinctly convex. Male FWs very short, without a stridulum (impressed file sometimes present) 17

15. Adult coloration uniform, body brown to black brown, legs ochre to dark brown. Females (Fig. 1H) brown with transverse lighter bands on abdomen and FWs; FWs very short *Bullita* Gorochov, 1986 (Fig. 4A)
- In adults, head, pronotum and FWs variegated coloured dorsally, head and pronotum contrastingly black laterally (head coloration uniform in *Koghiella minima* Desutter-Grandcolas, n. sp.); tibiae annulated yellow and black brown. Female without transverse lightly coloured stripes (Fig. 1I for *Koghiella*) 16

16. Male genitalia: pseudepiphallic sclerite triangular, longer than wide, with bifid apex (Fig. 1K). Genus distributed through the whole Grande Terre *Koghiella* Otte *et al.*, 1987 (Figs 4C, 5A)
- Male genitalia: pseudepiphallic sclerite very wide, wider than long, not bifid at apex (Otte *et al.* 1987: Fig. 17C). Only one species, from coastal forest near Oubatché *Ignambina* Otte, 1987
- Male genitalia: pseudepiphallic sclerite widely bifid at apex, and more rounded than triangular (Otte *et al.* 1987: Fig. 17B). Only one species, from Amoa valley *Amonemobius* Otte, 1987

17. Maxillary palpi elongate, joint 5 regularly widened toward apex. TI with a small outer tympanum. Coloration brown to ochre brown, without a distinct pattern on pronotum. Male: when present, FWs short but overlapping with a reduced but functional stridulum *Paora* Gorochov, 1986 n. stat. (Fig. 4E)

- Maxillary palpi short, joint 5 wide and more triangular. TI without a tympanum. Coloration: head and pronotum black brown, the anterior margin of pronotum and a wide band along the DD distal margin ivory (Fig. 1J). Male: when present, FWs very short, not or little overlapping; no complete stridulum, but sometimes a small file present *Kanakinemobius* Desutter-Grandcolas, 2016 (Fig. 1J).
- 18. TI without an outer tympanum *Paniella* Otte *et al.*, 1987 (Fig. 4D)
- TI with an outer tympanum 19
- 19. Head very large, wider than the pronotum. Males apterous *Orintia* Gorochov, 1986 (Fig. 6A)
- Head not as wide. Male with FWs variable in size, but with a functional stridulum 20
- 20. Large and massive species; coloration brown variegated with orange and black. Head rounded in front view. Male FW lateral field with several, closely-set, longitudinal parallel veins. Male genitalia: pseudepiphallic sclerite more or less quadrate with two distal apical lobes. Species foraging in forest leaf litter *Bobilla* Otte & Alexander, 1983 (Fig. 4B)
- Species thinner in shape; coloration lighter. Head longer than wide in front view. Male FW lateral field with fewer widely separate longitudinal veins. Male genitalia: pseudepiphallic sclerite elongate and very slender. Species living in rocky shores along streams or in coastal uplifted corals 21
- 21. TII with 2 apical spurs *Thetella* Otte & Alexander, 1983 (Fig. 4F)
- TII with 3 apical spurs *Ionemobius* Otte, 1987
- 22. Fastigium separated from the vertex by a thin, transverse furrow (Fig. 1E). FWs present in males, females apterous; stridulatory apparatus complete (Fig. 1G) *Protathra* Desutter-Grandcolas, 1997 (Fig. 2A)
- Fastigium not separated from the vertex by a thin, transverse furrow. FWs lacking in males and females 23
- 23. TIII with 3 outer and 2 inner subapical spurs. Coloration pale brown. Only one species in New Caledonia living cavities in uplifted corals on the coast of Lifou island *Parendacustes lifouensis* Desutter-Grandcolas, 2002 (Fig. 2B)
- TIII with 4 outer and 3 or 4 inner subapical spurs. Coloration dark brown, yellow and black. Nocturnal, forest-dwelling species *Caltathra* Otte, 1987 (Fig. 2C)
- 24. Species with legs I and II distinctly short, contrasting with elongate legs III. Head much wider than high in front view, elongate posteriorly to the eyes; face distinctly bulged. Species living on grass in opened areas or clear forests *Proturana* Otte, 1987 (Fig. 15A)
- Legs I and II not so short. Head longer in front view, not elongate posteriorly to the eyes; face not bulged.... 25
- 25. Species very thin and small (about 1 cm long and 2 mm wide), with small triangular head. Claws serrated (Fig. 1L, character also present in *Proturana* Otte, 1987) 36
- Species larger and longer; head less distinctly triangular. Claws simple 26
- 26. Scapes small, wider than long and much smaller than the fastigium; fastigium distinctly very wide and angular. When present, inner tympanum slit-shaped 27
- Scapes large, nearly twice as long as wide and about as wide as fastigium. When present, inner tympanum not slit-shaped 30
- 27. FWs short, not covering half body length; HWs lacking. Coloration light brown to black brown 28
- FWs very long, covering the whole abdomen; HWs present. Coloration yellowish brown with yellow, brown and ivory marks *Cardiodactylus* Saussure, 1878 (Fig. 15C)
- 28. Large species living in rainforests. Male FWs with a very high lateral field *Agnotecous* Saussure, 1878 (Fig. 15D)
- Smaller species living in maquis or in clear forests. Male FW lateral field more narrow 29
- 29. Species known from clear forests in Lifou island. Size small. Head shape triangular, with large eyes (eyes width > 45% head width); ocelli big; fastigium relatively narrow. FWs shorter in females than in males *Lebinthus* Stål, 1877 (Fig. 15E)
- Species known from maquis vegetation in southern Grande Terre. Size very small. Head shape more rounded, with small eyes (eye width = 35% head width); ocelli very small; fastigium wide, three times as wide as scape. FWs as long in females as in males *Pixibinthus* Robillard & Anso, 2016 (Fig. 15F)
- 30. Head longer than wide. TIII with 4 pairs of subapical spurs. Hind legs very long compared to body length. Species thin and slender *Pseudotriginidium* Chopard, 1915 (Fig. 2D)
- Head wider than high. TIII with at least five pairs of subapical spurs (only 3 inner subapical spurs in some *Calscirtus* species). Hind legs shorter and thicker. Species more stout and fusiform 31

- 31. TIII with 6 (rarely 7) inner subapical spurs. Small winged species; stridulum and tegminal glands (Fig. 1M) lacking in males 32
- TIII with 5 inner subapical spurs or less. Size and wing condition variable 33
- 32. TIII with 5 outer subapical spurs. TI with 2 apical spurs. TII with 3 apical spurs. TI with a wide inner tympanum, without an outer tympanum. Ocelli all wide, nearly equal in size *Aphonoides ouveus* Otte, 1987
- TIII with 6 outer subapical spurs. TI with 3 apical spurs. TII with 4 apical spurs. TI without an inner or outer tympanum. Ocelli all small *Pixipterus* Desutter-Grandcolas, 2016 (Fig. 13G)
- 33. Species cylindrical in shape, thick. FI inflated, very high, distinctly larger than FII. TIII with few spines, large but irregular in size, between subapical spurs. Males with a complete stridulum and no tegminal gland *Calscirtus* Otte, 1987 (Fig. 13A, B)
- Species fusiform or flat. FI not higher than FII. TIII serrulated with spines more regular in size. Males with or without a complete stridulum, sometimes with just a file. Males with or without tegminal glands 34
- 34. Species with complex color pattern, especially on head and FWs. Male without tegminal glands; stridulum absent or vestigial. Male genitalia: ectophallic fold short, not elongate; dorsal cavity lacking *Matuanus* Gorochov, 1986 (Fig. 13C, D)
- Color pattern more uniform. Males with or without tegminal glands; stridulum absent, or present and complete. Male genitalia: ectophallic fold with a long filiform distal part; dorsal cavity well-developed, twisted 35
- 35. TI with a large inner and a large outer tympanum, sometimes lacking; tympana equal in size. Male without a stridulum, with or without tegminal glands *Adenopterus* Chopard, 1951 (*) (Fig. 13E)
- TI inner and outer tympana oval and obliterate; outer tympanum sometimes larger. Male with a stridulum, or at least a file. Tegminal glands present *Archenopterus* Otte, 1987 (*) (Figs 13F, 14A)
- 36. Male with a complete stridulum *Anaxipha* Saussure, 1874 (*) (Fig. 3A)
- Male without a stridulum, or without a mirror 37
- 37. FWs pubescent in both males and females (Fig. 1N) *Amusurgus* Brunner von Wattenwyl, 1893 (Fig. 3B)
- FWs not pubescent in both males and females 38
- 38. Male FWs with a stridulatory device (but no complete stridulum) *Trigonidomorpha* Chopard, 1925, n. stat. (*) (Fig. 3D)
- FWs similar in both males and females *Metioche* Stål, 1877 (*) (Fig. 3C)

EMENDED DIAGNOSES FOR NEW CALEDONIAN GENERA OF GRYLLOIDEA

The classification adopted here is derived from the wide-scaled molecular phylogeny of Chintauan-Marquier *et al.* (2013, 2016). This hypothesis will be completed in the next future by diagnoses for taxa at and above subfamilial taxonomic level, with molecular tests of subfamilial monophylies. Meanwhile, we adopt the authors of the taxa equal and higher than subfamily as proposed by Eades *et al.* (2016). Some differences exist with the classification adopted by Eades *et al.* (2016), which do not impact the study of New Caledonian crickets. The infra order Grylloidea is subdivided into two main superfamilies, the Gryllotalpoidea Leach, 1815 and the Grylloidea Laicharting, 1781. The Gryllotalpoidea include the Gryllotalpidae Leach, 1815 (mole crickets) and the Myrmecophilidae Saussure, 1874 (ant-loving crickets and the Bothriophylacini Miram, 1934 tribe). The Grylloidea include the Mogoplistidae Brunner von Wattenwyl, 1873 (scaly crickets), the Trigonidiidae Saussure, 1874 (Trigonidiinae Saussure, 1874 and Nemobiinae Saussure, 1877), the Phalangopsidae Blanchard, 1845 (Phaloriinae Gorochov, 1985 and three/four additional subfamilies), the Gryllidae Laicharting, 1781 (Oecanthinae Blanchard, 1845; Euscyrinae Gorochov, 1985; Podoscirtinae Saussure, 1878; Hapithinae

Gorochov, 1986; Tafaliscinae Desutter, 1988; Pentacentrinae Saussure, 1878; Landrevinae Gorochov, 1982; Eneopterinae Saussure, 1893; Gryllinae Laicharting, 1781 and the *incertae sedis* tribe Odontogryllini de Mello, 1992), in addition to the *incertae sedis* Pteroplistinae Chopard, 1936.

Gryllotalpa, *Myrmecophilus* and scaly crickets will not be analyzed here: the presence of *Gryllotalpa* in New Caledonia is not ascertained, while *Myrmecophilus* and scaly crickets will be studied in forthcoming papers. Subsequent diagnoses are given for all the other genera of Grylloidea which occur in New Caledonia.

For those widespread genera which monophyly is not clearly established, the diagnosis is done for regional species only. This is the case in particular for Trigonidiinae.

Family PHALANGOPSIDAE Blanchard, 1845

Genus *Caltathra* Otte, 1987

Caltathra Otte *in* Otte *et al.*, 1987: 414.

TYPE SPECIES. — *Caltathra panaki* Otte, 1987 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 2C. Male genitalia: Desutter-Grandcolas 2002: figs 1-6, 9-13.

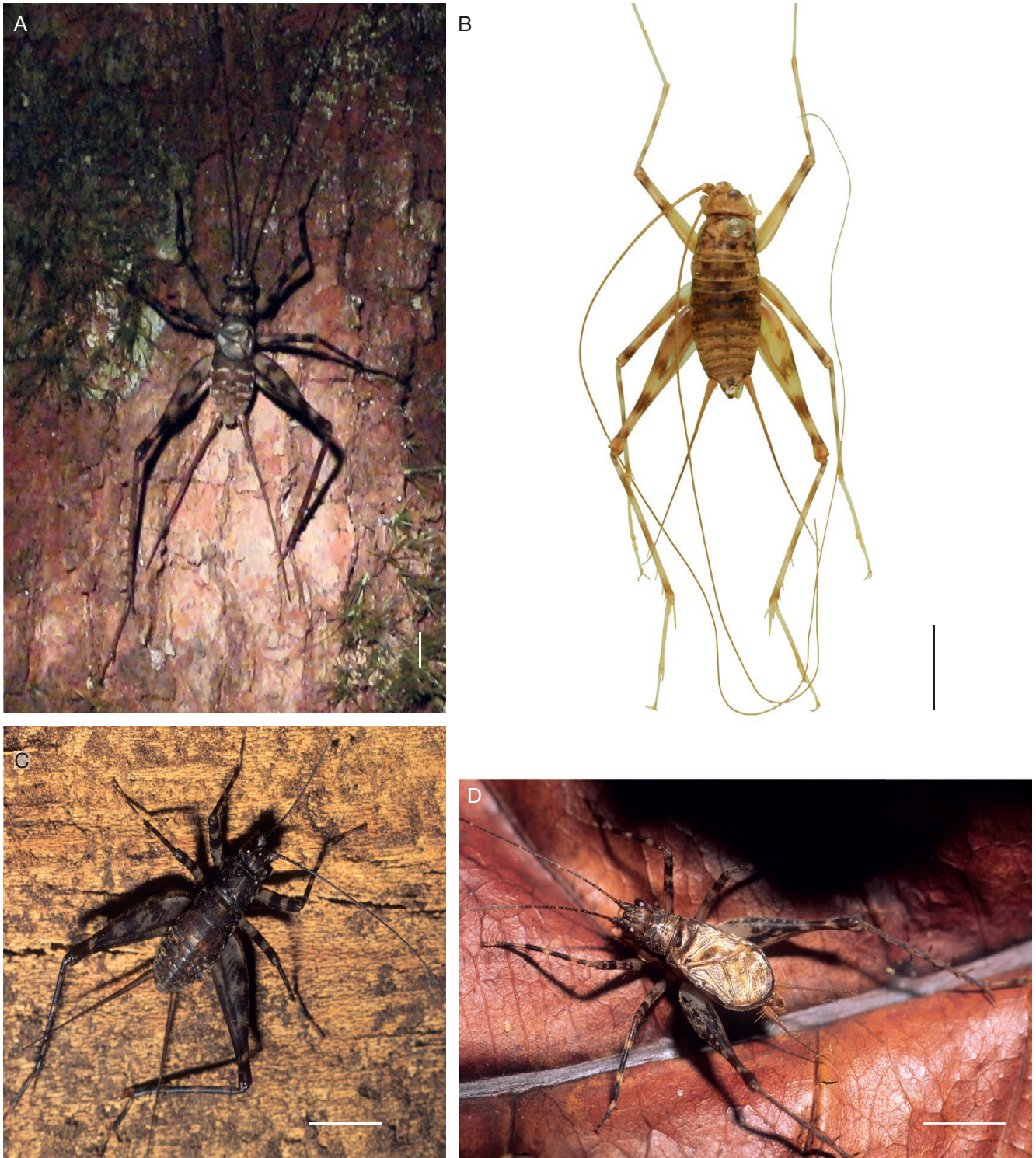


FIG. 2. — New Caledonian Phalangopsidae Blanchard, 1845: **A**, *Protathra centralis* Desutter-Grandcolas, 2014, from Aoupinié, by night (modified from Desutter-Grandcolas *et al.* 2014); **B**, *Parendacustes lifouensis* Desutter-Grandcolas, 1997, male, from Lifou (Loyalty Islands); **C**, *Calthra amiensis* Desutter-Grandcolas, 1997, from Col d'Amieu, by night (Photo PG); **D**, *Pseudotrigonidium noctifolia* Desutter-Grandcolas, 1997, from Col d'Amieu, by night (Photo PG). Scale bars: 5 mm.

EMENDED DIAGNOSIS. — After Otte *et al.* (1987) and Desutter-Grandcolas (1997b, 2002). Size medium. Male and female apterous. Coloration variegated yellow, brown and black. Head small and vertical; fastigium longer than wide, not separated from vertex by a transverse furrow; eyes protruding. Face yellow and brown; a

wide longitudinal yellow band between median ocellus and clypeus distal margin. Pronotum large, transverse; LL anterior angles raised dorsally. T1 with or without an inner tympanum; without an outer tympanum; with two, ventral, apical spurs. TII with three apical spurs, ventral inner spur the longest, dorsal outer spur missing. FIII

without a thin apical part. TIII with three or four inner, and four outer subapical spurs; with few spines above and between subapical spurs; with three inner and three outer apical spurs, dorsal spur the longest on inner side, median spur the longest on outer side. Basitarsomeres III very long; two rows of few, small dorsal spines. **Male.** Metanotum, tergites and subgenital plate without glandular structures. Subgenital plate short, truncated apically; with an apical longitudinal furrow. Male genitalia small and compact; pseudepiphallallic sclerite and rami well-developed; pseudepiphallallic sclerite with a median process; ectophallic dorsal valves well-developed and sclerotized, their inner side thickly sclerotized with a variable tooth; ectophallic fold small and membranous; ectophallic arc incomplete; dorsal cavity small. **Female.** Ovipositor shorter than FIII. Female genitalia: copulatory papilla very small; squared in dorsal view, triangular in lateral view, its distal margin sinuous, its base wider or not than the apex.

DISTRIBUTION. — Endemic to New Caledonia.

HABITAT. — Forest-dwelling species active on tree trunks at night.

Genus *Protathra* Desutter-Grandcolas, 1997

Protathra Desutter-Grandcolas, 1997b: 150.

TYPE SPECIES. — *Protathra gigantea* Desutter-Grandcolas, 1997b by original designation.

ILLUSTRATIONS. — Habitus: Fig. 2A. Male genitalia: Desutter-Grandcolas *et al.* 2014: figs 8-10. Calling song: Desutter-Grandcolas *et al.* 2014: fig. 11.

DIAGNOSIS. — After Desutter-Grandcolas *et al.* (2014). Size very large; coloration variegated yellow and brown, legs annulated. Face yellow and brown; a wide longitudinal yellow band between median ocellus and clypeus distal margin. Eyes very protruding. Fastigium very narrow and separated from vertex by a thin transverse furrow; median ocellus vertical, subapical on fastigium; lateral ocelli very close to each other; distance between one lateral ocellus and median ocellus much greater than distance between lateral ocelli. Scapes very large. Maxillary palpi moderately elongate; joint 3 smaller than joint 4; joint 5 the longest, truncate apically, regularly widened toward apex. Pronotum DD with a clear longitudinal median furrow; distal margin widely bordered with white setae; LL anterior angles raised dorsally, posterior angles truncate. TI with a small inner tympanum only; without an outer tympanum; two apical spurs; inner spur the longest. TII with three apical spurs; ventral inner spur the longest; dorsal outer spur missing. FIII regular, without a thin apical part. TIII higher than wide; three inner and four outer subapical spurs; three inner and three outer apical spurs, median spur the longest on both sides, median inner spur longer than about 1/3 basitarsomere III. TIII serrulated over their whole length with numerous, widely separate, very small spines. Basitarsomeres III very long; two rows of few, small dorsal spines.

Male. Metanotum, tergites and supra anal plate without glandular areas. Forewings short, covering less than half of abdomen; dorsal and lateral fields separated by a high vein; median area dorsal and flat, MP and CuA faint, CuP missing; lateral field narrow, narrowed in distal half, with faint and irregular veins, R close to MA and faint. Stridulatory apparatus complete and functional: harp crossed by several oblique parallel veins; mirror crossed by several oblique or transverse veins. Male subgenital plate low, with a distinct notch at about mid length of lateral margin; with a short distal, longitudinal, median furrow. Male genitalia: compact; pseudepiphallallic sclerite transverse; median process broadly conical and completely sclerotized; on each side of median process, a long and thin tube-shaped process with a bunch of long setae on its tip; pseudepiphallallic parameres large, thick and greatly sclerotized, bifid on distal margin; rami wide, separated from pseudepiphallallic sclerite but almost in contact with it; with

abruptly narrowed anterior part; ectophallic dorsal valves short and sclerotized; ectophallic fold short, truncate apically; ectophallic apodemes wide and flat; ectophallic arc incomplete; dorsal cavity lacking; endophallic sclerite U-shaped, with a faint median sclerotization. **Female.** Apterous; ovipositor longer than FIII. Female genitalia: copulatory papilla large, triangular, strongly sclerotized.

DISTRIBUTION. — Endemic to New Caledonia.

HABITAT. — Forest-dwelling species, active on tree trunks at light and hiding during the day in hollow trees or behind falling dead trees (Desutter-Grandcolas 1997b; Desutter-Grandcolas *et al.* 2014).

Genus *Parendacustes* Chopard, 1924

Parendacustes Chopard, 1924: 190.

TYPE SPECIES. — *Parendacustes cavicola* Chopard, 1924 by original monotypy.

ILLUSTRATIONS. — Habitus: Fig. 2B. Male genitalia: Desutter-Grandcolas 2002: figs 16-18.

EMENDED DIAGNOSIS. — After Chopard (1924) and Desutter-Grandcolas (2002). Size medium to large; coloration variegated yellow and brown, legs annulated. Eyes reduced in size and protruding. Fastigium very narrow or as wide as scape; not separated from vertex by a transverse furrow; median ocellus vertical, subapical on fastigium; lateral ocelli close to each other and very small compared to median ocellus. Scapes wide, but longer than wide. Maxillary palpi very thin and elongate; joints 3 and 4 subequal; joint 5 the longest, truncate apically, regularly widened toward apex. Pronotum very transverse (less so in *P. lifouensis*); DD with a clear longitudinal median furrow; LL well-developed, anterior angles raised dorsally, posterior angles shorter and truncate. TI with a small inner tympanum, without outer tympanum; two apical spurs, the inner the longest. TII with three apical spurs (only two in *P. lifouensis*); ventral inner spur the longest, dorsal outer spur missing. FIII with a thin apical part. TIII only slightly higher than wide; two to four inner and three to four outer subapical spurs; three inner and three outer apical spur, median spur the longest on both sides, median inner spur longer than half basitarsomere III (shorter in *P. lifouensis*). TIII serrulated over their whole length with numerous, widely separate, very small spines (except in *P. lifouensis*). Basitarsomeres III very long; two rows of few, small dorsal spines (only one in *P. lifouensis*). **Male.** Metanotum, tergites and supra anal plate without glandular areas. Forewings nearly covering whole abdomen (*P. lifouensis* apterous); dorsal and lateral fields separated by a high Media vein; median area lateral, MP and CuA thick, CuP short; lateral field narrow, R close to MA or not, thick, with few or numerous oblique veins. Stridulatory apparatus complete and functional: harp crossed by several oblique parallel veins; mirror broadly triangular, crossed by one circular vein often located in mirror distal third. Male subgenital plate low distally. Male genitalia: pseudepiphallallic sclerite small, transverse, without separate rami; median and lateral lophi both present, separate the ones from the others and from pseudepiphallallic sclerite; lateral lophi more or less hook-like; median lophi plate-like; pseudepiphallallic parameres having the shape of a vertical plate below median lophi; ectophallic apodemes short and wide, more or less vertical and cup-shaped distad; arc well-developed and roof-like; ectophallic fold short and truncated; dorsal valves absent; endophallic sclerite narrow and elongate, without a large apodeme. **Female.** Apterous; ovipositor variable.

DISTRIBUTION. — From Thailand in the North West, to New Caledonia in the South East, with a maximal diversity in Indomalaysia. In New Caledonia, *Parendacustes* is known by only one species from the Loyalty Islands (Lifou).

HABITAT IN NEW CALEDONIA. — *Parendacustes lifouensis* has been found exclusively by day in cavities inside uplifted corals along the sea side in Lifou island.

Subfamily PHALORIINAE Gorochov, 1985

DIAGNOSIS. — See Desutter-Grandcolas (2015).

Genus *Pseudotrigonidium* Chopard, 1915

Pseudotrigonidium Chopard, 1915: 152.

TYPE SPECIES. — *Pseudotrigonidium sarasini* Chopard, 1915 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 2D; Otte *et al.* 1987: fig. 21 (under *Tremellia*); Anso *et al.* 2016a: fig. 5. Male genitalia: Otte *et al.* 1987: fig. 24 (under *Tremellia*); Desutter-Grandcolas 1997a: figs 18-19 (under *Tremellia*). Calling song: Anso *et al.* 2016a: fig. 4.

Male. Two stridulum conditions: 1) Stridulum complete and functional; harp with four or five oblique, parallel veins, the most distal one concave; mirror crossed by two parallel veins. CuP present and short; and 2) Stridulum lacking, in micropterous (a file sometimes present) and apterous species. Subgenital plate long, narrow and high. Male genitalia: pseudepiphallic sclerite very elongate (except in *P. aptera* Desutter-Grandcolas, 1997 and *P. ana* Anso & Desutter-Grandcolas, 2016); pseudepiphallic parameres well-developed, lateral, making wide, often indented plates; arc complete and wide; ectophallic apodemes short; ectophallic fold often hyperthelic, extending dorsally between pseudepiphallic lateral parts; endophallic sclerite U-shaped, most often elongate; endophallic apodeme crest-like; no dorsal cavity.

Female. FWs rounded, with thick longitudinal and transversal veins. Ovipositor short to very short; valve apex thick and rounded, with teeth. Female genitalia: copulatory papilla very small, annular with thicker anterior part.

DISTRIBUTION. — Diversified in Oceania and Indomalaysia. In New Caledonia, *Pseudotrigonidium* is known throughout the whole Grande Terre; it is not yet reported from the Loyalty Islands.

HABITAT. — *Pseudotrigonidium* inhabits the understorey of forest vegetation, where it is active at night. Winged males are often found singing under the leaves of *Pandanus* or treeferns. *Pseudotrigonidium* hides during the day either in plant structures, such as inside the stems of dead fern leaves, or in the leaf litter and dead plant material accumulated at the base of tree trunks.

Family TRIGONIDIIDAE Saussure, 1874

FAMILIAL AND SUBFAMILIAL DIAGNOSES. — See Gorochov (1986b) and Desutter (1987, 1988, 1990).

REMARK

Two subfamilies have been gathered in the Trigonidiidae, the Trigonidiinae and the Nemobiinae, on both morphological (Gorochov 1986b; Desutter 1987) and molecular grounds (Chintauan-Marquier *et al.* 2013, 2016), invalidating the long lasting classification of Nemobiinae with field crickets (Gryllidae, Gryllinae). The family and the two subfamilies present many synapomorphies that support their monophylies and relationships.

Subfamily TRIGONIDIINAE Saussure, 1874

REMARK

Trigonidiinae are not well-known in New Caledonia, perhaps because they are uncommon in forests (see Anso 2016), which have been more often sampled than open vegetation, and mostly inhabit grassland or low shrubland vegetation often resulting from human activities. Chopard (1915) and Gorochov (1986a) do not mention trigonidiines. Chopard (1970) mentions two species of the widely distributed genus *Metioche* Stål, 1877, i.e. *Metioche vittaticollis* (Stål, 1860) and *M. flavipes* (Saussure, 1878). According to Otte *et al.* (1987), these two *Metioche* species may correspond to misidentified *Trigonidomorpha sjöstedti* Chopard, 1925; these authors actually record only two species, i.e. the widespread *Trigonidomorpha sjöstedti* and a new species *Anaxipha caledonica* Otte, 1987.

Material at hand in MNHN collection actually attests that Trigonidiinae are represented by four genera in the archipelago: *Metioche*, *Trigonidomorpha*, *Anaxipha* and *Amusurgus* Brunner von Wattenwyl, 1893, reported here for the first time from the Territory. Otte & Alexander (1983, tables 12 and 13) list a series of characters to identify males and females of trigonidiine genera, but these are not fully efficient to separate the genera present in New Caledonia. As suggested by Hugel (2012), this material will have to be reassessed using characters of male genitalia (see Otte & Cooper 2007), in order to fix their taxonomy with both traditional and genitalic characters. The diagnosis and list of genera given here are thus clearly preliminary.

Genus *Anaxipha* Saussure, 1874

Anaxipha Saussure, 1874: 370.

TYPE SPECIES. — *Gryllus pulicarius* Burmeister, 1838 by subsequent designation (Rehn, 1905).

ILLUSTRATIONS. — Habitus: Fig. 3A; Otte & Alexander 1983: fig. 161. Male genitalia: Otte *et al.* 1987: fig. 19. Calling songs: Otte & Alexander 1983: fig. 163.

EMENDED DIAGNOSIS FOR NEW CALEDONIAN SPECIES. — After Otte & Alexander (1983) and material preserved in MNHN. Head dorsum not fully flat between eyes. TI with an outer tympanum; inner tympanum lacking. FWs not hairy. HWs not developed. TIII with three pairs of long and thin alternate subapical spurs; only five relatively short apical spurs, ventral inner spur lacking.

Male. No dorsal gland on abdomen. FWs flat in lateral view. Stridulatory apparatus complete; mirror well-developed, most often diamond shaped. Apical field reduced. Metanotal glands present or lacking. Male genitalia: pseudepiphallus well-developed, symmetrical or almost so, and not hyperthelic; distal pseudepiphallus with two lateral long and thin lobes, and two shorter median ones; on each side, median and lateral lobes separated (*Anaxipha* undescribed species) or not (*Anaxipha caledonica* Otte, 1987) by an additional thin process; distal margins of lobes plain (*Anaxipha caledonica*, Otte *et al.* 1987: fig. 19B) or serrated (*Anaxipha* undescribed species), resembling some species of *Vanuaxipha* Otte & Cooper, 2007; pseudepiphallic parameres symmetrical, flat.

Female. FW length and colour as in males. Ovipositor: distal margins of dorsal and ventral valves highly crenulated (see Otte *et al.* 1987: fig. 19C).

DISTRIBUTION. — World-wide. Known in New Caledonia by only one species from Grande Terre, on the western coast near Koumac (*A. caledonica*). Additional material attests the presence of *Anaxipha* at Parc provincial de la Rivière Bleue in the South of Grande Terre and at the base of Mont Mou (MNHN).

Genus *Amusurgus* Brunner von Wattenwyl, 1893

Amusurgus Brunner von Wattenwyl, 1893: 212.

TYPE SPECIES. — *Amusurgus fulvus* Brunner von Wattenwyl, 1893 by monotypy.

ILLUSTRATIONS. — Habitus: Fig. 3B; Otte & Alexander 1983: figs 149, 150. Male genitalia: Otte & Alexander 1983: fig. 152.

EMENDED DIAGNOSIS. — After Otte & Alexander (1983) for Australia and material from New Caledonia preserved in MNHN. Head dorsum not flat between eyes. TI with a wide inner tympanum; outer tympanum grooved. FWs hairy; flat in lateral view. HWs well developed but shorter than FWs. TIII with three pairs of long and thin alternate subapical spurs; only five relatively short apical spurs, ventral inner spur lacking.

Male. Dorsal gland on abdomen. No stridulatory device. Subgenital plate large, distal margin bisinuate. Male genitalia: distal pseudepiphallal median lobes well developed and divergent; lateral lobes dejected latero-ventrally, as long or longer than median lobes (see Otte & Alexander 1983: fig. 152); pseudepiphallal parameres small. **Female.** FWs developed as in males. Ovipositor: distal margins of dorsal and ventral valves feebly crenulated (see Otte & Alexander 1983: fig. 153).

DISTRIBUTION. — Mostly diversified in South East Asia and Oceania (see Eades *et al.* 2016); reported here for the first time from New Caledonia (Loyalty islands).

Genus *Metioche* Stål, 1877

Metioche Stål, 1877: 48.

TYPE SPECIES. — *Trigonidium vittaticolle* Stål, 1860 by subsequent designation (Chopard 1968).

ILLUSTRATIONS. — Habitus: Fig. 3C; Otte & Alexander 1983: fig. 168. Male genitalia: See Hugel (2012).

EMENDED DIAGNOSIS FOR NEW CALEDONIAN SPECIES. — After Otte & Alexander (1983) and material preserved in MNHN. Macropterous or micropterous. Head dorsum flat between eyes. TI with an outer tympanum and an inner tympanum, or none. FWs not pubescent. HWs greatly developed well-beyond the body, or not. TIII with three pairs of long and thin alternate subapical spurs; only five relatively short apical spurs, ventral inner spur lacking.

Male. Dorsal gland present. Stridulatory apparatus lacking, even a file present; venation with few longitudinal veins. Male genitalia (see Otte & Alexander 1983: fig. 170; Hugel 2012): pseudepiphallus well-developed, symmetrical and not hyperthelic; distal pseudepiphallus with two lateral long and thin serrated lobes, and two very short median ones; pseudepiphallal parameres symmetrical, flat.

Female. FWs developed as in males. Ovipositor very feebly crenulated on distal margins of dorsal and ventral.

DISTRIBUTION. — According to Eades *et al.* (2016), *Metioche* is distributed worldwide and diversified mostly in South East Asia and Oceania. The material identified by Chopard (1970) and additional material collected since then attest the presence of the genus in New Caledonia.

Genus *Trigonidomorpha* Chopard, 1925 n. stat.

Trigonidomorpha Chopard, 1925: 40.

Trigonidium (*Trigonidomorpha*) – Otte 1994: 46.

TYPE SPECIES. — *Trigonidomorpha sjöstedti* Chopard, 1925 by monotypy.

ILLUSTRATIONS. — Habitus: Fig. 3D; Otte & Alexander 1983: fig. 174. Male genitalia: Otte & Alexander 1983: fig. 176.

DIAGNOSIS. — After Otte & Alexander (1983). Very similar to *Metioche*, from which it can be separated by the stridulatory device present on male FWs.

DISTRIBUTION. — Australia, India, Sri Lanka, Africa. In New Caledonia, the genus is reported from Sarramea (material in MNHN).

REMARK

After the phylogenetic topology of Chintauan-Marquier *et al.* (2013, 2016), *Trigonidomorpha* clearly separates from *Trigonidium* Rambur, 1839, which constitutes a robust monophyletic group. It consequently cannot be considered a subgenus of *Trigonidium* and we restore it as separate genus, even though its status will have to be reconsidered and validated with a complete taxonomic reanalysis of trigoniidiine genera.

Subfamily NEMOBIINAE Saussure, 1877

REMARKS

Nemobiinae are well-diversified in New Caledonia, with several endemic genera in addition to genera distributed in the Australian region. Ten genera are presently endemic to the Territory, two of which have only been recently discovered: *Amonemobius* Otte, 1987; *Bullita* Gorochov, 1986a (= *Fikola* Gorochov, 1986a); *Caledonina* Desutter-Grandcolas, n. gen.; *Ignambina* Otte, 1987; *Ionemobius* Otte, Alexander & Cade, 1987; *Koghiella* Otte, Alexander & Cade, 1987; *Orintia* Gorochov, 1986a; *Paniella* Otte, Alexander & Cade, 1987; *Paora* Gorochov, 1986a n. stat. (restored from its synonymy with *Apteronemobius* Chopard, 1929) and *Kanakinemobius* Desutter-Grandcolas, 2016.

Two other genera are present in New Caledonia: 1) *Bobilla* Otte & Alexander, 1983, found in New Caledonia by Otte *et al.* (1987) and otherwise distributed in Australia (Otte & Alexander 1983) and New Zealand (Otte *et al.* 1987); and 2) *Thetella* Otte & Alexander, 1983, newly reported here from New Caledonia.

Although the status of some of these genera may have to be checked with phylogenetic studies, Nemobiinae are today the most diversified cricket clade in New Caledonia and may reveal one of the best model group to test evolutionary hypotheses about New Caledonia colonisation. Available data also show that it is a very good indicator for ecological and conservation issues (Anso 2016).

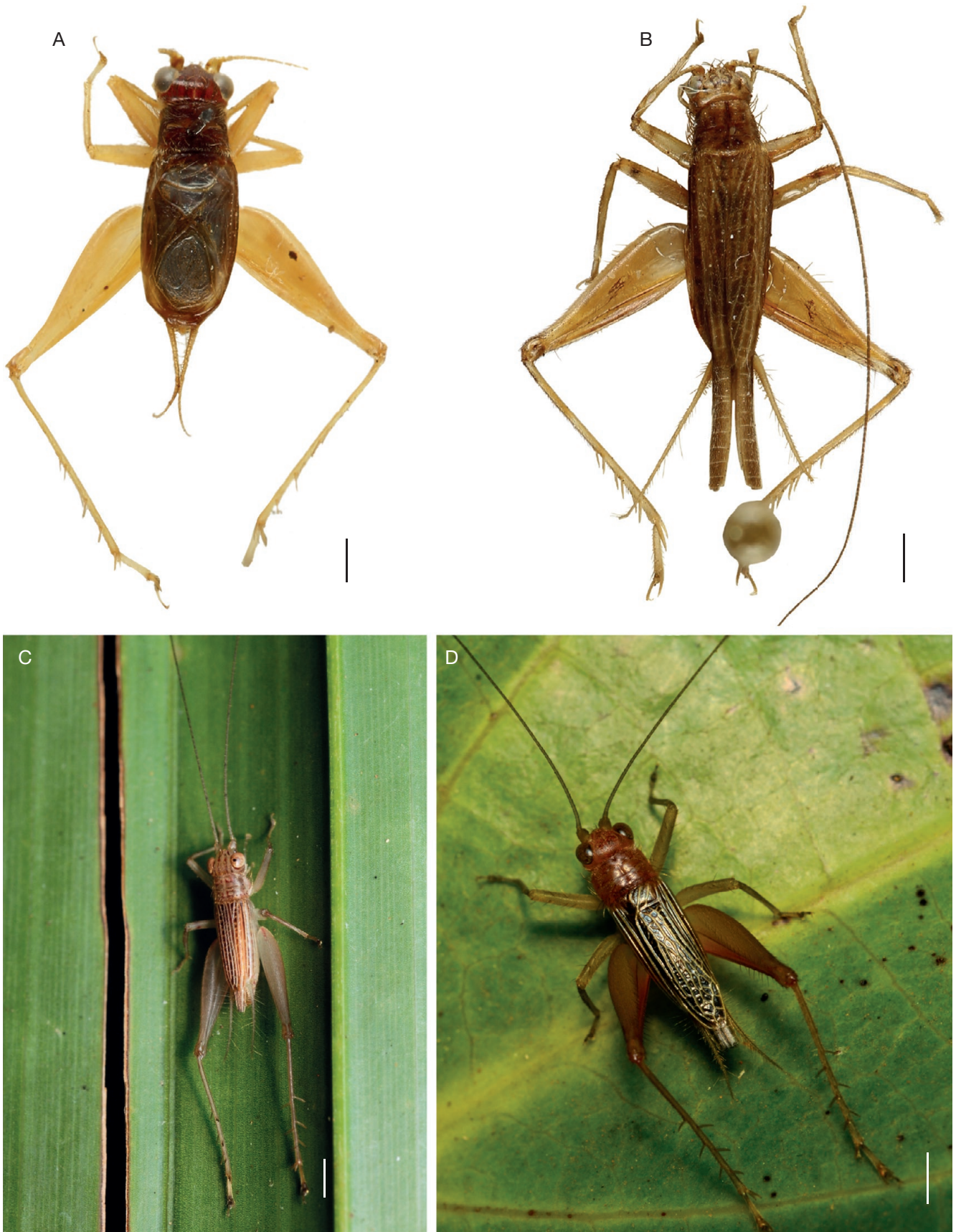


FIG. 3. — New Caledonian Trigonidiinae (Trigonidiidae): **A**, *Anaxipha* sp., male, from Col d'Amieu; **B**, *Amusurgus* sp., from Lifou (Loyalty Islands); **C**, *Metioche* sp., from the Seychelles (Photo SH); **D**, *Trigonidomorpha* sp. from Mauritius (Photo SH). Scale bars: 1 mm.

Genus *Bullita* Gorochov, 1986

Bullita Gorochov, 1986a: 693.

Synonymized with *Bobilla* Otte & Alexander, 1983 by Otte *et al.* (1987); synonymy invalidated by Desutter-Grandcolas (1997b).

Fikola Gorochov, 1986a. Type species *Fikola fusca* Gorochov, 1986. Synonymy in Desutter-Grandcolas (1997b).

TYPE SPECIES. — *Bullita pacifica* Gorochov, 1986a by original designation.

ILLUSTRATIONS. — Habitus: Figs 1H, 4A; Anso *et al.* 2016a: fig. 27. Male genitalia: Desutter-Grandcolas 1997c, figs 1, 2, 4, 5; Anso *et al.* 2016a: fig. 28. Calling songs: Anso *et al.* 2016a: figs 29–31.

EMENDED DIAGNOSIS. — Small Nemobiinae with uniform coloration, body dark brown and legs ochre (black brown in *Bullita obscura* Anso & Desutter-Grandcolas, 2016a), tergite VIII or IX bordered with white in females and males; females with additional white transverse bands on abdomen and FWs; male FWs with light yellow lateral margins. Eyes large but little protruding; distance between episternal suture and lower margin of eye less than eye mid width. TI with a wide inner tympanum, without outer tympanum; two long, ventral apical spurs. TII with three long apical spurs. TIII with four pairs of long subapical spurs, getting longer toward TIII apex; three apical spurs on each side; median spur the longest on outer side; dorsal spur the longest on inner side, nearly as long as basitarsomere III.

Male. FWs covering almost whole abdomen; stridulum with file and harp. Male genitalia: Pseudepiphallallic sclerite elongate, more or less triangular; pseudepiphallallic apical lobes longer than pseudepiphallallic parameres. Dorsal cavity wide and high; endophallic apodeme very high. Ectophallic fold unspecialized.

Female. FWs very short, only partly overlapping; venation on lateral field only, made of three longitudinal parallel veins; lateral field slightly longer than dorsal field, the limit between dorsal and lateral fields made by a short and thick vein, present distally only; ovipositor shorter than FIII; dorsal valves with crenulated apex.

DISTRIBUTION. — Endemic to New Caledonia.

HABITAT. — Straminicolous species living only in forest vegetation (see Anso 2016).

Genus *Bobilla* Otte & Alexander, 1983

Bobilla Otte & Alexander, 1983: 693.

TYPE SPECIES. — *Nemobius bivittatus* Walker, 1869 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 4B; Otte & Alexander 1983: fig. 133. Male genitalia: Otte & Alexander 1983: fig. 136. Calling songs: Otte & Alexander 1983: fig. 135.

EMENDED DIAGNOSIS. — Large nemobiines, with rounded head in front view. Eyes small and not at all protruding; distance between episternal suture and lower margin of eye greater than eye mid width. Ocelli set as a flat triangle; all large, but median ocellus more protruding. Maxillary palpi elongate; joint 5 very little widened apically, truncate distally. Pronotum transverse in males, less so in females; anterior margin slightly concave, posterior margin convex; lateral lobe squared, more narrow distally. TI with a large outer tympanum; no inner tympanum; two long and ventral apical spurs. TII with three apical spurs, the dorsal inner small, the dorsal outer lacking. TIII with three inner and three outer subapical spurs, all alternate; spurs growing longer distally, outer spurs shorter than inner spurs.

TIII with three inner and three outer apical spurs; ventral inner and outer spurs the smallest and subequal; median inner and outer spurs subequal; dorso-inner spur the longest, longer than half hindbasitarsomere. Basitarsomeres all long, tarsi longer than tibiae mid length. Coloration. Variegated light brown, dark brown and yellow. Head dorsum and DD anterior part lighter. Face, cheeks and lateral field darker. Scape and first two antennal articles lightly coloured. Legs 1 and 2 and tibiae III annulated. Cerci long, divergent.

Male. FWs well-developed and overlapping, but not covering whole abdomen. Stridulatory apparatus complete. Mirror very short, not filled by apical reticulation; asymmetrical, wider toward right FW outer side, than toward its inner side. Apical field very reduced. Lateral field wide, with several closely-set, longitudinal parallel veins (five or six in material at hand). Subgenital plate wide and low. Male genitalia wide, with short pseudepiphallallic sclerite; pseudepiphallallic median distal lobes very short, which gives the genitalia of some species a very distinctive shape with a pseudepiphallus very short in mid dorsal area; pseudepiphallallic lateral lobes bigger and longer laterally; pseudepiphallallic parameres reduced.

Female. FWs variously reduced, sometimes hardly visible from beneath pronotum, overlapping or not on mid line. Ovipositor short, shorter than FIII; apex short, not widened; dorsal valves with longitudinal carina and more or less crenulated margin.

DISTRIBUTION. — Australia, New Zealand and New Caledonia.

HABITAT. — *Bobilla* species have been found by day and night in the leaf litter.

Genus *Koghiella* Otte, Alexander & Cade, 1987

Koghiella Otte, Alexander & Cade, 1987: 406.

TYPE SPECIES. — *Koghiella bouo* Otte, 1987 by original designation.

ILLUSTRATIONS. — Habitus: Figs 1I, 4C, 5A; Anso *et al.* 2016a: fig. 32. Male genitalia: Figs 1K, 5E–G; Desutter-Grandcolas 1997c, figs 7, 8; Anso *et al.* 2016a: fig. 33. Calling songs: Otte *et al.* 1987: fig. 18; Anso *et al.* 2016a: figs 34, 35.

EMENDED DIAGNOSIS. — Coloration variegated dorsally, lateral parts of head, pronotum and FWs contrastingly black; tibiae annulated yellow and black; male and female FWs without coloured stripes (except in *K. minima* Desutter-Grandcolas, n. sp.: head entirely light brown, LL only partly light brown; FWs bordered with yellow in both male and female). Eyes wide; distance between episternal suture and lower margin of eye less than eye mid width. Ocelli set as a flat triangle; median ocellus smaller than lateral ocelli. Maxillary palpi short; joint 5 the longest, slightly but regularly widened distally, truncated obliquely distally. Pronotum transverse; anterior margin slightly concave, posterior margin convex; lateral lobe squared, more narrow distally. TI with a large outer tympanum, and no inner tympanum (no tympana in *K. minima* Desutter-Grandcolas, n. sp.); with two apical spurs. TII with three, long apical spurs. TIII with four pairs of subapical spurs (*contra* Otte *et al.* 1987); outer spurs regular in size (except in *K. minima* Desutter-Grandcolas, n. sp.); inner spurs growing in size toward TIII apex, the fourth (most basal) spur very small, the first (most distal) spur the longest, longer than hindbasitarsomere mid length. TIII with three inner and three outer apical spurs; outer spurs short, the median well longer than the dorsal; inner spurs long, median and dorsal spurs subequal but the dorsal the longest. Cerci long.

Male. FWs long, but not covering whole abdomen (not covering abdomen mid length in *K. minima* Desutter-Grandcolas, n. sp.). Stridulatory apparatus complete, but mirror not separate from apical reticulation (mirror lacking in *K. minima* Desutter-Grandcolas, n. sp.); diagonal branched to chord 1, chords 2 and 3 more distally connected, the chords all parallel and almost straight (except in the

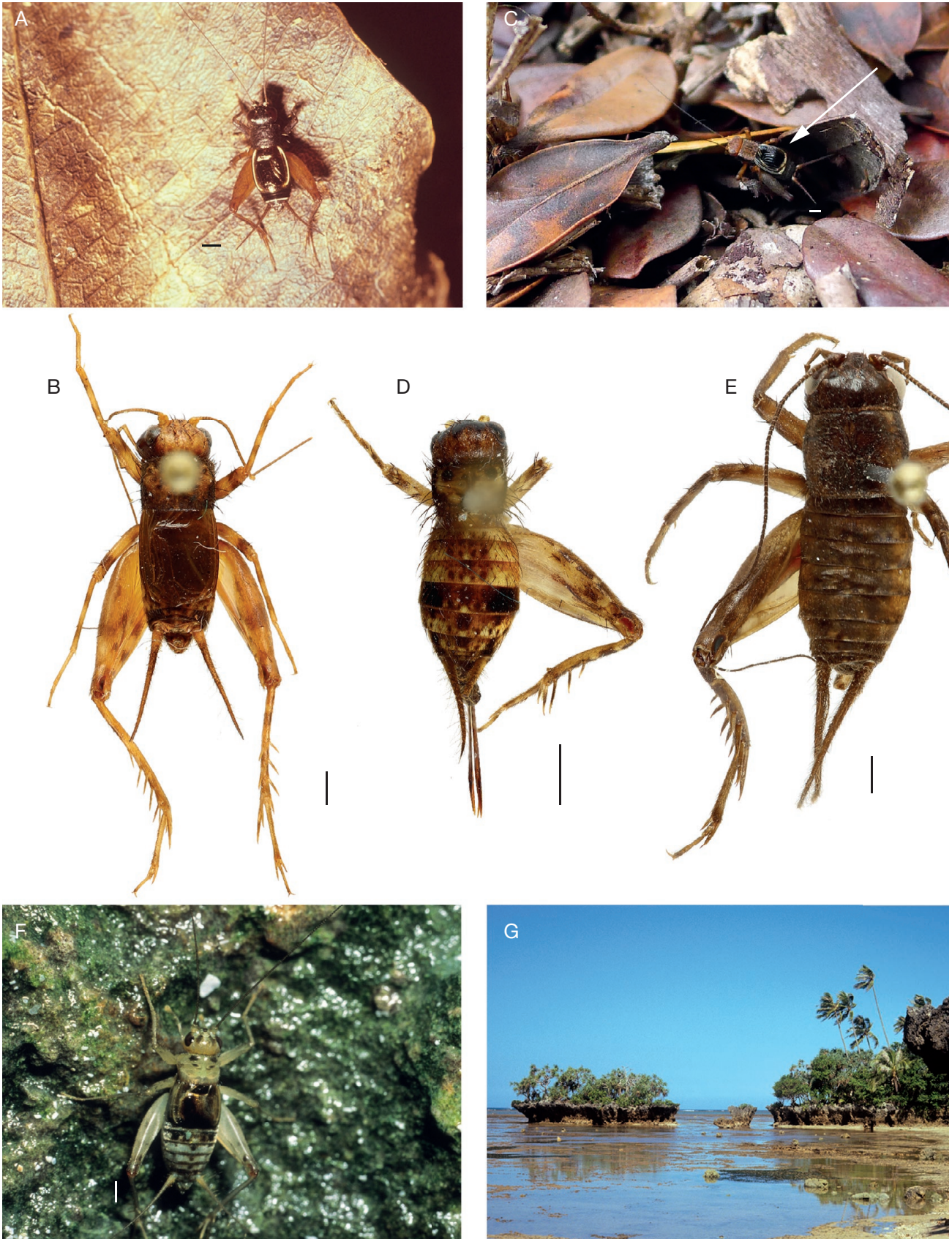


FIG. 4. — New Caledonian Nemobiinae (Trigonidiidae): **A**, *Bullitta transversa* Desutter-Grandcolas, 1997, Col d'Amieu, by day (Photo PG); **B**, *Bobilla* sp., specimen from Parc Provincial de la Rivière Bleue; **C**, *Koghiella flammea* Anso & Desutter-Grandcolas, 2016, from Bois du Sud, by day (Photo JA); **D**, *Paniella bipunctatus* Desutter-Grandcolas, 2016, female, from Grand Kaori; **E**, *Paora* sp., specimen from Dzumac; **F**, *Thetella* sp., from Lifou (Loyalty Islands), by day (Photo PG); **G**, uplifted calcareous substrate where *Thetella* sp lives, Loyalty Islands (Photo PG). Scales bar: 1 mm.

K. minima Desutter-Grandcolas, n. sp.). Subgenital plate flat and elongate. Male genitalia long and narrow; pseudepiphallic sclerite broadly triangular, being more narrow posteriorly than anteriorly; pseudepiphallic sclerite with two short, median apical lobes, variously separate and elongate; pseudepiphallic parameres flap-like, little developed.

Female. FWs short, covering less than half abdomen, and only partly overlapping; venation made of longitudinal parallel veins on dorsal and lateral fields, these veins strong only in FW parts not covered by pronotum. Subgenital plate distal margin strongly emarginate. Ovipositor straight.

DISTRIBUTION. — Endemic to New Caledonia.

HABITAT. — Straminicolous species inhabiting forest and shrubland vegetation.

REMARK

K. minima Desutter-Grandcolas, n. sp. is well-characterized within *Koghiella*. Its phylogenetic position within the genus will have to be checked before assessing its status further, to avoid erasing paraphyletic assemblages.

Koghiella minima Desutter-Grandcolas, n. sp.
(Fig. 5; Table 1)

TYPE LOCALITY. — New Caledonia, Grande Terre, Sarramea, 100 m.

ETYMOLOGY. — Species named after its very small size within the genus.

TYPE MATERIAL. — **Holotype.** New Caledonia, Grande Terre, Sarramea, 100 m, recrû en bordure de pâturage, 1 ♂, 26.III.1994, jour, litière, fn 18, L. Desutter-Grandcolas (MNHN-EO-ENSIF3956). **Paratypes.** 5 ♂: same locality, date and collector as the holotype, 5 ♂, fn 14-17, 19 (MNHN-EO-ENSIF3957-3961).

ADDITIONAL MATERIAL EXAMINED. — New Caledonia, Mt. Tereka, 120 m, 22°15'S, 166°23'E, 4 ♂, 1 female, 10-11.I.2005, dung trap, dry forest, G. Monteith. MNHN.

DIAGNOSIS. — Within the genus, species characterized by its very small size, the less contrasted coloration of head and pronotum, the lack of tympanum, and the yellow margins of FWs in males and females; legs I and II yellowish with faint brown rings; legs III much darker, TIII smoky black with yellowish spurs.

Male. FWs very small, not covering abdomen mid length, and truncate distally; mirror lacking. Lateral field with four longitudinal parallel veins. FWs shining black; margins of dorsal field yellow. Male genitalia: lateral margins of pseudepiphallic sclerite slightly convergent distally; pseudepiphallic median lobes quite long, slightly convex and separated by a wide V-shaped emargination.

Female. FWs very short, truncate, slightly overlapping; lateral field and median area of dorsal field dark, lateral margins of dorsal field yellowish.

HABITAT AND LIFE HISTORY TRAITS. — *Koghiella minima* Desutter-Grandcolas, n. sp. has been found in the leaf litter of a young forest at the edge of a pasture, during the day.

CALLING SONG. — Unknown.

DESCRIPTION

In addition to the characters of the genus: Size very small. Eyes relatively small and far apart (Fig. 5A). Both tympana lacking.

Coloration (Fig. 5A-D)

Head, pronotum and legs with short and thick, black setae. Head and palpi light yellowish brown, face somewhat paler with two transverse brown lines between episternal suture and lower margin of antennal pits, face yellow between these brown lines (Fig. 5C); head dorsum slightly darker, with faint yellowish longitudinal lines, the median one thinner and lighter. Scapes and base of antennae light yellowish; antennae otherwise light brown. Pronotum (Fig. 5A, B) anterior margin yellowish; DD light yellowish brown; LL light brown, except anterior margin. Legs I and II yellowish brown, with faint dark rings. FIII (Fig. 5D) light yellowish brown; outer side with black brown oblique lines; FIII inner side with brown spots and lines. TIII black brown; knees marked with yellowish; spurs yellowish, their mid parts brown or yellowish. Basitarsomeres mid part yellowish; base and apex brown in legs I and II, black in legs III. Abdomen black; last tergites variably ochre brown laterally. Supra anal plate and cerci light yellow. Sternites yellowish; mid part fully or partly dark brown.

Male (Fig. 5A)

FWs short, not covering abdomen mid length; dorsal and lateral fields shining black, veins limiting the dorsal field light yellow (Fig. 5B: MA distal part, CuA basal part, thick MP, A2, distal margin of dorsal field); apical field almost lacking; lateral field black with 4 longitudinal parallel veins, the upper ones more separated than the others. Stridulatory file with about 60 teeth. Subgenital plate short, triangular; black brown.

Male genitalia (Fig. 5E-G)

Slightly convex. Pseudepiphallic sclerite long, broadly triangular. Apical lobes well-developed, longer than lateral part of pseudepiphallic sclerite; quite wide, of same width on basal half length, then slightly narrowing toward apex; apex rounded; lobes separated by a wide V-shaped emargination and slightly convex in lateral view. Pseudepiphallic parameres very small. Ectophallic apodemes long and thin, regularly divergent. Dorsal cavity quite high, well above dorsal limit of pseudepiphallus.

Female

Known by one specimen originating from Mt. Tereka and not from type locality. FWs short and truncate, only slightly overlapping. Venation: five or six straight longitudinal, parallel veins on dorsal field, four curved parallel veins on lateral field. Lateral field brown; dorsal field yellowish except for brown median area. Subgenital plate short, transverse, distal margin emarginate. Ovipositor long and straight (ovipL = 4.2 mm, n = 1); apex short and not widened; ventral and dorsal valves margins slightly crenulated.

Genus *Ignambina* Otte, 1987

Ignambina Otte in Otte *et al.*, 1987: 410.

TYPE SPECIES. — *Ignambina oubatchia* Otte, 1987 by original designation.

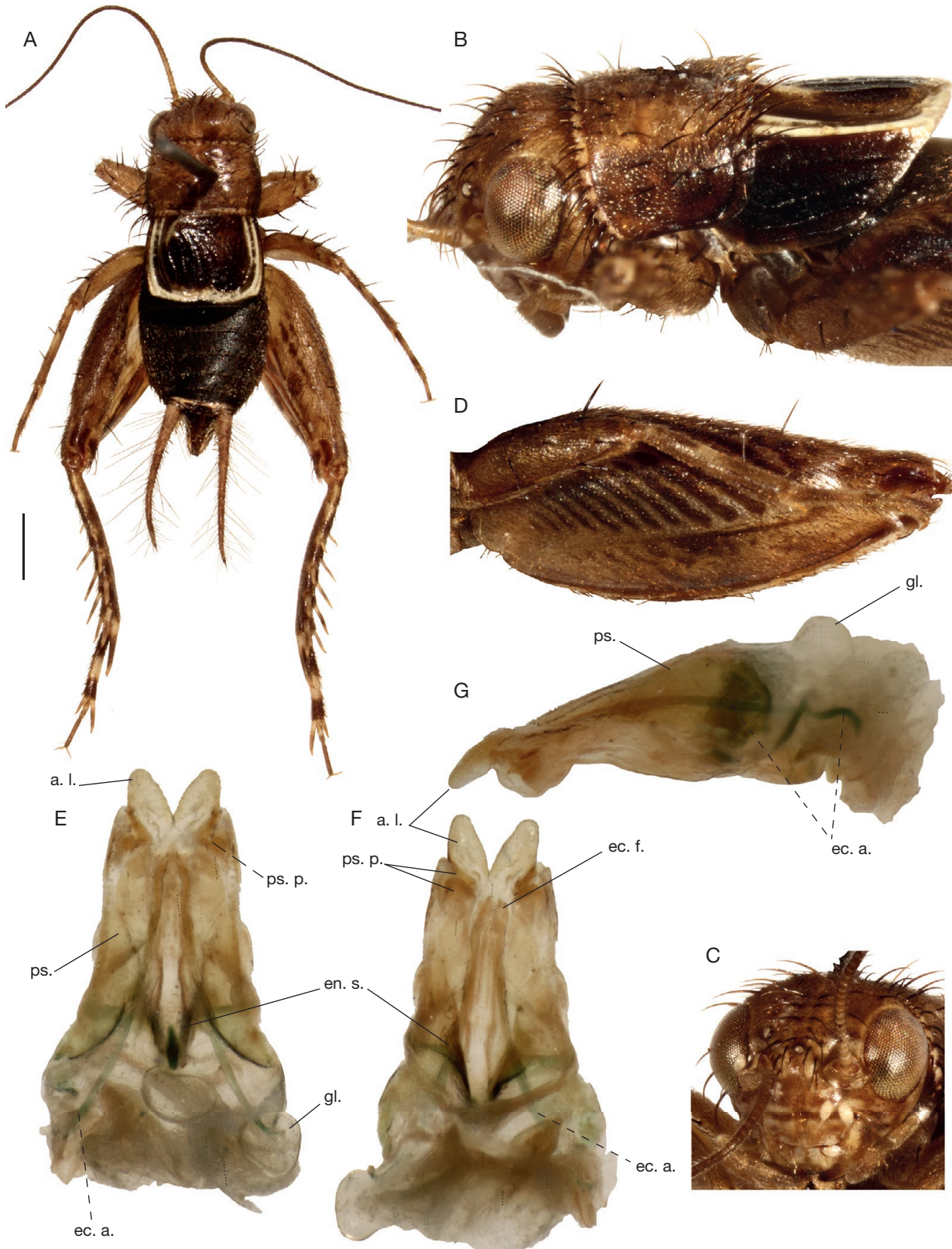


FIG. 5. — *Koghiella minima* Desutter-Grandcolas, n. sp.: **A**, male habitus; **B**, male head and pronotum, lateral view; **C**, male face coloration; **D**, F111 coloration; **E-G**, male genitalia, dorsal (**E**), ventral (**F**) and lateral (**G**) views. Abbreviations see Material and methods. Scale bar: 1 mm.

TABLE 1. — *Koghiella minima* Desutter-Grandcolas, n. sp. Measurements (in mm, FW width measured at mid length). Abbreviations: see Material and methods.

	iod	PronL	PronWp	FWL	FWW	FIIL	FIIW	TIIL	tars1-III
Male holotype	0.9	1.1	1.6	1.3	1.5	3.5	1.5	2.4	1
Males paratypes (n=5)	0.9-1	1.1-1.2	1.5-1.6	1.2-1.4	1.5-1.6	3.4-3.6	1.3-1.5	2.4-2.5	1.1-1.2
mean (n=6)	0.9	1.2	1.6	1.3	1.5	3.5	1.5	2.4	1.1 (n=5)

ILLUSTRATIONS. — Habitus: None. Male genitalia: Otte *et al.* 1987: fig. 17C.

DIAGNOSIS. — After Otte *et al.* (1987). Very similar to *Koghiella*, from which it can be separated by its male genitalia (pseudepiphallus very wide at base, with small, blunt spines on dorsal face; apex rounded and not bifurcate: Otte *et al.* 1987: fig. 17C). Female unknown.

DISTRIBUTION. — Endemic to New Caledonia. Known from the type locality of the type species only (coastal forest near Oubatche: Otte *et al.* 1987: 410).

Genus *Amonemobius* Otte, Alexander & Cade, 1987

Amonemobius Otte, Alexander & Cade, 1987: 410.

Amonemobius – Otte, Alexander & Cade 1987: 399 (typ. err.).

TYPE SPECIES. — *Amonemobius vexans* Otte, 1987 by original designation.

ILLUSTRATIONS. — Habitus pp: Otte *et al.* 1987: fig. 14G. Male genitalia: Otte *et al.* 1987: fig. 17B.

DIAGNOSIS. — After Otte *et al.* (1987). Very similar to *Koghiella*. TI with a large outer tympanum. Head dorsum mostly pale but occiput with four small black stripes; region posterior to eyes black; dorsum of pronotum largely pale with a dark patch in each corner. Male genitalia: pseudepiphallus with a deep median cleft; pseudepiphallic parameres longer than pseudepiphallic sclerite (Otte *et al.* 1987: fig. 17B).

DISTRIBUTION. — Endemic to New Caledonia. Known from the type locality of the type species only (Amoa river near Poindimié).

HABITAT. — Otte *et al.* (1987: 411) mention that *A. vexans* has been “found on banks along a road through the forest in the Amoia valley”.

Genus *Paniella* Otte, Alexander & Cade, 1987

Paniella Otte, Alexander & Cade, 1987: 411.

TYPE SPECIES. — *Pronemobius apterus* Chopard, 1915 by subsequent designation by Otte (1994a). *Ignambina oubatchia* Otte, 1987 erroneously mentioned as type species of *Paniella* in Otte *et al.* (1987).

ILLUSTRATIONS. — Habitus: Fig. 4D; Anso *et al.* 2016a: fig. 36. Male genitalia: none (LDG, pers. obs.).

DIAGNOSIS. — Small Nemobiinae with distinctly variegated coloration, with yellow, orange, brown and black; legs yellowish brown both dark marks and rings. Maxillary palpi short; joints 4 and 5 yellow or white; joint 5 very short and wide. Eyes small, not protruding, the distance between episternal suture and lower margin of eye nearly equal to eye mid width. TI lacking both inner and outer tympanum;

two long, ventral apical spurs. TII with three apical spurs. TIII with three pairs of short subapical spurs; three apical spurs on each side; median spur the longest on outer side; dorsal spur the longest on inner side, about half as long as basitarsomere III.

Males. Apterous. Male genitalia: Pseudepiphallic sclerite short and wide, more or less rounded; partly sclerotized dorsally, but membranous anteriorly to apical lobes; laterally more sclerotized. Pseudepiphallic apical lobes short but well-separated from one another, membranous. Dorsal cavity small; endophallic sclerite with a thin and elongate median part, and two larger lateral parts, extended anteriorly by a thin and long sclerotization. Ectophallic fold extended laterally.

Females. Apterous; ovipositor shorter than FIII; dorsal valves with crenulated apex.

DISTRIBUTION. — Endemic to New Caledonia.

HABITAT. — *Paniella* lives in rainforest. Many specimens deposited in the MNHN collection have been collected by fogging of trees and logs, while others have been collected by night high on tree trunks or on understorey plants.

Genus *Paora* Gorochov, 1986 n. stat.

Paora Gorochov, 1986a: 692.

Synonymized with *Apteronemobius* Chopard, 1929 by Otte *et al.* (1987). Restored from synonymy in the present paper.

TYPE SPECIES. — *Paora gusevae* Gorochov, 1986a by original designation.

ILLUSTRATIONS. — Habitus: Fig. 4E. Male genitalia: Gorochov 1986a: figs 2-4.

EMENDED DIAGNOSIS. — Very large nemobiines. Eyes large but not protruding; distance between episternal suture and lower margin of eye less than eye mid width, but greater than in other nemobiines such as *Bullita* or *Koghiella*. Maxillary palpi moderately long; joint 5 the longest, regularly widened toward apex. TI with a small outer tympanum; with two apical spurs, ventral. TII with three, long apical spurs. TIII with four pairs of subapical spurs; inner apical and subapical spurs longer than the outers; three pairs of apical spurs, inners longer than outers; dorsal spur the longest on inner side, longer than half basitarsomere III and only slightly longer than median spur; median spur the longest on outer side.

Males. TIII inner subapical spurs widened. FWs present, sometimes reduced; stridulatory apparatus with a well-developed harp in *P. gusevae* Gorochov, 1986, hardly visible in species with reduced FWs. Male genitalia: short; pseudepiphallic parameres extending beyond short pseudepiphallic apical lobes.

Females. Apterous.

DISTRIBUTION. — Endemic to New Caledonia. *Paora gusevae* is known from New Caledonia without precise locality, but material not yet described attests the presence of the genus in Mont Mou, in Aoupinié massif and close to the Dzumac (MNHN material).

HABITAT. — Unknown.

REMARK

Otte *et al.* (1987) synonymized *Paora* with *Apteronemobius* Chopard, 1929, because of similarities in male genitalia between the drawings of Gorochov (1986a) for *Paora gusevae* and the genitalia of *Apteronemobius darwini* Otte & Alexander, 1983 from Australia. However, Gorochov's description of *Paora* and the type species of *Apteronemobius* (*Apteronemobius longipes* Chopard, 1929, type specimen deposited in the MNHN), present huge differences in FW development (fully developed, with a stridulum in *Paora*, lacking in *Apteronemobius*), TIII subapical spurs (four pairs *versus* two pairs, respectively) and male genitalia. In *Apteronemobius*, male genitalia are convex, the rami almost as long as pseudepiphallic sclerite; the pseudepiphallic sclerite is longer than wide, well-narrowed toward apex at mid length; the apical lobes are long and squared, separated from each other by a regular space and well-sclerotized over their whole length; the pseudepiphallic parameres are short, and the dorsal cavity is well-developed and sclerotized by endophallic sclerite. In *Paora*, the pseudepiphallic sclerite is wider than long, the apical lobes very short, the pseudepiphallic parameres very long and thick. For these reasons, we restore *Paora* from its synonymy with *Apteronemobius*, but it will be necessary to compare it with other winged Nemobiinae from New Caledonia to confirm its status.

Genus *Orintia* Gorochov, 1986

Orintia Gorochov, 1986a: 698. — Otte *et al.* 1987: 412.

TYPE SPECIES. — *Orintia incrustata* Gorochov, 1986 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 6A; Gorochov 1986a: fig. 27. Male genitalia: Fig. 7.

EMENDED DIAGNOSIS. — Small to medium apterous nemobiines with a very wide head. Coloration pattern distinctive: body variegated orange, dark brown, black and ivory; pronotum often with a wide V-shaped ivory area covering part of DD and LL, with posterior part of LL black; head dorsum lightly coloured; antennae pubescent and annulated dark and white; last three joints of maxillary palpi white; abdomen light brown or orange brown with rows of brown dots and two squared black spots. Head and body with long and thick setae. Head distinctly large, wider than body, and much wider than high in front view (Fig. 6). Eyes very wide but not protruding; distance between episternal suture and lower margin of eye shorter than eye mid width. Joint 5 of maxillary palpi long compared to joints 3 and 4, regularly widened toward apex (Fig. 8A). Pronotum transverse; wider anteriorly than posteriorly, which gives the body a particular shape. TI with a small outer tympanum; no inner tympanum; two apical spurs. TII with three long apical spurs (only two in *O. cornuta* Desutter-Grandcolas, n. sp.). TIII short compared to FIII; with three outer and three inner apical spurs; with three pairs of relatively short and alternate inner and outer subapical spurs, getting slightly longer toward TIII apex. Basitarsomeres very long; hindbasitarsomeres longer than half TIII.

Males. Face plain or slightly concave at level of episternal suture; with a pair of long horns in *Orintia cornuta* Desutter-Grandcolas, n. sp. (Fig. 6B-D). Metanotum and tergites without glandular structures. Subgenital plate short and low. Male genitalia (Fig. 7)

short and wide; margins of pseudepiphallic sclerite straight or slightly convex; main part of pseudepiphallic sclerite clearly more sclerotized, broadly squared; a pair of short apical lobes, rounded or rectangular; lateral lobes dejected laterally, distinctly separated from pseudepiphallic sclerite, about as long as median lobes, their distal margin somewhat coiled and with a deep notch.

Females. Face more convex than in males. Apterous. Subgenital plate very short and transverse; distal margin straight in examined material. Ovipositor long, thin and straight; valves very little widened before apex; dorsal valves finely crenulated distally.

DISTRIBUTION. — Endemic to New Caledonia. Up to now, *Orintia* was mentioned from New Caledonia without precision (Gorochov 1986a; Otte *et al.* 1987). It is reported here for the first time from Mont Panié, Aoupinié, Col d'Amieu, Pic du Grand Kaori, Pic d'Amoa, Pic du Pin, Mont Dzumac, Mont Koghis and Parc des Grandes Fougères (material in MNHN collection).

HABITAT. — *Orintia* specimens have been found in rainforest by day in the leaf litter or under bark. Others were foraging by day on the dense moss covering dead fallen trees (LDG, pers. Obs.).

REMARKS

Gorochov (1986a) described this genus in the Lissotrachelini (Pentacentrinae). Otte *et al.* (1987) tentatively transferred it to the Thetellini (Nemobiinae). Morphological and genitalic characters show that *Orintia* belongs to Nemobiinae, although it is not clear in which tribe.

Orintia has been described on one female only. Male characters are described here for the first time.

Orintia cornuta Desutter-Grandcolas, n. sp.
(Figs 6, 7, 8A; Table 2)

TYPE LOCALITY. — New Caledonia, Grande Terre, Mont Panié, Wewec, 20°35'41.80"S, 164°43'42.37"E.

ETYMOLOGY. — Species named after the pair of long horns present on male face.

TYPE MATERIAL. — **Holotype.** New Caledonia, Grande Terre, Mont Panié, Wewec, 20°35'41.80"S, 164°43'42.37"E, 410 m, 1 ♂, 6-11.XI.2010, jour, fn 189, collected with a mouth aspirator, perched on an understorey structure, F. Legendre (MNHN-EO-ENSIF3964). **Paratype.** 1 ♂: Same locality, date and collector as holotype, 20°35.39'46"S, 164°43'40.40"E, 420m, 1 ♂, fn 215, collected by beating (MNHN-EO-ENSIF3965).

DIAGNOSIS. — Within the genus, *O. cornuta* Desutter-Grandcolas, n. sp. is characterized by the pair of long horns present on male face, the highly contrasting coloration of its head and pronotum (see below and Fig. 6B, C), and the presence of only two apical spurs on TII. From the type species, *Orintia incrustata* (known by a female only), it can be recognized by the coloration of its head, with alternatively yellow and dark brown transverse stripes (Fig. 6B) and of its abdomen (tergites III, VIII and IX darker: Fig. 6A, to be compared with fig. 27 in Gorochov 1986a). Male genitalia with rectangular median distal lobes; lateral lobes only slightly coiled but with a deep lateral notch; ectophallic apodemes thick at base and not projecting beyond pseudepiphallic sclerite.

Female. Unknown.

HABITAT AND LIFE HISTORY TRAITS. — Unknown.

TABLE 2. — *Orintia cornuta* Desutter-Grandcolas, n. sp. Measurements (in mm). Abbreviations: see Material and methods.

	iod	PronL	PronWa	PronWp	FIIL	FIIW	TIIL	tars1-III
Male holotype	1.1	1.2	2.1	1.8	4.6	2	3.4	1.4
Male paratype	1.1	1.2	1.9	1.6	4.4	1.6	3	1.2
mean (n=2)	1.1	1.2	2	1.7	4.5	1.8	3.2	1.3

DESCRIPTION

In addition to the characters of the genus: Size medium.

Coloration (Fig. 6A-C)

Face (Fig. 6D) and cheeks (Fig. 6C) black; a light yellow line along the eyes outer margin; dorsally, a yellowish transverse band between eyes, running along distal margin of fastigium and turning around lateral ocelli; area around and behind ocelli black; head dorsum otherwise yellowish, with a median brown fleck; scapes yellowish, with two ivory dots, one on dorsal side and one on inner margin; antennae yellowish basally, then black brown with a whitish article every 10 to 12 dark articles (Fig. 6A). Pronotum LL entirely dark brown; DD yellowish, with two pairs of dark brown dots, one along each margin. Legs yellowish, with incomplete black rings: TI, TII with two rings; FI, FII with one ring, plus one basal and one apical black dot on outer side; TIII with three black rings; tibial apex yellowish; FIII (Fig. 6E) with four black spots on dorsal side, more or less extended on inner and outer sides of FIII. Cerci light yellow.

Male

Face slightly concave along median part of episternal suture. Under each antennal pit, area just above episternal suture projecting as a long cylindrical and slightly curved horn (Fig. 6A-D); each horn thicker ventrally close to its base; both horns slightly convergent distally. Subgenital plate triangular (Fig. 8E); distal margin bisinuate with acute median part; black.

Male genitalia (Fig. 7)

Slightly convex on mid length, rectangular with a narrow distal part. Pseudepiphallallic sclerite more sclerotized dorsally. Median apical lobes well-developed, rectangular with a longer outer angle; lobes only hardly separated with a distal margin making a very wide V. Lateral lobes well-separated from main pseudepiphallallic part, dejected laterally; their distal margins somewhat coiled, with a deep median notch. Ectophallic apodemes short, not projecting beyond anterior margin of pseudepiphallallic sclerite, and thick at their base.

Female

Unknown.

Genus *Thetella* Otte & Alexander, 1983

Thetella Otte & Alexander, 1983: 193.

Burcus Gorochov, 1986a. Type species *Burcus boklavae* Gorochov, 1986a. Synonymy in Otte (1994a).

TYPE SPECIES. — *Thetella oonoomba* Otte & Alexander, 1983 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 4F. Male genitalia: Otte & Alexander 1983: fig. 147. Calling song: Otte & Alexander 1983: fig. 146.

EMENDED DIAGNOSIS. — Large and relatively thin, lightly coloured nemobiines. Head somewhat flattened dorsally. Fastigium not very wide, but slightly wider than scape; ocelli in flat triangle, all small, the median the smallest. Eyes small, not protruding; distance between margin of cheek and lower margin of eye more than eye mid width. Maxillary palpi not elongate; joint 5 slightly longer than joint 3, little and regularly widened toward apex, truncated apically. Pronotum transverse; DD anterior margin concave, posterior margin convex; LL rectangular, lower margin shorter than upper margin. Legs I and II thin; tibiae shorter than femora. TI with a large outer tympanum, no inner tympanum. TI and TII with two apical spurs. TIII shorter than FIII; three outer and two inner apical spurs; median spur the longest on outer side; inner spurs very long, the dorsal the longest, longer than half basitarsomere. TIII with three outer and two inner subapical spurs, all short and about the same size. Tarsi elongate, with long basitarsomeres. Abdomen setose. Cerci long.

Male. FWs short, reaching abdomen mid length. Venation faint, except MA and MP, located at the limit between dorsal and lateral fields. Stridulatory apparatus complete, but mirror not separate from short apical field; chords widely apart from each other; CuP lacking. Subgenital plate short; distal margin with an acute median process. Male genitalia with a very long and narrow pseudepiphallallic sclerite, curved upward and bifid at apex; rami and ectophallic apodemes short and wide; dorsal cavity short and very narrow.

Female. FWs lacking. Subgenital plate transverse, deeply emarginate distally. Ovipositor long and straight; apex regularly narrowed, ventral valves somewhat concave; dorsal valves with a variable longitudinal crest, margins and crest somewhat crenulated.

VARIATION. — While all the specimens of *Thetella* examined have only two inner subapical spurs on TIII, one female which otherwise fits *Thetella* diagnosis has three inner subapical spurs. It is moreover thinner than *Thetella*, and its coloration is variegated yellowish brown and dark brown. It originates from the Mandjelia summit, far from any coast or river: the status of this female will have to be checked with additional material and data.

DISTRIBUTION. — *Thetella* is recorded from Australia (Otte & Alexander 1983), Tahiti (Gorochov 1986a as *Burcus*), Hawaii (Otte 1994b) and Vanuatu (LDG, pers. obs.). It is here newly reported from New Caledonia, where it has been found in many localities of Grande Terre, Île des Pins and Lifou (LDG, pers. obs., material in MNHN).

HABITAT. — *Thetella* lives in small cavities in alveolate rocks located along streams or on the coast, mostly uplifted corals (Fig. 4G). Along the sea, it hides in these cavities when the tide is high, and gets out at low tide, grazing algae on the rocks. Males can be heard singing from the small cavities.

Genus *Ionemobius* Otte, Alexander & Cade, 1987

Ionemobius Otte, Alexander & Cade, 1987: 411.

Ionomobius – Otte, Alexander & Cade 1987: 411 (misspelling).

TYPE SPECIES. — *Ionemobius alliciens* Otte, 1987, by subsequent designation (see infra).

ILLUSTRATIONS. — Habitus pp: Otte *et al.* 1987: figs 13C, 14F. Male genitalia: Otte *et al.* 1987: fig. 17A.



FIG. 6. — *Orintia cornuta* Desutter-Grandcolas, n. sp. (Trigonidiidae, Nemobiinae): **A**, habitus, dorsal; **B**, **C**, head and pronotum, in dorsal (**B**) and lateral (**C**) views; **D**, face; **E**, FII outer side. Scale bar: 1 mm.

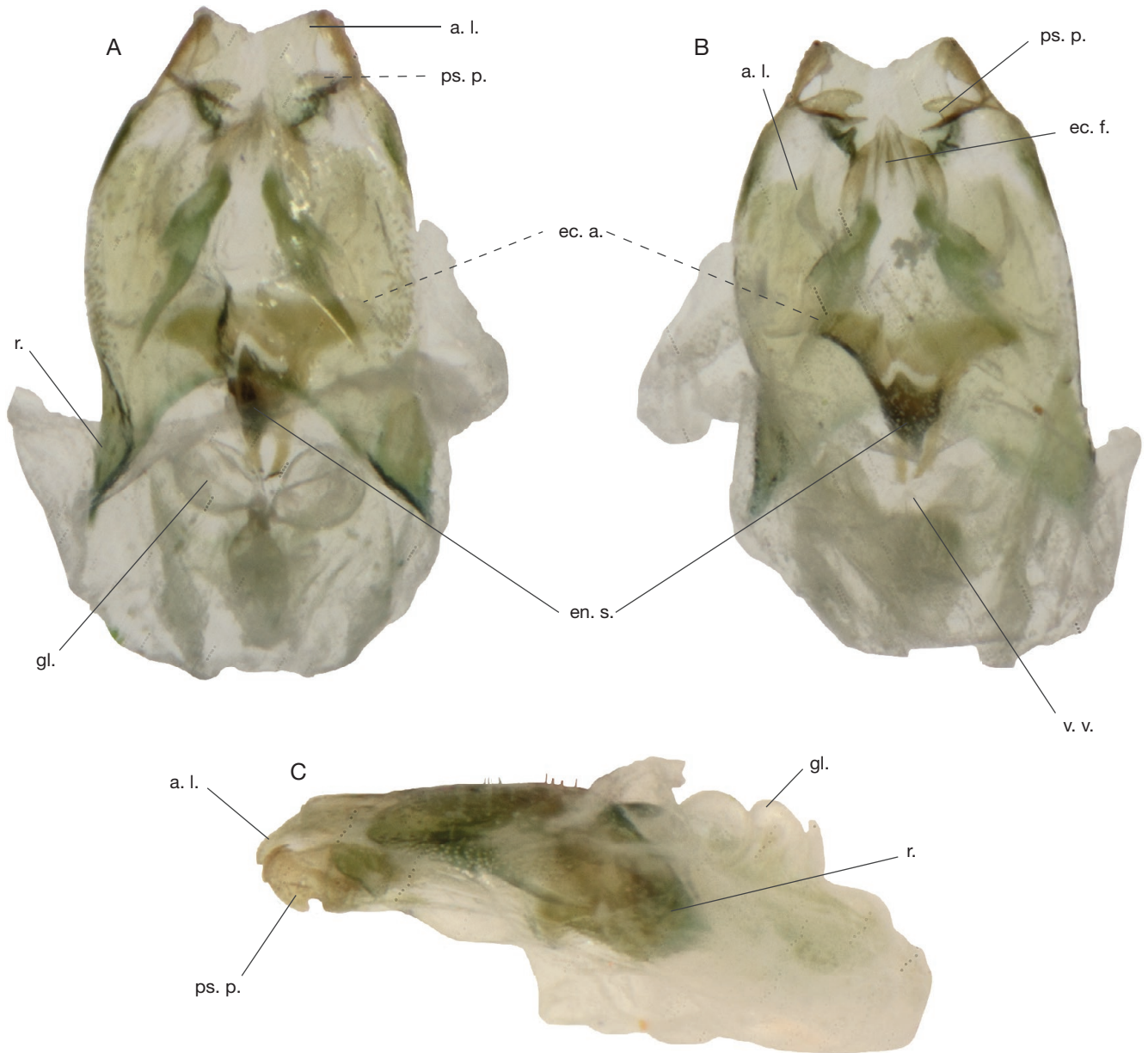


FIG. 7. — *Orintia cornuta* Desutter-Grandcolas, n. sp. (Trigonidiidae, Nemobiinae): male genitalia, in dorsal (A), ventral (B) and lateral (C) views. Abbreviations: see Material and methods.

DIAGNOSIS. — After Otte *et al.* 1987. Similar to *Thetella*, except for the number of TII apical spurs (3, instead of 2 in *Thetella*). Otte *et al.* (1987) consider that *Thetella* and *Ionemobius* are so similar that they could belong to the same genus; no specimen could however be studied to check this hypothesis.

DISTRIBUTION. — Endemic to New Caledonia. Known from the type locality of the type species only (coastal forest near Thio).

HABITAT. — Otte *et al.* (1987: 412) mention that *I. alliciens* has been “collected along a small stream and along the stony shoreline among wet stones and debris”. This habitat fits that of *Thetella*, which would support an hypothesis of synonymy between the two genera.

REMARK

In Otte *et al.* (1987), the type species indicated for *Ionemobius* is *Amonemobius vexans* Otte, 1987, which is clearly an error. In his Catalogue, Otte (1994a) mentions *I. alliciens* Otte, 1987 as the type species of *Ionemobius*, but not formally designates it as such.

Genus *Kanakinemobius* Desutter-Grandcolas, 2016

Kanakinemobius Desutter-Grandcolas in Anso *et al.*, 2016a: 84.

TYPE SPECIES. — *Kanakinemobius mandjelia* Desutter-Grandcolas, 2016 by original designation.

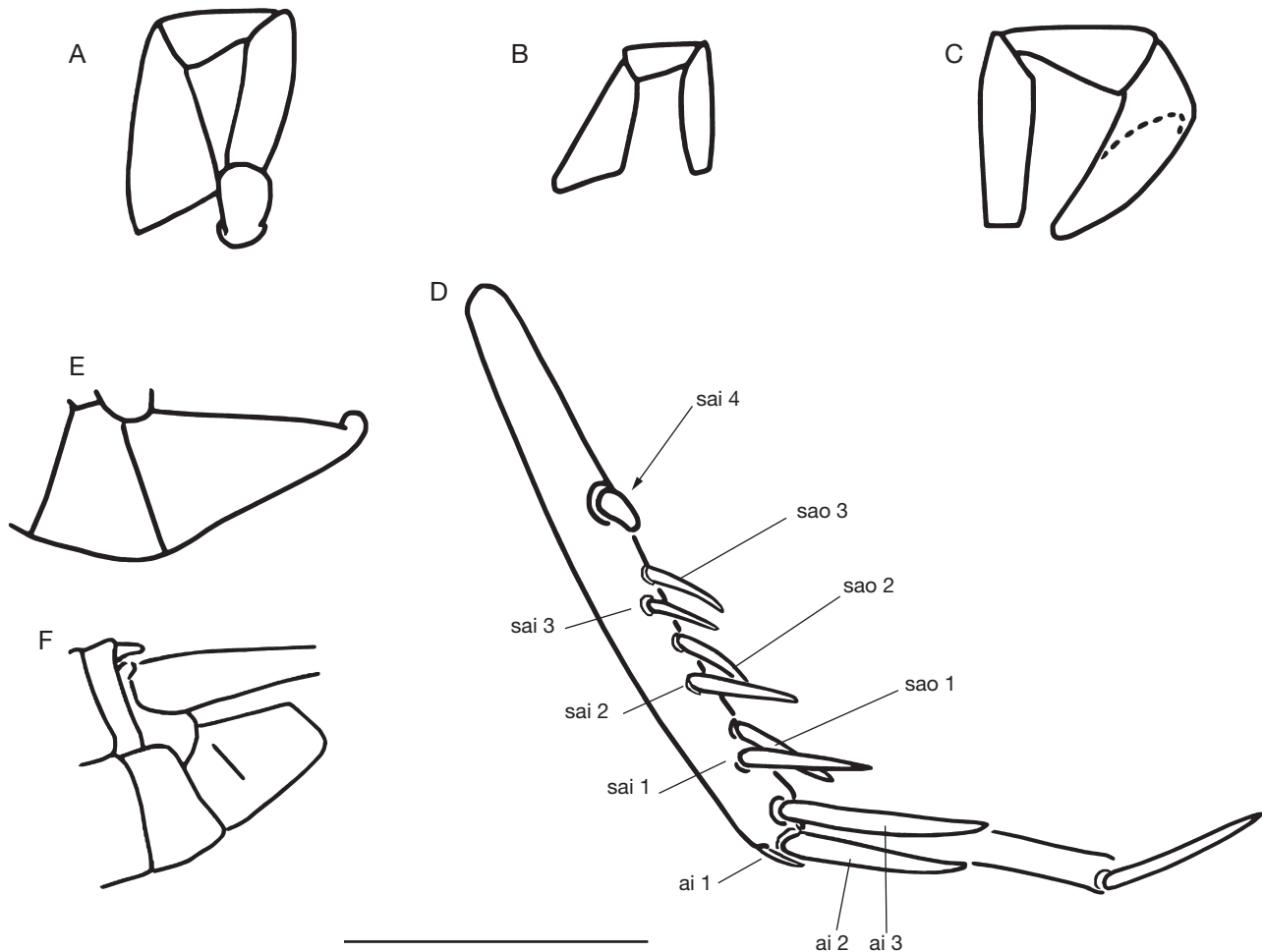


FIG. 8. — **A-C**, Maxillary palpi of *Orintia cornuta* Desutter-Grandcolas, n. sp. (**A**), *Caledonina chopardi* Desutter-Grandcolas, n. sp. (**B**) and *Archenopterus adamanthus* Desutter-Grandcolas, n. sp. (**C**); **D**, Hind tibia spurs of *C. chopardi* Desutter-Grandcolas, n. sp.; **E**, **F**, male subgenital plate of *Orintia cornuta* Desutter-Grandcolas, n. sp. (**E**) and *C. chopardi* Desutter-Grandcolas, n. sp. (**F**). Scale bar: 1 mm.

ILLUSTRATIONS. — Habitus: Fig. 1J; Anso *et al.* 2016a: fig. 37A-C. Male genitalia: Anso *et al.* 2016a: fig. 37H-J.

DIAGNOSIS. — Small to median nemobiines with a distinct coloration pattern (body quite uniformly brown to dark brown, with black head and pronotum, except for two transverse ivory bands on pronotum). Head dorsum quite flat; ocelli small, set as a low and wide triangle. Antennae setose. Eyes little protruding; distance between episternal suture and lower margin of eye about one third eye mid width. Maxillary palpi short; joint 3 slightly longer than joint 4; joint 5 the longest, greatly widened toward apex. Pronotum rounded, longer dorsally than laterally; distal part of lateral lobe directed inwardly. FWs very short in both males and females. TI lacking a tympanum, on both inner and outer sides. TII with three long apical spurs, outer dorsal spur lacking. TIII short; with four pairs of subapical spurs.

Males. FWs not reaching metanotum half length, not overlapping, but with an impressed file bearing about 20 teeth. Metanotum and tergites without glandular structures. Subgenital plate long and narrow. Male genitalia elongate; pseudepiphallallic sclerite narrow, almost of same width over its whole length; apical lobes very long, flat and wide.

Females. FWs very short, not reaching one third of metanotum length, most often hardly visible beneath pronotum. When present, venation faint and irregular. Subgenital plate transverse; distal

margin V-shaped. Ovipositor short, valves not widened before apex, but regularly thinner; dorsal valve with a variable longitudinal crest close to lower margin. Female genitalia. Copulatory papilla having the shape of a thick plate.

DISTRIBUTION. — Endemic to New Caledonia, where it is known from the Mandjelia summit, Poro, Touho and the Grand Kaori in the South (MNHN collection).

HABITAT. — Forest-dwelling species, which habitat is not clearly documented.

Genus *Caledonina* Desutter-Grandcolas, n. gen.

TYPE SPECIES. — *Caledonina chopardi* Desutter-Grandcolas, n. sp.

ILLUSTRATIONS. — Habitus: Fig. 9A. Male genitalia: Fig. 9F-H.

ETYMOLOGY. — Genus named after its geographical origin.

DIAGNOSIS. — Very small (body less than 5 mm long), brightly coloured species; head and DD light orange and brown (Fig. 9A, B); LL shiny black; FW lateral field party dark brown; legs light yellow. Pronotum transverse, much wider than long. TI with a large outer

tympanum, no inner tympanum. TII with two long apical spurs. TIII with three pairs of apical spurs; four inner and three outer subapical spurs. Tarsi all long, longer than half tibiae.

Male. FWs long, covering almost the whole abdomen. Stridulum complete; mirror partly reticulated. TIII upper inner subapical spur short, wide and thick (probably glandular, as in *Pteronemobiini*: Fig. 8D). Male genitalia wide, with short pseudepiphallic sclerite; pseudepiphallic median distal lobes very well developed, turgescient and covered with long setae; pseudepiphallic lateral lobes almost as long as median lobes, connected both to median lobes and to pseudepiphallic parameres.

Female. Unknown.

DISTRIBUTION. — Endemic to New Caledonia; known from Aoupinié mountains only.

HABITAT. — See below *Caledonina chopardi*, Desutter-Grandcolas, n. gen., n. sp.

REMARKS

In the molecular phylogeny proposed by Chintauan-Marquier *et al.* (2013, 2016), *Caledonina* Desutter-Grandcolas, n. gen. is the sister group of *Koghiella*. *Caledonina* Desutter-Grandcolas, n. gen. is however closer to *Bobilla*, not included in the molecular phylogeny. Both genera present very similar male genitalia, especially the pseudepiphallic median lobes; they differ by several morphological characters, such as the number of TIII subapical spurs (four outer in *Caledonina* Desutter-Grandcolas, n. gen. against three in *Bobilla*; TIII most basal inner subapical spur glandular in *Caledonina* Desutter-Grandcolas, n. gen. but not so in *Bobilla*). These data validate the occurrence of species with a tibial gland in males within the *Nemobiini*, a characters used up to now to separate *Pteronemobiini*.

DESCRIPTION

Very small (body less than 5 mm long in males), brightly coloured species. Eyes wide but not protruding; distance between episternal suture and lower margin of eye well shorter than eye mid width. Ocelli set as a low triangle, the laterals much bigger than the median; median ocellus subapical. Maxillary palpi (Fig. 8B) a little elongate; joint 4 very short compared to joints 3 and 5; joint 5 the longest, regularly widened toward apex but not very wide, as in *Kanakinemobius* Desutter-Grandcolas, 2016. Pronotum much wider than long (Fig. 9A); LL squared. TI with a large outer tympanum, no inner tympanum; two apical spurs, ventral, the outer small, the inner much longer. TII with two, long and ventral, apical spurs. TIII with three outer and four inner subapical spurs, all alternate; outer spurs more equal in size than the inner, the first (distal) inner subapical spur longer than all subapical spurs, the fourth (basal) inner subapical spur small and short (Fig. 8D), resembling the glandular spur of *Pteronemobiini* (at least in males). TIII with three inner and three outer apical spurs; ventral spurs much shorter than median and dorsal spurs, the inner longer than the outer; median spur the longest on outer side, nearly twice as long as dorsal outer spur, but shorter than dorsal and median inner spurs; these last spurs longer than all other apical and subapical spurs, and reaching or extending slightly beyond hindbasitarsomere mid length. Tarsi all very long, longer than tibiae mid length.

Coloration (Fig. 9A-D)

Variiegated light orange and light brown; LL shining black; FW lateral field upper part dark brown. Legs light yellow, FIII somewhat darker. Tergites black with a yellow dot on each side, sternites light yellow. Cerci light yellowish brown, darker at base.

Male

TIII fourth (most basal) inner subapical spur (Fig. 9E) short, thick and blunt distally (glandular). FWs not covering whole abdomen (Fig. 9A, B). Stridulum complete, but apical field and mirror partly filled with large reticulation. Limit between lateral and dorsal fields made by MP; file very short, running on about half FW width only; a wide area between file and CuA, with a faint CuP running between. FWs truncate distally, with a very short median fan. Lateral field with four longitudinal parallel veins, including MA and R. Subgenital plate long and high, but transverse, and truncate distally (Fig. 8F).

Male genitalia (Fig. 9F-H)

Pseudepiphallic sclerite short; pseudepiphallic median distal lobes very well developed, turgescient and covered with long setae; median lobes making the V-shaped distal margin of pseudepiphallus; pseudepiphallic lateral lobes almost as long as median lobes, connected both to median lobes and to pseudepiphallic parameres.

Female

Unknown.

Caledonina chopardi Desutter-Grandcolas, n. sp. (Figs 8B, D, F; 9; Table 3)

TYPE LOCALITY. — New Caledonia, Aoupinié mountains.

TYPE MATERIAL. — **Holotype.** New Caledonia, Grande Terre, Massif de l'Aoupinié, 400 m, 11 km SW Ponérihouen, 1 ♂, 23.III.1994, jour, milieu ouvert (chemin), sous pierre, fn 2, L. Desutter-Grandcolas (MNHN-EO-ENSIF3962).

Paratype. 1 ♂. Same locality, date and collector as the holotype, fn 1, molecular sample LDG 246 (MNHN-EO-ENSIF3963).

ETYMOLOGY. — Species named in honor of the great orthopterist, Lucien Chopard.

DIAGNOSIS. — In addition to the characters of the genus, head and cheeks light orange and light brown, face light brown; pronotum anterior margin and DD distal margin yellow, LL brown, DD light brown and light yellow.

Male. Stridulatory file with about 86 stridulatory teeth (n = 1). Subgenital plate yellow with two longitudinal but slightly convergent brown lines. Male genitalia as on Fig. 9F-H.

CALLING SONG. — Unknown.

DISTRIBUTION. — Known from type locality only.

HABITAT. — *Caledonina chopardi* Desutter-Grandcolas, n. gen., n. sp. has been found under stones by day on a trail running through an open, not forested area.



FIG. 9. — *Caledonina chopardi* Desutter-Grandcolas, n. gen., n. sp. (Trigonidiidae, Nemobiinae): **A**, habitus, dorsal; **B**, head and pronotum, in lateral view; **C**, face; **D**, Fll outer side; **E**, right FW, dorsal; **F-H**, male genitalia, in dorsal (**F**), ventral (**G**) and lateral (**H**) views. Scale bar: 1mm. Abbreviations: see Material and methods.

TABLE 3. — *Caledonina chopardi* Desutter-Grandcolas, n. gen., n. sp. Measurements (in mm). Abbreviations: see Material and methods.

	iod	PronL	PronWp	FWL	FWW*	FIIL	FIIIw	TIIIL	tar1-III
Holotype	0.9	0.9	1.6	2	1.3	3.1	1.2	2.1	0.9
Paratype male	0.7	0.9	1.4	2	1.3	2.9	1.1	2	0.9
Mean (n = 2)	0.8	0.9	1.5	2	1.3	3	1.2	2.1	0.9

DESCRIPTION

In addition to the characters of the genus: Coloration. Head dorsum and cheeks light orange, with light brown longitudinal stripes; a wide brown stripe behind each eye. Face and mouthparts light brown. Antennae light yellow. Pronotum anterior margin light yellow; DD light brown and light yellow, distal margin light yellow.

Male

FWs nearly reaching tergite VII distal margin. Venation: diagonal not bifurcated and not connected to file; chords longitudinal, very close together; chords 1 and 2 partly fused distally. File with about 86 teeth (n = 1). Subgenital plate yellowish, with a pair of brown lines, longitudinal but slightly convergent toward apex.

Male genitalia

Pseudepiphallic sclerite short; pseudepiphallic median distal lobes very well developed, turgescient and covered with long setae; median lobes close to one another on their inner margin, their distal margins making the V-shaped margin of pseudepiphallus; pseudepiphallic lateral lobes almost as long as median lobes, connected both to median lobes and to pseudepiphallic parameres.

Female

Unknown.

Family GRYLLIDAE Laicharting, 1781

REMARK

Gryllidae are represented in New Caledonia by Eneopterinae Saussure, 1893, Euscyrtinae Gorochoy, 1985, Gryllinae Laicharting, 1781, Podoscirtinae Saussure, 1878 and Oecanthinae Blanchard, 1845.

Subfamily GRYLLINAE Laicharting, 1781

REMARK

Four genera of the Gryllinae subfamily are present in New Caledonia, i.e. *Gryllodes* Saussure, 1874, *Lepidogryllus* Otte & Alexander, 1983, *Notosciobia* Chopard, 1915 and *Teleogryllus* Chopard, 1961. *Notosciobia* is endemic to New Caledonia, while the three other genera have wider distributions. From the point of view of their phylogenetic relations (Chintauan-

Marquier *et al.* 2016), *Gryllodes*, *Lepidogryllus* and *Teleogryllus* are more closely related to one another, while *Notosciobia* belongs to a clade comprising at least *Anurogryllus* Saussure, 1877, *Itaropsis* Chopard, 1925, *Phonarellus* Gorochoy, 1983, *Urogryllus* Randell, 1964 and *Zebragryllus* Desutter-Grandcolas & Cadena-Casteñada, 2014.

Genus *Notosciobia* Chopard, 1915

Notosciobia Chopard, 1915: 140. — Otte *et al.* 1987: 385.

TYPE SPECIES. — *Notosciobia rouxi* Chopard, 1915 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 10A. Male genitalia: Anso *et al.* 2016a: fig. 8. Calling songs: Otte *et al.* 1987: figs 4, 5; Anso *et al.* 2016a: figs 9-11.

EMENDED DIAGNOSIS. — After Chopard (1915) and Otte *et al.* (1987). Species small to large. Body highly pubescent. Head longer than wide in front view, somewhat narrow in lateral view (compared to other grylline genera below). Median ocellus reduced or lacking, subapical. Maxillary palpi with joints 3 and 4 subequal, distinctly shorter than joint 5; joint 5 regularly widened toward apex, dorsal margin slightly concave, ventral margin slightly convex. Pronotum wider than long, but not transverse; LL high, squared, with a distinctive vertical groove in posterior half; DD lateral sides roughly parallel, or pronotum wider anteriorly than posteriorly, especially in females. TI lacking inner tympanum; outer tympanum well-developed, elongate; with three apical spurs. TII with four apical spurs. TIII short; with four or five inner and outer subapical spurs; three apical spurs on each side, the median the longest on outer side, the dorsal on inner side. Basitarsomeres III with two rows of few, strong spines; inner and outer spines almost always in front of each other. FWs present most often in both sexes, although very reduced and not overlapping in females. HWs lacking. **Coloration.** Body and head brown to dark brown, with a silky aspect due to short and numerous setae. Suture between lateral ocelli yellowish. Legs lighter coloured, often yellowish. **Male.** FWs most often short, not covering whole abdomen, but reaching supra anal plate in some of the biggest species. Stridulum complete, but mirror ill-defined from apical field and often partly filled with cells. Lateral field very high, with several parallel, longitudinal veins. Male genitalia: Pseudepiphallus very short, most often wider than long (except in *N. farino* Anso & Desutter-Grandcolas, 2016), with two distal lateral lobes and no median one, which gives the pseudepiphallic sclerite a wide H-shape; distal margin of pseudepiphallic sclerite between lateral lobes U- or V-shaped. Rami not fused anteriorly, but curved more or less strongly. Pseudepiphallic parameres elongate, sclerotized on both inner and outer margins. Ectophallic fold thin but not very elongate. Dorsal cavity present but short and low, not twisted.

Female. FWs very short when present, flap-like and not at all overlapping; venation lacking, or made of several longitudinal veins more or less anastomosed. Ovipositor very short, thin and straight; apex most often very short; apex of ventral valves with a deep, subapical transverse notch; the apex of dorsal valve triangular, deeply crenulated on lower margin.

CALLING SONG. — Documented for most species (see Otte *et al.* 1987: figs 4, 5, table 2; Anso *et al.* 2016a: figs 7, 9-11).

DISTRIBUTION. — Endemic to New Caledonia.

HABITAT. — *Notosciobia* species live in forested area, where they are encountered in leaf litter; they are often found in burrows; one juvenile has been found in a gallery under a small stone together with a scorpion (LDG and JA, pers. obs.).



FIG. 10. — New Caledonian Gryllinae (Gryllidae): **A**, *Notosciobia* sp., from Parc Provincial de la Rivière Bleue, by night (Photo PG); **B**, *Teleogryllus oceanicus* (Le Guillou, 1841) from Vanuatu; **C**, *Lepidogryllus comparatus* (Walker, 1869), specimen from Col d'Amieu, mé Areto; **D**, *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp., male holotype from Grand Kaori; **E**, *Gryllodes sigillatus* (Walker, 1869), from Rodrigues (Photo SH). Scales bars: 2 mm.

Genus *Teleogryllus* Chopard, 1961

Teleogryllus Chopard, 1961: 277.

TYPE SPECIES. — *Gryllus posticus* Walker, 1869 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 10B; Otte & Alexander 1983: fig. 36. Male genitalia: Otte & Alexander 1983: fig. 39. Calling songs: Otte & Alexander 1983: fig. 38.

EMENDED DIAGNOSIS. — After Otte & Cade (1983). Species medium or large, reddish brown, brown or black. Body slightly pubescent. Head only slightly longer than wide in front view, high in lateral view (compared to *Notosciobia*). Eyes not protruding. Median ocellus well-developed, apical. Maxillary palpi: joint 3 somewhat longer than joint 4; joint 5 the longest, regularly widened toward apex, dorsal and ventral margins slightly concave and convex respectively. Pronotum transverse, slightly wider anteriorly than posteriorly; LL higher anteriorly than posteriorly, without a vertical groove or depression in posterior half. TI with a small, rounded inner tympanum; outer tympanum well-developed, elongate; three apical spurs, set as a triangle. TII with four apical spurs. TIII shorter than FIII but not particularly short; with five to seven (usually five or six) inner or four to eight (usually six to eight) outer subapical spurs; three apical spurs on each side, the median the longest on each side. Basitarsomeres III with two rows of few, strong spines, outer spines more numerous. FWs present in both sexes. HWs variable. **Coloration.** Head and pronotum dark brown, with a yellow stripe along inner margin of each eye and along margins of fastigium; suture between lateral ocelli often yellow. Legs lighter brown. HWs variable, often well developed in both sexes.

Male. FWs covering abdomen completely or almost completely. Stridulum complete; mirror well-defined, small, rounded or oval, divided by one half-circled vein; harp with most often two to four veins, oblique but horizontal at mid length. Lateral field very high, with several parallel, slightly oblique veins.

Male genitalia. Pseudepiphallic sclerite long and narrow, with a long median lobe and two shorter lateral lobes. Rami short, not fused anteriorly. Pseudepiphallic parameres elongate, sclerotized on inner and outer margins; their apex acute. Ectophallic fold long and very thin. Dorsal cavity high, not twisted.

Female. FWs as long as in males, overlapping. Ovipositor long, but shorter than in *Gryllodes*.

CALLING SONG. — Revising the African species of *Teleogryllus*, Otte & Cade (1983) conclude that *Teleogryllus* species are conspicuous singers, which songs are complex and usually made of two distinct parts. Among the species occurring in New Caledonia, *T. marini* Otte & Alexander, 1983 alternates short trills and small groups of syllables, while *T. oceanicus* (Le Guillou, 1841) emits irregular succession of echemes comprising two or three syllables (Otte & Alexander 1983: fig. 38; Otte *et al.* 1987: fig. 12).

DISTRIBUTION. — *Teleogryllus* is widespread in the Palaetropics and in Oceania. In addition to New Caledonia, *T. marini* is known to occur in Queensland and Fiji Islands, while *T. oceanicus* is widespread through Southwest Pacific, from Australia to Hawaii.

HABITAT. — *Teleogryllus* species live in open areas, even man-made such as lawns. Some are burrowing species, but most use crevices to hide during the day (S. Hugel, pers. comm.).

REMARK

This worldwide-distributed genus is present in New Caledonia with two species, i.e. *Teleogryllus oceanicus* (Le Guillou, 1841) and *Teleogryllus marini* Otte & Alexander, 1983, which can be separated by their songs and details in male genitalia (Otte *et al.* 1987).

Genus *Lepidogryllus* Otte & Alexander, 1983

Lepidogryllus Otte & Alexander, 1983: 101.

TYPE SPECIES. — *Gryllus parvulus* Walker, 1869 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 10C, D; Otte & Alexander 1983: fig. 65. Male genitalia: Fig. 11E-H; Otte & Alexander 1983: fig. 68. Calling song: Fig. 12; Otte & Alexander 1983: fig. 67.

EMENDED DIAGNOSIS. — After Otte & Alexander (1983). Medium sized species. Body not pubescent; lightly coloured, except for *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp. Head rounded in front view, high in lateral view (compared to other grylline genera). Eyes not protruding. Median ocellus present, smaller than lateral ocelli, subapical. Maxillary palpi with joints 3 and 4 subequal, slightly shorter than joint 5; joint 5 little widened toward apex, dorsal and ventral margins almost straight and parallel. Pronotum wider than long, transverse; LL longer than high, without a distinctive vertical groove in posterior half, but with a clear depression; DD lateral sides slightly convex. TI lacking inner tympanum (a depression at best present); outer tympanum well-developed, elongate; three apical spurs, set as a triangle. TII with four apical spurs. TIII short; with six (sometimes seven) inner and seven outer subapical spurs; three apical spurs on each side, the median the longest on each side (inner median and dorsal apical spurs subequal in *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp.). Basitarsomeres III with two rows of few, strong spines; outer spines more numerous. FWs present in both sexes, shorter in females. HWs present or lacking in both males and females.

Coloration. Body, head and legs yellowish marked with brown, except in *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp. (Fig. 10D). A wide (narrow in *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp.) yellow transverse band between the lateral ocelli; median ocellus circled with yellow, this coloration prolonged toward face. Head dorsum light brown (black in *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp.) with several longitudinal yellow lines. Pronotum yellow abundantly marked with brown (black in *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp.); LL lower margin entirely light yellow.

Male. FWs well-developed, covering whole abdomen or nearly so, shorter in *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp.; apical field well-developed with several cell alignments. Stridulum complete, with a small, well-delimited mirror; harp with two oblique veins. Lateral field high, with several slightly oblique, longitudinal veins. Male genitalia: Pseudepiphallic sclerite transverse, H-shaped, with two wide and rounded distal lateral lobes and sometimes a very small median process. Rami short and straight. Pseudepiphallic parameres elongate and narrow; sclerotized on inner and outer margins; concave, with a wide apical tooth. Ectophallic fold short. Dorsal cavity well-developed, high and not twisted. **Female.** FWs well-developed, covering most of abdomen, overlapping. Ovipositor well-developed, long and straight.

CALLING SONG. — The song of *Lepidogryllus comparatus* (Walker, 1869) and *L. parvulus* (Walker, 1869) are described in Otte & Alexander (1983: fig. 67). We describe here the song of *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp. (cf. infra and Fig. 12)

DISTRIBUTION. — Australia, Norfolk Island and New Caledonia (Otte *et al.* 1987). Two species are present in New Caledonia: the widespread species, *Lepidogryllus comparatus*, and *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp. described from Province Sud (Grand Kaori).

HABITAT. — *Lepidogryllus comparatus* is “often found in drier grassy areas, especially on the west side of the island, sometimes on stony road banks.” (Otte *et al.* 1987: 399). It has also been found hiding under stones in shubland vegetation in the South of Province

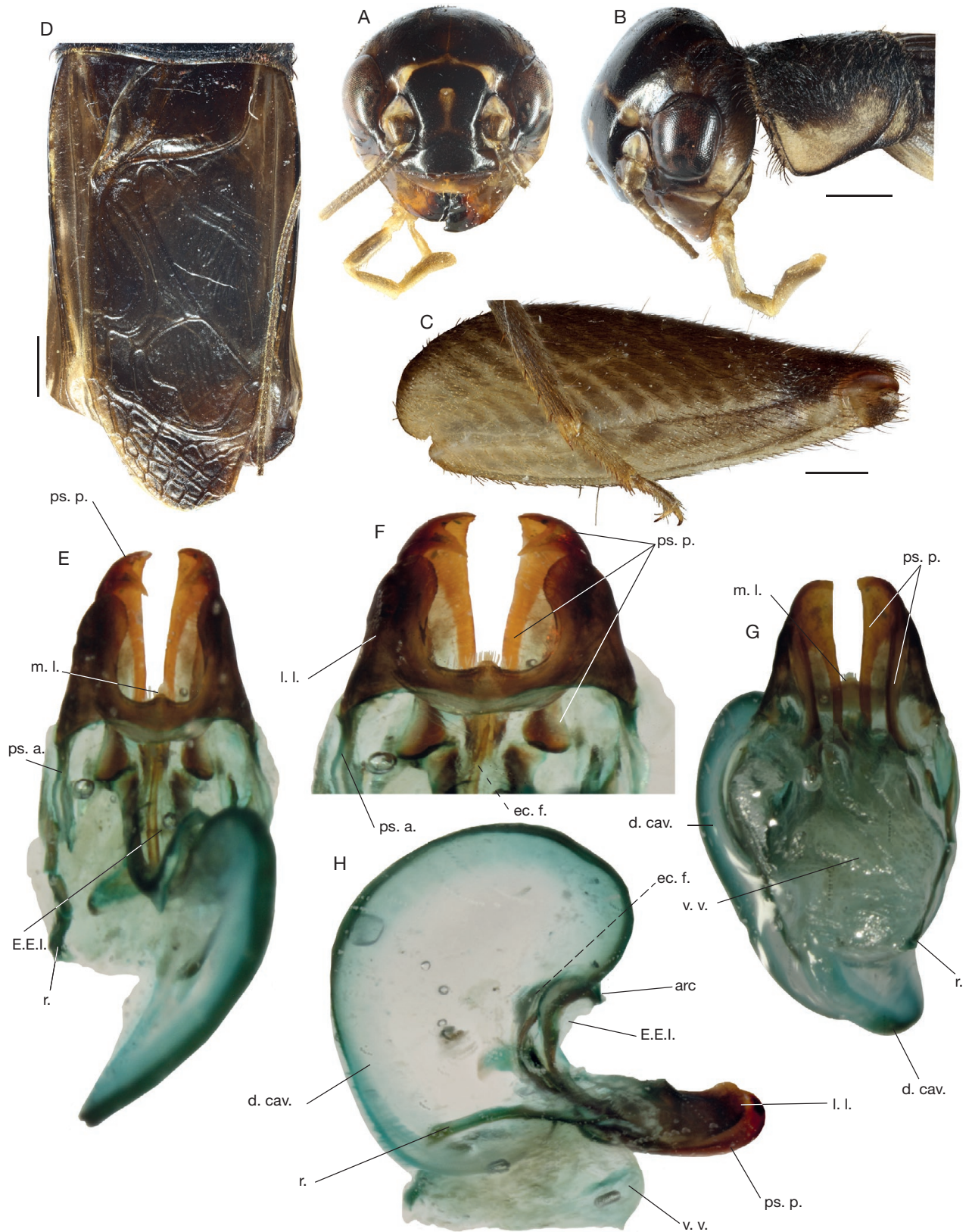


FIG. 11. — *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp. **A**, face; **B**, head and pronotum, in lateral view; **C**, FW outer side; **D**, male right FW, dorsal; **E-H**, male genitalia, in dorsal (**E**), ventral (**G**) and lateral (**H**) views, with detailed dorsal view of pseudepiphallallic sclerites (**F**). Scales bars: 1 mm. Abbreviations: see Material and methods.

Sud (LDG and JA, pers. obs.). *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp. has been found along road side close to a small tuft of grass.

Lepidogryllus darthvaderi

Desutter-Grandcolas & Anso, n. sp.
(Figs 10D; 11; 12; Table 4)

TYPE LOCALITY. — New Caledonia, Pic du Grand Kaori.

TYPE MATERIAL. — **Holotype.** New Caledonia, Grande Terre, Pic du Grand Kaori, 1 ♂, 13.IV.2016, nuit, milieu ouvert en bord de route, fn 55, J. Anso and L. Desutter-Grandcolas (MNHN-EO-EUSIF4194).

ETYMOLOGY. — Species named after its striking coloration within the genus : wholly dark (bad) with some light patches (good), as the bad fictional character Darth Vader (Dark Vador in French) in Star Wars, George Lucas.

DIAGNOSIS. — Within the genus, species characterized by its shining body, almost completely black except for few pale yellow marks (lower part of LL, thin line between lateral ocelli, short frontal line under median ocellus); legs dark brown.

Male. Stridulatory file short, with 92 teeth ($n = 1$); apical field short, with four cell alignments, each with few cells. Male genitalia: pseudepiphallic sclerite with a short median process, as in *L. comparatus*; in lateral view, pseudepiphallic sclerite and paramere very close to one another, the paramere distal margin well-rounded, as in *L. parvulus*. Female unknown.

CALLING SONG. — Fig. 12. At 22°C, the calling song of *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp. consists of a repetition of echemes of 0.89 ± 0.08 s; each echeme is made of 103 ± 3 syllables, with the following characteristics: syllable duration 5.7 ± 0.8 ms; syllable period: 9.2 ± 3.6 ms; syllable duty cycle = 18%. The dominant frequency is 4.4 ± 0.1 kHz.

DISTRIBUTION. — Known from type locality only.

HABITAT. — *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp. has been found by night in a disturbed open area close to a road side, calling from under a short tuft of grass.

DESCRIPTION

Species similar to other species of the genus by moderate size, head shape, shape and size of ocelli and maxillary palpi, auditory tympana, hing leg spurs and spines, male stridulatory apparatus and male genitalia. Coloration. Head black, shining; occiput with six faint, yellowish lines, reaching beyond posterior margin of eyes, the two most lateral on each side reaching eye inner margin. Ocelli pale yellow; suture between lateral ocelli maked by a thin pale yellow line, prolonged by a thicker yellow line between each ocellus and eye (Fig. 11A). Lower part of cheeks yellowish, getting darker dorsad. Face black, shining; a short yellow line below median ocellus (Fig. 11A). Mouthparts yellowish brown. Scapes and antennae brown. Maxillary palpi light yellow, but joint 3, basal part of joint 4, distal and dorsal parts of joint 5 brownish (Fig. 11A). Pronotum shining black; anterior margin yellow; LL lower half pale yellow with black ventral margin; a wide pale yellow spot on widened part of LL posterior margin (Fig. 11B). Legs. FI light brown with yellow spots (base of dorsal setae

and ventral margin. FII as FI, lighter in inner and outer basal parts. TI and TII light brown, yellow dorsally. FIII light brown with black knees; outer side light yellow at base and between brown oblique lines (Fig. 11C). TIII dark brown; spurs yellow with black apex. Tarsi I, II light yellow dorsally, brown laterally; tarsomeres 3 brown. Tarsi III dark brown, but yellow at level of tarsomeres 2 and claws. Cerci brown.

Male

FWs nearly reaching tergite IX anterior margin. Venation (Fig. 11D): diagonal bifurcated; chords 2 and 3 connected more distally; chords 1 and 2 parallel. File with 92 teeth ($n = 1$); harpe with two transverse, parallel veins; mirror small, not divided, but bordered on inner margin by distal, sublateral cell d2. Lateral field with longitudinal veins, the most dorsal one (Sc) bifurcated only twice. Subgenital plate long and high; black brown, lighter distally.

Male genitalia (Fig. 11E-H)

Pseudepiphallic sclerite transverse, H-shaped, with a narrow distal median process; pseudepiphallic apodemes long, more than twice as long as median pseudepiphallus length; pseudepiphallic lateral lobes long and wide, rounded on margin and apex. Pseudepiphallic parameres symmetrical, very long; inner and outer margins sclerotized and almost parallel; apex cuplike, concave with a rounded apex and a long subapical dorsal spine-like process. Epi-ectophallic invagination long; lateral sclerotization narrow; arc narrow; apodemes very short; ectophallic fold very narrow, short, slightly going beyond anterior margins of inner and outer sclerotization of parameres. Dorsal cavity higher than long, not twisted, almost closed ventrally.

Female

Unknown.

Genus *Grylloides* Saussure, 1874

Grylloides Saussure, 1874: 409.

TYPE SPECIES. — *Gryllus sigillatus* Walker, 1869 by subsequent designation (Kirby 1906).

ILLUSTRATIONS. — Habitus: Fig. 10E; Otte 2006: fig. 1. Male genitalia: Otte 2006: fig. 2. Calling song: Otte & Alexander 1983: fig. 67.

EMENDED DIAGNOSIS. — After Otte & Alexander (1983). Medium sized species, larger than *Lepidogryllus*. Body pubescent, lightly coloured. Head rounded in front view, high in lateral view (compared to other grylline genera). Eyes slightly protruding. Median ocellus present, smaller than lateral ocelli, subapical. Maxillary palpi: joint 4 slightly longer than joint 3, shorter than joint 5; joint 5 little but regularly widened toward apex, dorsal and ventral margins slightly divergent. Pronotum wider than long, transverse; LL longer than high, without a vertical groove or depression in posterior half; LL anterior part raised dorsally, posterior part shorter; DD lateral sides convex. TI outer tympanum well-developed, elongate; with a tympanal trace on inner side; three apical spurs, set as a triangle. TII with four apical spurs. TIII shorter than FIII but not particularly short; with five inner and five outer subapical spurs; three apical spurs on each

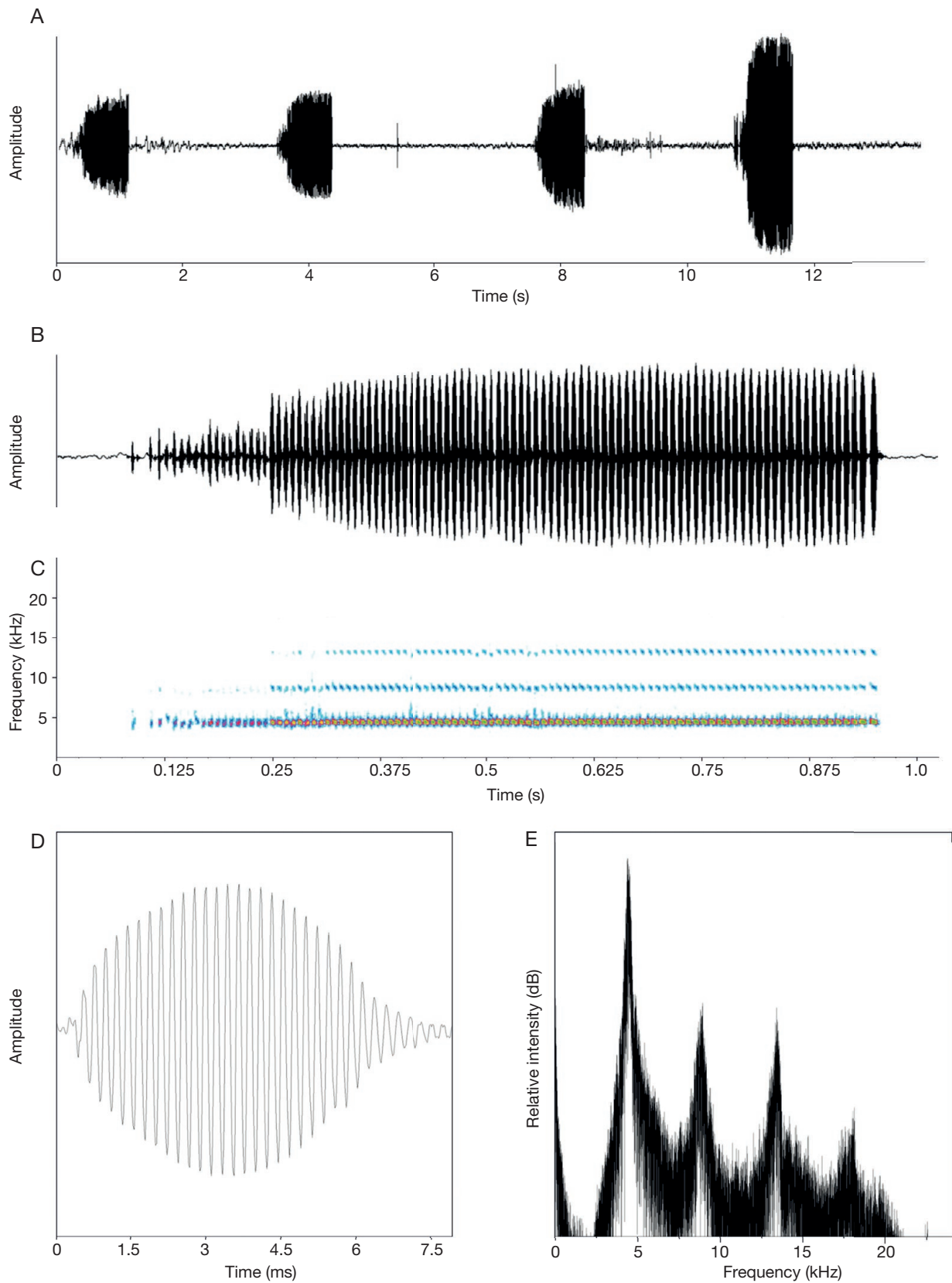


FIG. 12. — Calling song of *Lepidogryllus darthvaderi* Desutter-Grandcolas & Anso, n. sp. (Gryllidae, Gryllinae). **A**, Oscillogram of a song bout of 13 s; **B**, **C**, detailed oscillogram (**B**) and sonogram (**C**) of one echeme; **D**, oscillogram of one syllable; **E**, logarithmic spectrogram of one syllable. Abbreviations: see Material and methods.

TABLE 4. — *Lepidogryllus darthvaderi*, Desutter-Grandcolas & Anso, n. sp. Measurements (in mm). Abbreviations: see Material and methods.

	iod	PronL	PronWp	FWL	FWW*	FIIL	FIllw	TIIL	tar1-III
Holotype	1.8	2.1	3.7	6.8	3	7.4	2.7	4.7	2.3

side, the median the longest on outer side, the dorsal on inner side. Basitarsomeres III with two rows of few, strong spines; outer spines more numerous. Short FWs present in both sexes. HWs present or lacking in both sexes. Cerci very long. **Coloration.** Body, head and legs yellowish marked with brown. A wide yellow transverse band between lateral ocelli; median ocellus circled with yellow, this coloration prolonged toward face. Head dorsum with an alternation of yellow and brown transverse bands, from between lateral ocelli to brown occiput. Pronotum almost completely light yellow, only distal margin and a spot on LL dark brown.

Male. FWs reduced, covering about half abdomen; apical field very reduced. Stridulum complete, with a well-delimited mirror; harp with two oblique veins. Lateral field high, with several slightly oblique, longitudinal veins. Male genitalia: Pseudepiphallic sclerite transverse, H-shaped, with two short distal lateral lobes and a small, squared median process. Rami long and straight. Pseudepiphallic parameres elongate and narrow, sclerotized on inner and outer margins, concave, with a small apical tooth. Ectophallic fold long and thin. Dorsal cavity well-developed, high and not twisted.

Female. Tergite I brown distinctly visible. FWs flap-like, widely separate; venation thick, with longitudinal and transverse veins on dorsal field and longitudinal veins on lateral field. Ovipositor very long with a thin, lanceolate apex.

CALLING SONG. — The song of *Grylloides sigillatus* is described by Otte & Alexander (1983: fig. 67) as a succession of echemes comprising usually three syllables.

DISTRIBUTION. — Cosmopolitan genus (see Otte 2006). *Grylloides sigillatus* (Walker, 1869) is reported from Nouméa by Otte *et al.* (1987: 399).

HABITAT. — *Grylloides sigillatus* is a widespread species encountered in cities (Otte & Alexander 1983: 160).

Subfamily PODOSCIRTINAE Saussure, 1878

REMARKS

As discussed in Anso *et al.* (2016a), several genera of Podoscirtinae have been described from New Caledonia, i.e. *Adenopterus* Chopard, 1951, *Peltia* Gorochov, 1986a, *Matuanus* Gorochov, 1986a, *Archenopterus* Otte, 1987, *Calscirtus* Otte, 1987 and *Pixipterus* Desutter-Grandcolas, 2016. One species originating from the Loyalty Islands has been described in the genus *Aphonooides* Chopard, 1940 (Otte *et al.* 1987), and later transferred to the genus *Mistshenkoana* Gorochov, 1990 (Gorochov 1990). Finally, Saussure (1878) described *Tapinopus platyceps* Saussure, 1878 from one female originating from New Caledonia, which status has not been clarified up to now: *incertae sedis* within Podoscirtinae (Otte *et al.* 1987), *nomen dubium* (Otte 1994a), or transferred to the Australian genus *Tambourina* as *nomen dubium* (Eades *et al.* 2016).

Otte *et al.* (1987) synonymized *Peltia* with *Adenopterus*, while Gorochov (2003) considered *Archenopterus* and *Peltia* as subgenera of *Adenopterus*. None of these groups are in

fact clearly monophyletic (see Anso *et al.* 2016a). As no phylogenetic analysis including New Caledonian podoscirtines is available today, we will consider *Adenopterus* and *Archenopterus* as valid genera, as downgrading them as subgenera would just move the problem of their monophyly from one taxonomic level to another. We accept however the synonymy of *Peltia* with *Adenopterus*, as the male genitalia of *Peltia roseola* Gorochov, 1986 are very similar to those of *Adenopterus* species.

Molecular evidence attest the monophyly of *Calscirtus* and *Matuanus*, and the sistership relation of *Adenopterus* and *Archenopterus* (Chintauan-Marquier *et al.* 2013, 2016, and Fig. 17).

Genus *Calscirtus* Otte, 1987

Calscirtus Otte in Otte *et al.*, 1987: 444.

TYPE SPECIES. — *Calscirtus amoa* Otte, 1987 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 13A, B. Male genitalia: Anso *et al.* 2016a: figs 12, 15. Calling song: Otte *et al.* 1987: fig. 45; Anso *et al.* 2016a: figs 16, 17.

EMENDED DIAGNOSIS. — See Table 5. Body slender. General coloration light yellowish brown, uniform. Lateral ocelli wide, median ocellus tiny; ocelli set as an equilateral triangle; median ocellus subapical. Fastigium narrow. Maxillary palpi short; joint 5 truncate on almost whole length. Pronotum of regular width, slightly wider than long. Tympanal condition polymorphic (both inner and outer tympana present and equal in size, or inner tympanum lacking, or inner tympanum replaced by a shallow depression); three apical spurs. FI very high. TII with four apical spurs. FII inflated. TIII with five inner (sometimes only three) and five outer subapical spurs; three inner and three outer apical spurs; serrulation strong, irregular. Basitarsomeres III neither inflated, nor compressed; with two rows of dorsal spines. HWs truncate, slightly longer than FWs.

Male. FW well-developed with a complete stridulum; no tegminal gland. FW venation: chords long and hardly curved; chords 1 and 2 fused basally, but not fused to chord 3; mirror crossed by only one vein, transverse only in its basal, proximal part; diagonal bifurcate. Subgenital plate long, not acute, furred apically. Male genitalia most often broadly symmetrical; pseudepiphallic sclerite broadly symmetrical; pseudepiphallic parameres either long and straight, or rounded; ectophallic fold symmetrical or not; endophallic membrane slightly concave, but true dorsal cavity lacking.

Female. FW venation numerous, with many longitudinal veins separated by numerous transverse veins delimiting square cells; apex of ovipositor with apical longitudinal striae, and strong, subapical teeth; subgenital plate with a very deep, median emargination, each lateral lobe bearing a distal glandular area covered with many short setae. Female genitalia: copulatory papilla small, with a more or less circular distal sclerite, prolonged ventrally by a sclerotized plate (see Desutter-Grandcolas 1997b: fig. 38).

DISTRIBUTION. — Endemic to New Caledonia.

HABITAT. — *Calscirtus* species live in rainforest, dry forest or pre-forest vegetation, but have never been found in shrubland (Anso 2016, Anso *et al.* 2016a). They usually forage at night on plants: the females are often observed in the understorey, while males usually sing higher on trees. By day, they have been found several times sheltering in hollow twigs (Desutter-Grandcolas 1997b).

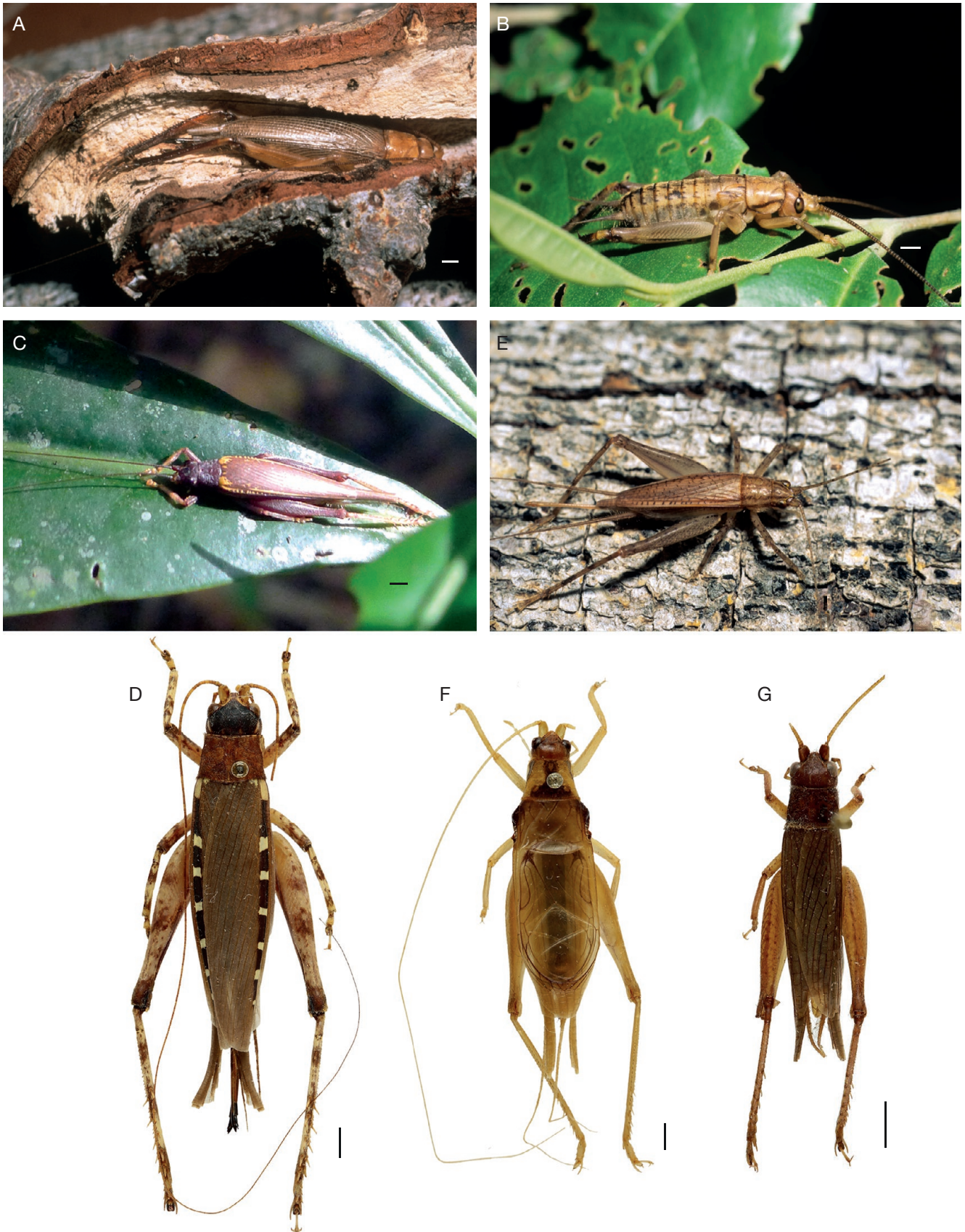


FIG. 13. — New Caledonian Podoscirtinae (Gryllidae). **A**, *Calscirtus amoa* Otte, 1987, from Col d'Amieu, adult hiding during the day in a gallery dug in a dead branch (Photo PG); **B**, *Calscirtus* sp., juvenile, from Lifou (Loyalty Islands), by night (Photo PG); **C**, *Matuanus caledonicus* (Saussure, 1878), male, from Monts Koghi (Photo HJ); **D**, *Matuanus elegans* Otte, 1987, female, from Col d'Amieu (Photo PG); **E**, *Adenopterus* sp., female (Photo PG); **F**, *Archenopterus bouensis* Otte, 1987, male, from Parc Provincial de la Rivière Bleue; **G**, *Pixipterus mou* Desutter-Grandcolas, 2016, male, from Mont Mou. Scales bars: 2 mm.

Genus *Matuanus* Gorochov, 1986

Matuanus Gorochov, 1986a: 705. — Otte *et al.* 1987: 447. — Desutter-Grandcolas 1997b: 154. — Robillard & Desutter-Grandcolas 2008: 276 (key to species, p. 275).

TYPE SPECIES. — *Matuanus priapus* Saussure, 1878 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 13C, D; Otte *et al.* 1987: fig. 51. Male genitalia: Anso *et al.* 2016a: fig. 18D-F; Robillard & Desutter-Grandcolas 2008: figs 4, 5, 11-16, 20-22.

EMENDED DIAGNOSIS. — See Table 5. Body variably fusiform. Coloration variable, often variegated with distinct pattern. Lateral ocelli larger than median ocellus; distance between lateral ocelli shorter than distance between one lateral ocellus and median ocellus. Pronotum transverse, rounded laterally. TI with a large inner and a smaller outer tympanum; with three apical spurs. FI little widened. TII with four apical spurs (sometimes three). TIII with five pairs of subapical spurs; with three inner and three outer apical spurs; serrulation a little strong, regular. Basitarsomeres III high, often compressed laterally, with one row of dorsal spines. HWs not truncate. **Male.** FWs without a mirror; file and harp variable; no tegminal gland. Metanotum and tergites not glandular. Subgenital plate long, acute, narrowed at mid length. Male genitalia: symmetrical, without a dorsal cavity; pseudepiphallallic sclerite long and narrow, wider anteriorly; pseudepiphallallic parameres long and narrow, symmetrical. **Female.** Subgenital plate large, more or less enveloping; distal margin deeply indented. Female genitalia: copulatory papilla small, dorso-ventrally asymmetrical with a wide ventral sclerotization and a small apical ring.

DISTRIBUTION. — Mainly diversified in New Caledonia, but recorded also in Vanuatu (Santo) and French Polynesia (Tahiti) according to Robillard & Desutter-Grandcolas (2008).

HABITAT. — Forest-dwelling species probably living in the canopy. Specimens (mostly females) are found on understorey plants at night.

Genus *Adenopterus* Chopard, 1951

Adenopterus Chopard, 1951: 511. — Otte *et al.* 1987: 425.

Adenopterus Adenopterus – Gorochov 2003: 299.

Adenopterus Peltia Gorochov, 1986a: 704. Type species *Peltia roseola* Gorochov, 1986a. Synonymized with *Adenopterus* by Otte *et al.* (1987).

TYPE SPECIES. — *Adenopterus norfolkensis* Chopard, 1951 by original designation.

ILLUSTRATIONS. — Habitus: fig. 13E; Otte *et al.* 1987: fig. 30. Male genitalia: Otte *et al.* 1987: figs 34-38; Anso *et al.* 2016a: figs 21C-E, 22D-H.

EMENDED DIAGNOSIS. — See Table 5. Color pattern variable. Body elongate and thin. HWs truncate or not. Ocelli most often all big, but this character variable. Pronotum transverse, slightly narrowed anteriorly. TI with large and oval inner and outer tympana; two apical spurs. FI not enlarged. TII with three (rarely four) apical spurs. TIII with five inner and five outer subapical spurs; outer spurs 1 to 4 clustered at apex. TIII serrulated; spines numerous, small and of regular size. Basitarsomeres III with one row of dorsal spines; neither high, not flattened.

Male. FWs without a stridulum; tegminal glands variable. Subgenital plate long and acute. Male genitalia symmetrical; pseudepiphallallic sclerite longer than wide, convex; pseudepiphallallic parameres long, narrow and not widened; ectophallallic fold very long and thin; dorsal cavity well-developed, twisted.

Female. Subgenital plate squared; distal margin straight or bisinuate. Female genitalia: copulatory papilla comprising a short distal ring prolonged by a ventral plate.

DISTRIBUTION. — Eastern Oceania.

HABITAT. — In New Caledonia, *Adenopterus* species occur in a large gradient of vegetation, from shrubland to rainforest, where they forage at night on plants (Anso *et al.* 2016a).

REMARK

The monophyly of this genus is not attested and should be checked.

Genus *Archenopterus* Otte, 1987

Archenopterus Otte *in* Otte *et al.*, 1987: 439.

Adenopterus Archenopterus – Gorochov 2003: 299.

TYPE SPECIES. — *Archenopterus gressitti* Otte, 1987 by original designation.

ILLUSTRATIONS. — Habitus: Figs 13F, 14A; Otte *et al.* 1987: fig. 39. Male genitalia: Fig. 14D-G; Otte *et al.* 1987: figs 42-44. Calling songs: Otte *et al.* 1987: fig. 45; Anso *et al.* 2016a: fig. 23.

EMENDED DIAGNOSIS. — See Table 5. Color pattern quite uniform. Body looking flattened in males, because of FW development and shape. HWs truncate. Ocelli of medium size, the median slightly smaller. Pronotum well narrowed anteriorly. TI with oval, well developed and obliterate inner and outer tympana; three (rarely two) apical spurs. FI not enlarged. TII with four (sometimes very small) apical spurs. TIII with five inner and five outer subapical spurs; outer spurs 1 to 3 very close. TIII serrulated; spines numerous, small and of regular size. Basitarsomeres III with one row of dorsal spines; neither high, nor flattened.

Male. FWs with a well-developed stridulum; tegminal glands developed. Subgenital plate with thin and acute apex. Male genitalia symmetrical or asymmetrical; pseudepiphallallic sclerite longer than wide, convex; pseudepiphallallic parameres rectangular, widened or not, with two distal spines; ectophallallic fold long and thin; dorsal cavity well-developed, twisted.

Female. Subgenital plate wider than long; distal margin bisinuate. Female genitalia: copulatory papilla small, hardly sclerotized, cylindrical.

DISTRIBUTION. — Endemic to New Caledonia.

HABITAT. — Nocturnal species living in tree canopy, in forest and preforest vegetation (Anso *et al.* 2016a).

REMARK

The monophyly of this genus is not attested and should be checked.

Archenopterus adamantus Desutter-Grandcolas, n. sp. (Figs 8C; 14; Table 6)

TYPE LOCALITY. — New Caledonia, Mont Panié, Wewec.

TYPE MATERIAL. — **Holotype.** New Caledonia, Grande Terre, Mont Panié, Wewec, 20°35'39.46"S, 164°43'40.40"E, 420 m, 1 ♂, 6-11. XI.2010, jour, fn 213, collected by beating, F. Legendre, molecular sample LDG 492 (MNHN-EO-ENSIF3966).

TABLE 5. — Main morphological characters of Podoscirtinae genera (Gryllidae) present in New Caledonia.

	<i>Adenopterus</i> Chopard, 1951 (*)	<i>Archenopterus</i> Otte, 1987 (*)	<i>Matuanus</i> Gorochov, 1986	<i>Calscirtus</i> Otte, 1987	<i>Aphonoides ouveus</i> Otte, 1987	<i>Pixipterus</i> Desutter-Grandcolas, 2016
Colour pattern	Variable	Quite uniform	Variiegated coloration	Light yellowish brown, uniform	Pale, uniform	Color uniform, FWs grey
Body shape / Size	Elongate, thin	Flattened in males (wide FWs)	Fusiform, variable	Cylindrical, large	Fusiform, small size. Head < pron width	Small size
Ocelli (three in all)	Lateral big, median variable	Size average, median slightly smaller	Lateral larger, but median not tiny	Lateral large, median tiny	Ocelli all large, nearly equal in size	Ocelli all small
Pronotum	Transverse, slightly narrowed anteriorly	Well narrowed anteriorly	Transverse, but rounded	Regular width; slightly wider than long	Hardly wider than long	Transverse
Tympana	Two, equal in size	Two, outer somewhat bigger	Two, inner larger	Two	One	None
Inner	Large and oval (rarely lacking)	Oval, obliterate	Oval, in shallow furrow	Small, or mere depression	Large	–
Outer	Large and oval (rarely lacking)	Oval, obliterate	Oval	Oval, obliterate	–	–
Anterior femur	Not enlarged	Not enlarged	Somewhat widened	Very large	Not enlarged	Not enlarged
Spurs and spines						
TI	Two	Three (rarely two)	Three	Three	Two	Three
TII	Three (rarely four)	Four, outers very small	Four (sometimes three)	Four	Three	Four
TIII Inner/outer subapical spurs	5 i, 5 o. Outers 1-4 clustered at apex	5 i, 5 o. Outers 1-3 very close	5 i, 5 o. O 1-3 very close	5 i (sometimes only three), 5 o	6 i (5-8), 5 (5-7) o in TIII apical half	6 i, 6 o
Serrulation	Numerous, small and regular	Numerous, small and regular	A little strong, but regular	Few, irregular, often very strong spines	ND	Numerous, small and regular
Basitarsomere III						
Shape	Not high, not flattened	Not high, not flattened	High, often compressed laterally	Not widened, not compressed	ND	Not widened, not compressed
Dorsal spines	One row	One row	One row	Two rows	ND	One row
Male						
Stridulum	Lacking	Present, well-developed	Mirror always lacking. File and harp variable	Present, well-developed	Lacking	Lacking
Tegminal gland	Developed (sometimes lost)	Developed	Lacking	Lacking	Lacking	Lacking
Subgenital plate	Long, acute apex	Distal apex thin and acute	Long, acute, narrowed at mid length	Long, not acute, furrowed apically	ND	Long, not acute; distal half wide, foliaceous, with a distal furrow.
HW	Truncate or not	Not truncate	Not truncate	Truncate / slightly longer than HWs	Longer than FW	Longer than FW
Male genitalia						
Symmetry	Symmetrical	Variable	Symmetrical	Most often broadly symmetrical	Symmetrical	Symmetrical
Pseudepiphallic sclerite	Longer than wide, convex	Longer than wide, convex	Long and narrow, with wider anterior margin	Long and straight, or rounded	Transverse, apex V-shaped	Very long, narrow
Pseudepiphallic parameres	Long, narrow, not widened	Rectangular, widened or not, with 2 small spines like hooks	Symmetrical Long and narrow	Symmetrical or not	Symmetrical	Symmetrical. Very small
Ectophallic fold	Very long and thin	Very long and thin	Not very elongate, wide. Elongate in some species	Elongate, but triangular	Short	Short
Dorsal cavity	Well-developed, twisted	Well-developed, twisted	Lacking	Lacking, endophallic membrane slightly concave	ND	Lacking
Female						
Subgenital plate	Squared; distal margin straight or bisinuous	Wider than long; distal margin bisinuate, not concave	Distal apex straight or sinous, sometimes as in <i>Calscirtus</i>	Deeply concave on distal margin; lateral gland	ND	As in <i>Calscirtus</i>
Female genitalia						
Copulatory papilla	A short ring with a ventral plate	Small, hardly sclerotized, cylindrical	A short ring with a ventral plate	A short ring with a ventral plate	ND	A short and low ring

ETYMOLOGY. — Species named after the shape of male FWs, with few, wide cells, recalling a gemstone (*adamans*, *-antis*, lat. diamant).

DIAGNOSIS. — Species fitting *Archenopterus* by the shape of the pronotum (well-narrowed anteriorly), the four apical spurs of TII (with outer spurs very small), the tegminal gland in males, the short and inflated pseudepiphallallic parameres in male genitalia. Species resembling *Adenopterus* by the number of TI apical spurs and by the lack of a stridulum. Species similar to the Australian genus *Riatina* Otte & Alexander, 1983 by the stridulatory device (file present, harp small with few, oblique and parallel veins, no mirror) and its well-developed inner and outer tympana, but differing from that genus at least by the shape of the pronotum, the length of its legs and its male genitalia. *Archenopterus adamantus* Desutter-Grandcolas, n. sp. is otherwise characterized by the relative size of its tympana (inner bigger than outer); its very thin and elongate body and legs; its thin, trapezoidal pronotum; the regular distribution of subapical spurs in TIII apical mid length; the large cells between longitudinal veins on male FWs; and the features of male genitalia (dorsal cavity not twisted, pseudepiphallallic parameres short and widely inflated with a long and acute apical process).

REMARK

Archenopterus adamantus Desutter-Grandcolas, n. sp. shows altogether original characters, and characters reminding several podoscirtine genera, showing the high diversity of Podoscirtinae in New Caledonia. It is close to *Archenopterus hemiphonus* Otte, 1987 and *Archenopterus bouensis* Otte, 1987, as shown by their male genitalia (pseudepiphallallic parameres short and inflated: see Otte *et al.* 1987: fig. 44) and male FW venation (see Otte *et al.* 1987: fig. 41F for *A. hemiphonus*), from which it differs by coloration, size and genitalia. As argued above, phylogeny will be necessary to test the monophyly of New Caledonian podoscirtines, especially related to other non caledonian genera, and so help proposing monophyletic generic entities: New Caledonian species may belong to one diversified clade endemic to the Territory, or to several monophyletic genera representing several independent colonisations of New Caledonia.

DESCRIPTION

Thin, middle sized species (Fig. 14A). Head small, triangular and wider than high in front view; wider than pronotum anterior part (Fig. 14B). Eyes small, but highly protruding. Fastigium well-developed, triangular and narrowed toward apex, but more narrow than scape apically; flat, contrasting with the somewhat convex head dorsum. Three large ocelli, the median somewhat smaller than the lateral ones, subapical. Maxillary palpi short and pubescent; joints 3 and 5 subequal, joint 4 smaller; joint 5 truncated over four fifth of its length and somewhat triangular (Fig. 8C). Pronotum narrowed in front; DD anterior margin straight, posterior margin bisinuate (Fig. 14B); LL high, with short anterior and posterior angles; with rounded angles; anterior part raised dorsally; with a distinct longitudinal groove before LL posterior angle, deeply impressing LL posterior part. Legs all long and very thin. TI with a large outer tympanum and a large inner tympanum, the inner longer and deeper than the outer; both obliterate; with two apical spurs, ventral. TII with four apical spurs, inners long, outer spurs very small. TIII longer than FIII; with

five outer and five inner subapical spurs, all slightly alternate, regularly spaced over TIII distal length; inner spurs on one hand, and outer spurs on the other almost equal in size, but outers shorter than inners. TIII with three inner and three outer apical spurs; inner spurs longer than outer spurs; median spur slightly the longest on outer side; dorsal spur the longest on inner side. Tarsi all very short; basitarsomeres III short, with one row of dorsal spines, on outer side.

Coloration (Fig. 14A, B)

Variiegated yellowish brown and dark brown; head brown; LL and a longitudinal band on DD brown; legs light yellow with few brown rings on tibiae and femora. Cerci yellowish.

Male

FWs extending well beyond abdomen tip, rounded distally (Fig. 14A). HWs well longer than FWs. Tegminal gland present, wide with a small thicket of strong setae (Fig. 14B, C). No complete stridulum, but a clear transverse vein (Fig. 14B); dorsal field overwise with six longitudinal veins separated by transverse veins that delimit large rectangular cells (Fig. 14A). Lateral field with few oblique and transverse veins, delimiting squared cells. Subgenital plate long; apex narrowed and acute.

Male genitalia (Fig. 14D-G)

Symmetrical. Pseudepiphallallic sclerite longer than wide, convex; apex raised as a high process with strong setae on ventral side; lateral lobes smaller, flat, with few strong setae on their margins dorsally, separated from main part of pseudepiphallallic sclerite by a deep gutter. Pseudepiphallallic parameres short, as inflated, rounded and hollowed, each with a long, convex and acute distal spine. Rami straight, wide, shorter than pseudepiphallallic sclerite. Ectophallallic apodemes short, only slightly projecting from pseudepiphallallic sclerite anterior margin. Ectophallallic fold extending beyond pseudepiphallallic parameres, largely sclerotized dorsally and laterally. Dorsal cavity short and low, not twisted.

Female

Unknown.

Genus *Pixipterus* Desutter-Grandcolas, 2016

Pixipterus Desutter-Grandcolas in Anso *et al.*, 2016: 55.

TYPE SPECIES. — *Pixipterus punctulatus* Desutter-Grandcolas & Anso, 2016 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 13G. Male genitalia: Anso *et al.* 2016a: fig. 24D-G, 26E-H.

DIAGNOSIS. — See Table 5. Small, elongate species without a tympanum on both TI sides, and without a stridulum or even a file in males. General coloration uniform and dull, without highly coloured spots or lines. TIII with six (rarely seven) inner and six outer subapical spurs; serrulation regular and abundant; three inner and three outer apical spurs, as in other New Caledonian genera. HWs longer than FWs in males and females.

Male. Subgenital plate elongate, but not acute; with a transverse furrow at mid length; distal part narrowed from transverse furrow to

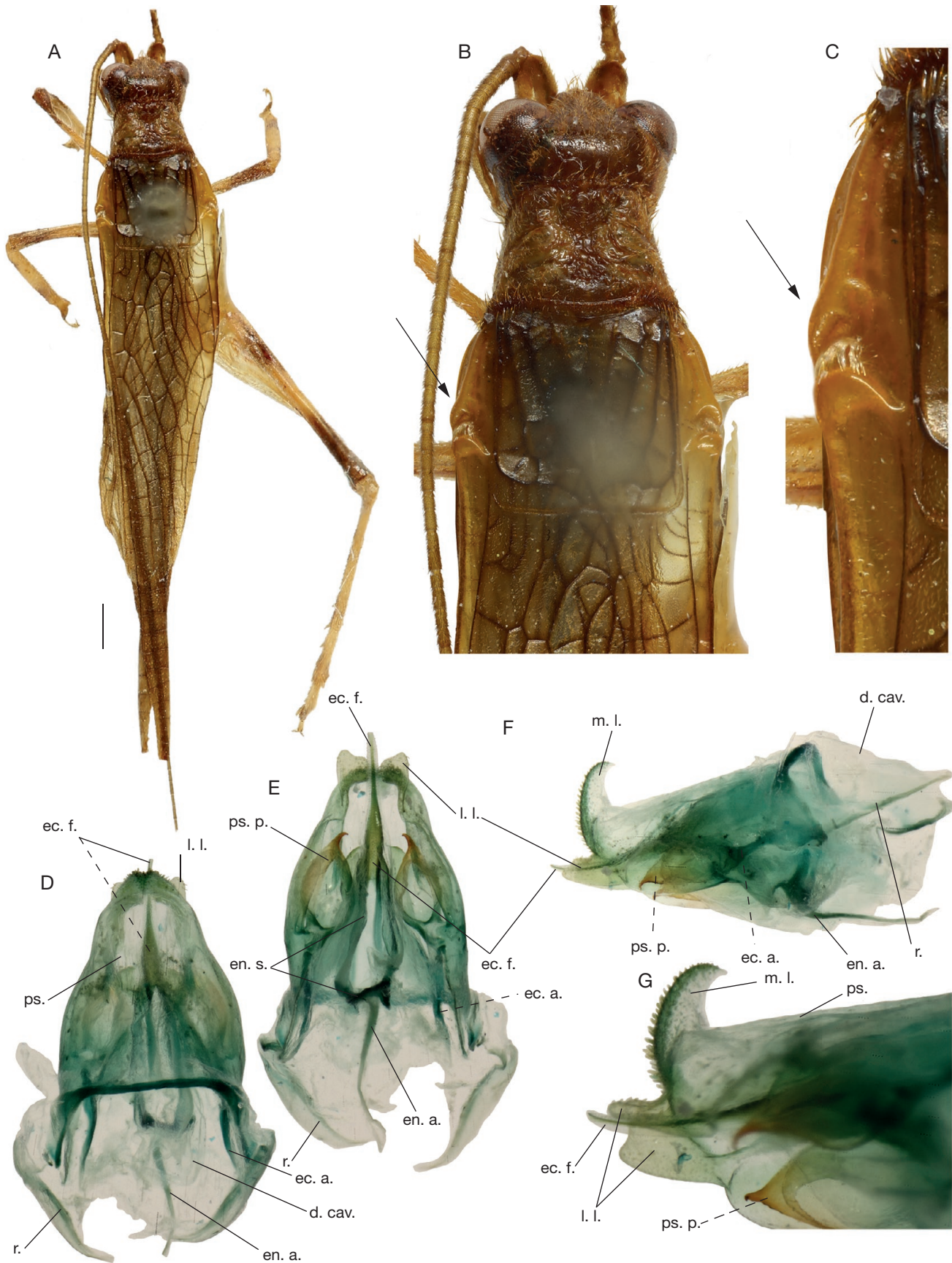


FIG. 14. — *Archenopterus adamantus* Desutter-Grandcolas, n. sp. (Gryllidae, Podoscirtinae). **A**, habitus, male holotype, hindtibia glued dorsal side down, not remounted for sake of specimen fragility; **B**, head, pronotum and FW base of male holotype, FW gland shown with arrow; **C**, FW gland of male holotype (arrow); **D-G**, genitalia of male holotype, in dorsal (**D**), ventral (**E**) and lateral (**F**, **G**) views. Scale bar: 1 mm. Abbreviations: see Material and methods.

TABLE 6. — *Archenopterus adamantus* Desutter-Grandcolas, n. sp. Measurements (in mm). Abbreviations: see Material and methods.

	iodPronL	PronWa	PronWp	FWL	HWL	FIIL	FIIIw	TIIL	tar1-III	
Holotype	0.7	1.5	1.3	2	10.2	14.3	7.8	1.4	8.3	0.9

apex, broadly triangular, with a longitudinal furrow. Male genitalia as in *Adenopterus*, but pseudepiphallallic sclerite very long and narrow, somewhat oval; pseudepiphallallic apex single, raised and more or less flattened toward pseudepiphallallic sclerite; with a pair of lateral lobes raised dorsally, one on each side of pseudepiphallallic apex; pseudepiphallallic anterior margin raised dorsally, but not plicated, and widened laterally; ectophallallic fold and pseudepiphallallic parameres very small, located close to pseudepiphallallic sclerite distal margin. **Female.** Subgenital plate concave distally, as in *Calscirtus*. Ovipositor straight, somewhat flattened dorso-ventrally and not widened laterally before apex; with numerous, parallel longitudinal striae (Anso *et al.* 2016a: fig. 24J). Female genitalia: copulatory papilla very small and little sclerotized, having the shape of a low ring.

DISTRIBUTION. — Endemic to New Caledonia.

HABITAT. — Shrubland vegetation in Southern New Caledonia.

Genus *Aphonoides* Chopard, 1940

Aphonoides Chopard, 1940: 203.

TYPE SPECIES. — *Gryllus (Eneopterus) punctatus* Haan, 1842.

ILLUSTRATIONS. — Habitus: Otte & Alexander 1983: fig. 268. Male genitalia: Otte *et al.* 1987: fig. 20C.

EMENDED DIAGNOSIS. — From Otte & Alexander (1983) and Otte *et al.* (1987) for the New Caledonian species. Small, fusiform species with long FWs and HWs in both sexes. Head more narrow than pronotum (not shown in *A. ouveus*). Eyes small but protruding. Ocelli variable (all large and nearly equal in size in *A. ouveus*). TI with a large inner tympanum; outer tympanum lacking or marked by a depression; with two apical spurs. TII with three apical spurs. TIII with three inner and three outer apical spurs, the outers small with the median the longest, the inners longer with the ventral very small and the dorsal the longest (Otte & Alexander 1983: fig. 277A, B) (not shown in *A. ouveus*); with five to seven outer (five in *A. ouveus*) and five to eight inner (six in *A. ouveus*) subapical spurs, small and located in TIII distal half (not shown in *A. ouveus*).

Male. No stridulum and no tegminal glands. Male genitalia symmetrical; pseudepiphallallic sclerite more or less triangular or rectangular; distal margin more or less deeply emarginate between two setose lobes. **Female.** Apex of ovipositor not lanceolate; dorsal valves rounded, ornamented with rounded teeth of variable size (Otte & Alexander 1983: fig. 276O-Z). Subgenital plate distal margin straight or somewhat bisinuuous.

DISTRIBUTION. — *Aphonoides* is distributed in Australia and New Guinea (Otte & Alexander 1983). As mentioned above, it is represented in New Caledonia by *Aphonoides ouveus* only.

HABITAT. — According to Otte & Alexander (1983), *Aphonoides* may inhabit tree foliage.

REMARK

In New Caledonia, *Aphonoides* is known by only one species, *Aphonoides ouveus* Otte, 1987 originating from the Loyalty Islands. This species has been transferred to the genus *Mistschenkoana* Gorochov, 1990 by Gorochov (1990). Because of

the lack of clear distinctive and diagnostic characters, and as we could not examine specimens of *Aphonoides ouveus*, we keep this species in its original genus, as hypothesized by Otte & Alexander (1983). The monophyly of both *Aphonoides* and *Mistschenkoana* will have to be checked.

Subfamily OECANTHINAE Blanchard, 1845

Genus *Oecanthus* Serville, 1831

Oecanthus Serville, 1831: 38.

TYPE SPECIES. — *Gryllus pellucens* Scopoli, 1763 by subsequent designation (Kirby 1906).

ILLUSTRATIONS. — Habitus: Fig. 15B; Otte & Alexander 1983: fig. 298. Male genitalia: Otte & Alexander 1983: fig. 301D. Calling song: fig. 16.

DIAGNOSIS. — Medium sized species, with narrow body and very thin FIII. Lightly coloured, most often green or very light brown. FWs translucent. Head prognathous, elongate. Eyes very little prominent; only two ocelli present, often not clear. Fastigium narrower than scapes; scapes longer than wide. Maxillary palpi moderately elongate, all joints tubular and very thin; joint 5 the longest, apex obliquely truncate. Pronotum longer than wide, distinctly narrowed anteriorly; lower margin of lateral lobes somewhat raised dorsally. Legs all very thin. TI inflated at level of well-developed inner and outer tympana. TIII furrowed dorsally; with three inner and three outer apical spurs, dorsal spur the longest on each side; with six or seven inner and five outer small subapical spurs; serrulation present both above and between subapical spurs. Basitarsomeres III very long, without dorsal spine. Second tarsomeres not flattened. Claws bifidous at base. Cerci short. FWs always present. HWs most often longer than FWS.

Male. Metanotum gland very developed (Hancock's gland). FWs translucent, covering abdomen and very wide; stridulum well-developed, FW wider at mirror level. Stridulum complete; file straight; harp with few transverse veins; mirror divided into two very wide cells. Apical field reduced; chords all parallel and closely set; chords 1 and 2 fused basally. Lateral field specialized. Male genitalia little sclerotized; pseudepiphallallic short, anterior margin concave, distal apex shortly bifidous; pseudepiphallallic parameres flap-like, close to pseudepiphallallic apex; rami very long and thin; ectophallallic fold short; ectophallallic apodemes well-developed; dorsal cavity large, bordered by two longitudinal invaginations.

Female. FWs and HWs as developed as in males. Ovipositor straight; dorsal valves longer than ventral valves, with thick crests.

DISTRIBUTION. — *Oecanthus* is distributed worldwide; only one species is reported from New Caledonia, *Oecanthus rufescens* Serville, 1831, which has been described from India and recorded in Australia (Otte & Alexander 1983; Metrani & Balakrishnan 2005).

HABITAT. — Nocturnal species singing from high herbs or shrubs in disturbed vegetation, often along road side.

Oecanthus rufescens Serville, 1839 (Fig. 16)

Oecanthus rufescens Serville, 1839: 361.

TYPE LOCALITY. — India, Bombay.

RECORDED SPECIMENS. — New Caledonia, Mont Mou, 1 ♂, 16.VII.2012, by night, tall grass along trail, J. Anso & L. Desutter-Grandcolas (MNHN).



FIG. 15. — New Caledonian Euscyrtinae Gorochov, 1985 (A), Oecanthinae Blanchard, 1845 (B) and Eneopterinae Saussure, 1874 (C-F) (Gryllidae): A, *Proturana* sp., from Sarramea, by day (Photo PG); B, *Oecanthus rufescens* Serville, 1839, from Col des Roussettes, by night (Photo JA); C, *Cardiodactylus novaeguineae* (de Haan, 1842), from Lifou (Loyalty Islands), by night (Photo PG); D, *Agnotecous* sp., from Col de Mourange, by day (Photo LDG); E, *Lebinthus lifouensis* Desutter-Grandcolas, 1997, from Lifou, by day (Photo PG); F, *Pixibinthus sonicus* Anso & Robillard, 2016, from Col de la Madeleine, by day (Photo JA). Scale bars: 2 mm.

CALLING SONG. — Fig. 16. At 23.5°C, the calling song of *Oecanthus rufescens* consists of a long repetition of syllables (trill), with the following characteristics: syllable duration = 14.9 ± 0.3 ms; syllable period = 22.5 ± 1.6 ms; silence inter-syllable = 7.6 ± 1.6 ms; syllable duty cycle = 66.4%; the dominant frequency is 3.3 kHz and correspond to the fundamental frequency (MNHN-SO-2016-19).

Subfamily EUSCYRTINAE Gorochov, 1985

Genus *Proturana* Otte, 1987

Proturana Otte in Otte *et al.*, 1987: 424.

TYPE SPECIES. — *Euscyrtes subapterus* Chopard, 1970 by original designation.

ILLUSTRATIONS. — Habitus: Fig. 15A. Male genitalia: Otte *et al.* 1987: fig. 20B.

EMENDED DIAGNOSIS. — Size small. Body shape distinctively elongate and thin, this shape reinforced by a colour pattern with many longitudinal stripes; legs I and II contrastingly short compared to long legs III. Head dorsum and face both convex, at right angle. Eyes small but somewhat protruding, widely apart from each other. Fastigium flat, narrow and elongate. Second tarsomeres flat and wide. TI without inner and outer tympana; three apical spurs. TII with three apical spurs. TIII with three inner and three outer apical spurs; outer spurs very short; median and dorsal spurs subequal on outer side; dorsal spur the longest on inner side; six to nine inner and five outer subapical spurs present in TIII distal half, short. TIII serrulation strong in TIII distal two third, more numerous on outer side. Basitarsomeres III short, shorter than tarsomeres 3; with apical spines and sometimes a few spines on outer side only. Cerci very short; often convergent at mid length, and thick at base. Coloration pale, with several longitudinal lines prolonged on head, pronotum and body; a wide brown band running from eye to abdomen mid length through LL; legs light yellowish brown with light brown dots and lines.

Male. FWs tiny, wider than long, partly overlapping; no stridulum, but a functional file made of very tiny teeth. HWs lacking in observed specimens. Subgenital plate long, pointing between cerci; lateral margins enveloping distally. Male genitalia: small; pseudepiphallic sclerite broadly triangular, distal margin raised and curved back on main sclerite; two turgescens and setose areas close to anterior margin; rami straight, strongly divergent; ectophallic fold wide and convex, separated from pseudepiphallic sclerite by a wide bilobated structure (fused pseudepiphallic parameres?).

Female. FWs very short, only slightly projecting from beneath pronotum. Ovipositor long, flattened dorso-ventrally, distinctly curved upwards then downwards, without a distinct apex.

DISTRIBUTION. — Endemic to New Caledonia, known from Dumbea (*P. subapterus*), Sarramea and Bourail (MNHN material).

HABITAT. — *Proturana* lives on grass in opened forest.

Subfamily ENEOPTERINAE Saussure, 1893

Genus *Agnotecous* Saussure, 1878

Agnotecous Saussure, 1878: 546.

TYPE SPECIES. — *Agnotecous tapinopus* Saussure, 1878 by original monotypy.

ILLUSTRATIONS. — Habitus: Fig. 15D. Male genitalia: Desutter-Grandcolas & Robillard 2006: figs 4-6. Calling songs: Robillard *et al.* 2010: figs 3, 7.

DIAGNOSIS. — After Otte *et al.* (1987), Desutter-Grandcolas (1997c) and Desutter-Grandcolas & Robillard (2006). Medium to large species with brown coloration, without HWs and with short HWs in both males and females. Head flat dorsally. Fastigium very wide, 1.5 to 2 × as large as scape. Ocelli set as a wide and flat triangle; median ocellus vertical and subapical on fastigium. Eyes not prominent. Scapes small, slightly longer than wide. Joint 5 of maxillary palpi short, regularly widened distad, truncate obliquely at apex. Pronotum distinctively long and wide; DD somewhat wider than long, narrowed anteriorly. TI with an oval outer tympanum and a slit-like inner tympanum; with three apical spurs. TII with four apical spurs. TIII with four subapical spurs on each side; inner subapical spurs longer and strongly curved; with three inner and three outer apical spurs, median spur the longest on each side; median outer spur twice as long as other outer spurs. TIII serrulated over its whole length. Basitarsomeres III with two rows of dorsal spines; inner row with one or few spines. Cerci moderately long.

Male. Metanotum without glandular structures. FWs short, not reaching abdomen mid length, truncate dorsally; lateral field very high, longer than dorsal field, and partly covering body dorsum. Venation: dorsal field with complete stridulum, with one or no harp vein, and a reduced mirror, lost in apical reticulation; lateral field with numerous parallel veins. Subgenital plate long and rounded; apex narrow and acute; lateral margin inflated, probably glandular. Male genitalia: Pseudepiphallic sclerite very elongate, tubular; pseudepiphallic apex most often elongate as a prominent median process, and with two distal lobes; rami short, extending pseudepiphallic sclerite; pseudepiphallic parameres small and little differentiate; ectophallic fold simple and very short; ectophallic apodemes long, thin and almost parallel; dorsal cavity wide, low and distinctly plicated transversally; endophallic sclerite located at level of ectophallic arc; endophallic apodeme crest-like on dorsal cavity.

Female. FWs short, not reaching tergite II distal margin; most often not overlapping; dorsal and lateral fields with strong, longitudinal parallel veins, and variable transverse veinlets. Subgenital plate small, transverse. Ovipositor straight. Female genitalia with a very small copulatory papilla; apex sclerotized, distinctly separate from half-ringed basal sclerite.

CALLING SONGS. — Long echemes emitted with a dominant frequencies of 15 to 18 kHz, carried by the second harmonic (Anso *et al.* 2016b).

DISTRIBUTION. — Endemic to New Caledonia. Mostly forest-dwelling species known throughout the whole Grande Terre.

HABITAT. — Forest-dwelling species which usually hide in leaf litter, and are active at night either in the leaf litter or perched on understorey plants.

Genus *Lebinthus* Stål, 1877

Lebinthus Stål, 1877: 50.

TYPE SPECIES. — *Lebinthus bitaeniatus* Stål, 1877, by monotypy.

ILLUSTRATIONS. — Habitus: Fig. 15E. Male genitalia: Desutter-Grandcolas 1997a: figs 10-12. Calling song: Desutter-Grandcolas 1997a: fig. 8.

DIAGNOSIS. — After Desutter-Grandcolas (1997a) and Robillard (2010), for New Caledonian species only. Genus resembling *Agnotecous*. Brachypterous, HWs lacking. Size small.

Male. FW lateral field as long as or shorter than dorsal field. Mirror badly differentiated from apical cells. Male genitalia: Pseudepiphallic

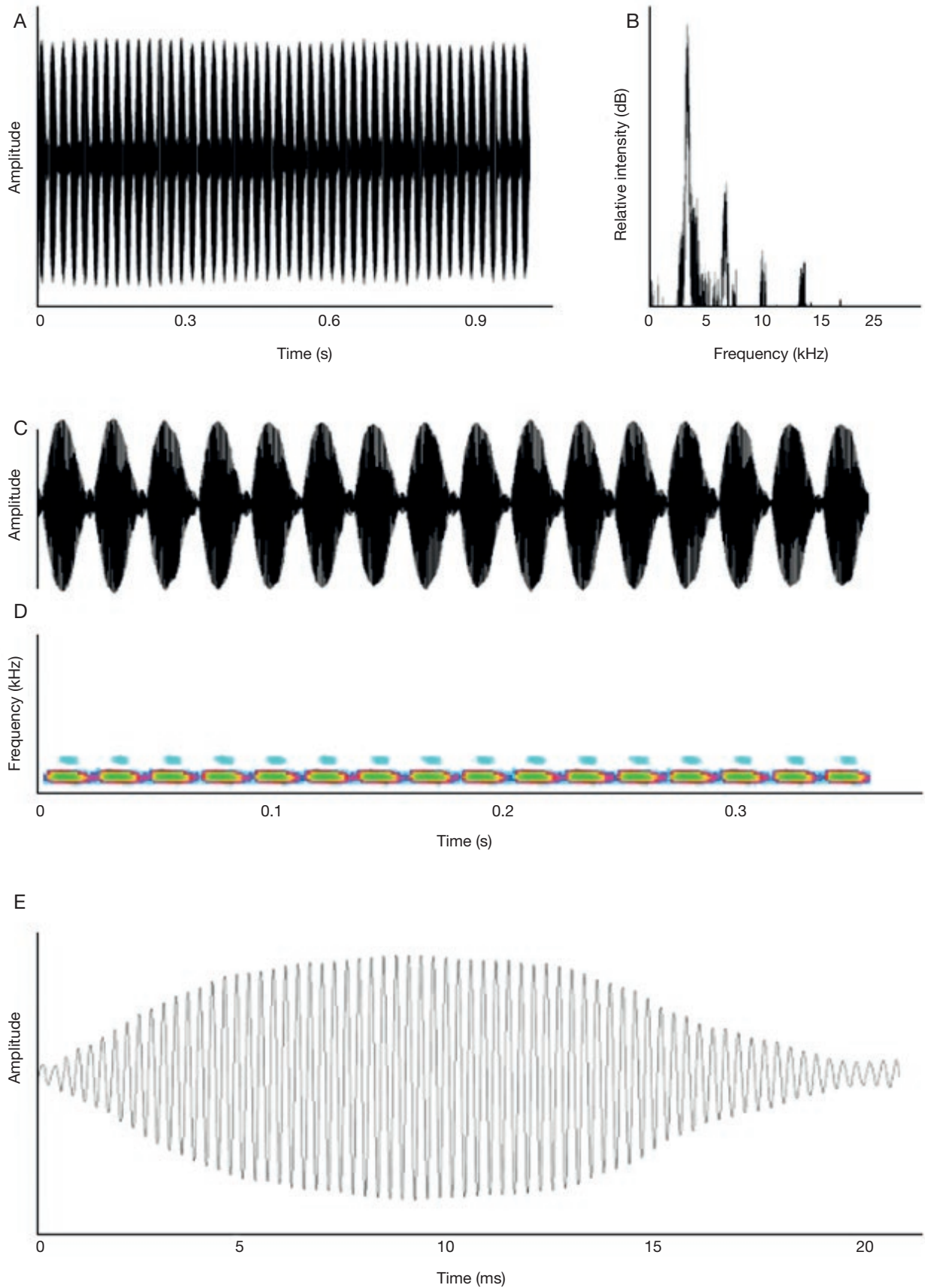


FIG. 16. — Calling song of *Oecanthus rufescens* Serville, 1831 (Gryllidae, Oecanthinae): **A**, Oscillogram of a song bout of 1 s; **B**, logarithmic spectrogram of one syllable; **C**, **D**, detailed oscillogram (**C**) and sonogram (**D**) of a song bout of 16 syllables; **E**, oscillogram of one syllable. Abbreviations: see Material and methods.

sclerite triangular, slightly convex; its apex well-separated from main sclerite, setose, concave on lateral and distal margins; ectophallic arc wide, located at pseudepiphallallic sclerite mid length; ectophallic fold wide and short, with two wide and almost connected lateral sclerites; dorsal cavity small.

CALLING SONG. — Call of *Lebinthus lifouensis* described by Desutter-Grandcolas (1997a), but recorded with a recorder suitable for frequencies less than 20 kHz.

DISTRIBUTION. — *Lebinthus* is widely distributed in western Pacific Ocean; it is known in New Caledonia by only one species, *L. lifouensis* Desutter-Grandcolas, 1997 from the Loyalty Islands.

HABITAT. — Straminicolous species inhabiting clear forests.

Genus *Pixibinthus* Robillard & Anso, 2016

Pixibinthus Robillard & Anso in Anso *et al.*, 2016b: 12.

TYPE SPECIES. — *Pixibinthus sonicus* Anso & Robillard, 2016, by original designation.

ILLUSTRATIONS. — Habitus: Fig. 15F. Male genitalia: Anso *et al.* 2016b: fig. 4. Calling song: Anso *et al.* 2016b: fig. 7.

DIAGNOSIS. — After Anso *et al.* (2016b). Size very small, smaller than all previously described species of *Lebinthus* from the Loyalty Islands and Vanuatu. As in *Lebinthus* and *Agnotecous*, FW short and HWs absent in both sexes, but: body stocky; head shape more rounded in front view; eyes small, representing about 35% of head width in dorsal view; fastigium as wide as three times scape width; ocelli very small. Coloration: Body mostly brown to dark brown, slightly contrasted, with lighter legs; cheeks entirely shiny black; FW mostly gray to dark brown with pale basal area; veins orange brown; dorsal part of lateral field whitish.

Male. Genitalia: Pseudepiphallallic sclerite triangular; apex elongate without paired lobes and forming a wide gutter; rami short; ectophallic fold long, with elongate lateral sclerites forming a “(“ pattern; its apex triangular and membranous; ectophallic apodemes parallel and long, their apex lamellate; ectophallic arc well sclerotized, wide and slightly curved posteriorly, with a small medio-posterior expansion. **Female.** FWs as long as in males, unlike in most *Lebinthus* species; slightly overlapping.

CALLING SONG. — Short trill emitted at a dominant frequency of about 28 kHz (Anso *et al.* 2016b).

DISTRIBUTION. — Endemic to New Caledonia; known from maquis vegetation in the South of Province Sud.

HABITAT. — After Anso *et al.* (2016b), *Pixibinthus* is a straminicolous, nocturnal species.

Genus *Cardiodactylus* Saussure, 1878

Cardiodactylus Saussure, 1878: 657.

TYPE SPECIES. — *Platydictylus novaeguineae* de Haan, 1844 by subsequent designation (Kirby 1906).

ILLUSTRATIONS. — Habitus: Fig. 15C. Male genitalia: Robillard & Ichikawa 2009: fig. 4. Calling song: Robillard & Ichikawa 2009: fig. 7.

DIAGNOSIS. — After Robillard & Ichikawa (2009). Large, fusiform species, with long FWs, HWs and cerci in both sexes. Coloration variegated, with yellow, whitish, brown and black; palpi yellow to

white, with or without a brown apical ring on joint 5. Eyes slightly protruding. Fastigium as wide as scape, thus relatively narrow compared to other eneopterine genera. Pronotum transverse. TI with an inner and an outer tympana.

Male. Stridulum complete; harp longer than wide, with two strongly bisinuated, oblique veins; mirror well delimited, more or less clearly separated from apical field; apical field elongate with several cell alignments. Male genitalia: pseudepiphallallic sclerite very long, greatly narrowed at mid length, setose laterally and ventrally, with two high dorsal crests partly fused dorsally; rami short and wide.

Female. Ovipositor long, apex lanceolate and flattened laterally. Female genitalia: copulatory papilla with rounded sclerotized base and apex.

CALLING SONG. — The call of *C. novaeguineae* (de Haan, 1844) is complex, with two different types of echemes. The dominant frequency is carried on the third harmonic (Robillard & Ichikawa 2009).

DISTRIBUTION. — *Cardiodactylus* is highly diversified in the western Pacific; it is known in New Caledonia by only *C. novaeguineae*, a widely distributed species in Oceania (Robillard & Ichikawa 2009).

HABITAT. — *Cardiodactylus novaeguineae* is restricted to opened forest in coastal areas, where it forages from afternoon to night on vegetation (Robillard & Ichikawa 2009).

DISCUSSION

As a hot spot of biodiversity (Myers *et al.* 2000; Mittermeier *et al.* 2011), New Caledonia has a rich and original fauna, which is highly endemic and disharmonic at the regional scale (Grandcolas *et al.* 2008). Crickets (Orthoptera, Gryllidea) clearly present these properties of New Caledonian biotas: 19 of the 40 genera, and most of the 180 species recorded today in the archipelago are endemic to New Caledonia, with less than 5% of the species present in New Caledonia widespread at the regional or local scales.

The most diversified cricket clades are the Nemobiinae (Trigonidiidae) and the Podoscirtinae (Gryllidae), with at least 13 endemic genera and more than 90 endemic species, showing varied ecological particularities. By contrast, other clades are clearly underrepresented by comparison with other tropical areas, i.e. the Oecanthinae (Gryllidae) and the Trigonidiinae (Trigonidiidae): the Oecanthinae are diversified through the whole world (see for example Toms & Otte 1988 for Africa, Walker 1962, 1963, 1967 for North and Central America, Otte 1994b for Hawaii) but only one species is reported from New Caledonia, widely distributed from India to Australia; the Trigonidiinae are also present in New Caledonia with four or five species belonging to the wide spread genera *Anaxipha*, *Trigonidomorpha*, *Metioche* (as attested by Chopard 1970 and Otte *et al.* 1987), and *Amusurgus* (newly reported here from New Caledonia).

Between these extremes, three cricket clades show an intermediate level of endemism, i.e. their New Caledonian representatives belong to few endemic genera and to a few species of otherwise widespread genera. These clades are the Phalangopsidae, the Eneopterinae (Gryllidae) and the

Gryllinae (Gryllidae). The Phalangopsidae are represented in New Caledonia by two endemic genera (*Caltathra* and *Protathra*), several species of the genus *Pseudotrigonidium* distributed through the whole Grande Terre, and one species of the widespread genus *Parendacustes* from the Loyalty Islands. Two genera of Eneopterinae are endemic to New Caledonia: the speciose genus *Agnotecous* and the monospecific genus *Pixibinthus*. By contrast, two eneopterine genera widely distributed and diversified in Oceania are each known by only one species in New Caledonia: *Cardiodactylus* on one hand (on Grande Terre) and *Lebinthus* on the other (on the Loyalty Islands). The Gryllinae (Gryllidae) are represented by one speciose, endemic genus, *Notosciobia*, and two widespread genera, *Lepidogryllus* and *Teleogryllus*, with two New Caledonian species each, not mentioning the cosmopolitan species *Gryllodes sigillatus* heard singing in Nouméa (Otte *et al.* 1987).

All these clades have been relatively well-studied, and their endemic *versus* non-endemic status is now well attested, even though many species are still awaiting formal descriptions (LDG, pers. obs.).

From an evolutionary point of view, the New Caledonian crickets belong to all the main cricket clades supported by phylogenetic molecular evidence (see Chintauan-Marquier *et al.* 2016, and Fig. 17). This phylogenetic evidence can be used to hypothesize several colonizations and local diversifications of crickets in New Caledonia (Silvertown 2004). New Caledonian Nemobiinae for example belong to two documented clades that can be interpreted as two independent colonizations of the archipelago: the most diversified clade includes the endemic genera *Paora*, *Bullita*, *Koghiella* and *Caledonina* Desutter-Grandcolas, n. gen. (referred to as Nemobiinae n. gen.-NC in Chintauan-Marquier *et al.* 2016), to which one could probably add *Amonemobius* and *Ignambina* which may be close to *Koghiella*; this clade is the sister group of *Cophonemobius faustini* Desutter-Grandcolas, 2009 from Vanuatu. The second clade is represented by *Thetella* (to which *Ionemobius* is clearly related), which belongs to another nemobiine clade and has colonized most Pacific islands. The molecular analyses did not take into account *Bobilla*, distributed in New Caledonia, Australia and New Zealand, and the New Caledonian endemics *Orintia*, *Paniella* and *Kanakinemobius*: *Bobilla* could originate from an additional colonization event, owing to its wider regional distribution and probable monophyly, while no clear hypothesis about the relationships of *Paniella* and *Kanakinemobius* can be proposed today. Anyway, in the light of their clear monophyly, and their phylogenetic and ecological diversity in New Caledonia (Anso *et al.* 2016a), the Nemobiinae will certainly prove in the next future one of the most interesting model group to study the origin and time of evolution of New Caledonian fauna, and test the taxon cycle (e.g., Ricklefs & Bermingham 2002) and niche preemption (Silvertown *et al.* 2005) hypotheses.

Studying the less diversified Eneopterinae, Anso *et al.* (2016b) showed that the sister taxa *Agnotecous* and *Pixibinthus* originate a short time after New Caledonian re-emergence

(Pelletier 2006; Cluzel *et al.* 2012): they later diversified toward forest and shrubland vegetation respectively, and this ecological specialisation paralleled their acoustic and morphological evolution, with the calling songs of the larger *Agnotecous* being emitted with lower frequencies than those of the smaller *Pixibinthus* on one hand, and of their sister group *Lebinthus* on the other. Similar colonizations and diversifications may have taken place in the Phalangopsidae (resulting in the clade *Caltathra* - *Protatha*, independently from the specific radiation of the phaloriine genus *Pseudotrigonidium*), in the Gryllinae (resulting in *Notosciobia*, which belongs to a wide-world distributed clade, sistergroup to that including the genera *Teleogryllus*, *Lepidogryllus* and *Gryllodes*), and in the Euscyrtrinae (resulting in the endemic *Proturana*). As to the Podoscirtinae, *Caliscirtus* on one hand, and *Archenopterus*, *Adenopterus* and *Matuanus* on the other belong to two distinct clades within the subfamily; the recently discovered *Pixipterus* could not be included in the molecular analyses, but its specialization for shrubland and preforest vegetation may parallel that of *Pixibinthus* in the Eneopterinae.

Finally, as documented for *Lebinthus lifouensis* Desutter-Grandcolas, 1997 by Nattier *et al.* (2011), more recent colonizations can be hypothesized for taxa present exclusively in the Loyalty Islands, i.e. *Parendacustes lifouensis* and *Aphonoides ouveus*, as for the widespread or cosmopolitan species/genus (*Oecanthus*, *Teleogryllus*, *Lepidogryllus*, *Gryllodes*, *Cardiodactylus*, *Thetella*).

Taking all these hypotheses together in the context of geological history and geographic isolation of New Caledonia, the colonization of New Caledonia by crickets may have been a long and complex story. It may have involved many independent colonizations and a large number of local subsequent diversifications toward a wide array of habitats. Confronting all these events in a phylogenetic frame would allow to answer several questions related to dating and ecological diversification: did the colonization events happen in a narrow time window, or did they succeed through a large time scale since New Caledonia re-emergence? How did the different clades interact during their subsequent diversification, if they did? Among closely related taxa, can niche pre-emption by early colonists prevent the diversification of later colonists (Silvertown *et al.* 2005), or can it be a source of diversification? And finally, how did the original biological traits of New Caledonian crickets arise and are they responsible for the high number of species observed? Available evidence for Eneopterinae (Anso *et al.* 2016b) document character displacements (toward larger size and lower frequency of the calling song) and adaptive radiation in rainforest habitats. This case study shows what can be expected for still more diversified cricket clades in New Caledonia, such as the Nemobiinae. Answering these questions will help figure out how such a rich fauna has been shaped through time, as done at a lower scale of diversification for stick insects of the Mascarene Islands (Bradler *et al.* 2015). All these results in turn could help predicting the resilience of New Caledonian fauna to environmental changes.



FIG. 17. — Phylogeny of the cricket clade (Orthoptera, Gryllidea), based on the Bayesian analysis of seven molecular markers (12S, 16S, 18S, 28SA, 28SD, H3, cytB) for 212 terminals. Branches of New Caledonian genera are marked with red, with the following genera missing: *Metioche* Stål, 1877 (Trigonidiinae), *Amonemobius* Otte, 1987, *Bobilla* Otte & Alexander, 1983, *Ignambina* Otte, 1987, *Ionemobius* Otte, 1987, *Kanakinemobius* Desutter-Grandcolas, 2016, *Orintia* Gorochov, 1986 and *Paniella* Otte *et al.*, 1987 (Nemobiinae), *Pixipterus* Desutter-Grandcolas, 2016, *Aphonoides ouveus* Otte, 1987 (Podoscirtinae), *Pixibithus* Robillard & Anso, 2016 (Eneopterinae). Modified after Chintauan-Marquier *et al.* (2016). Species present in New Caledonia are indicated in red; genera present in New Caledonia with different species than those used in the phylogeny are indicated in purple. See A3 version on www.zoosystema.com

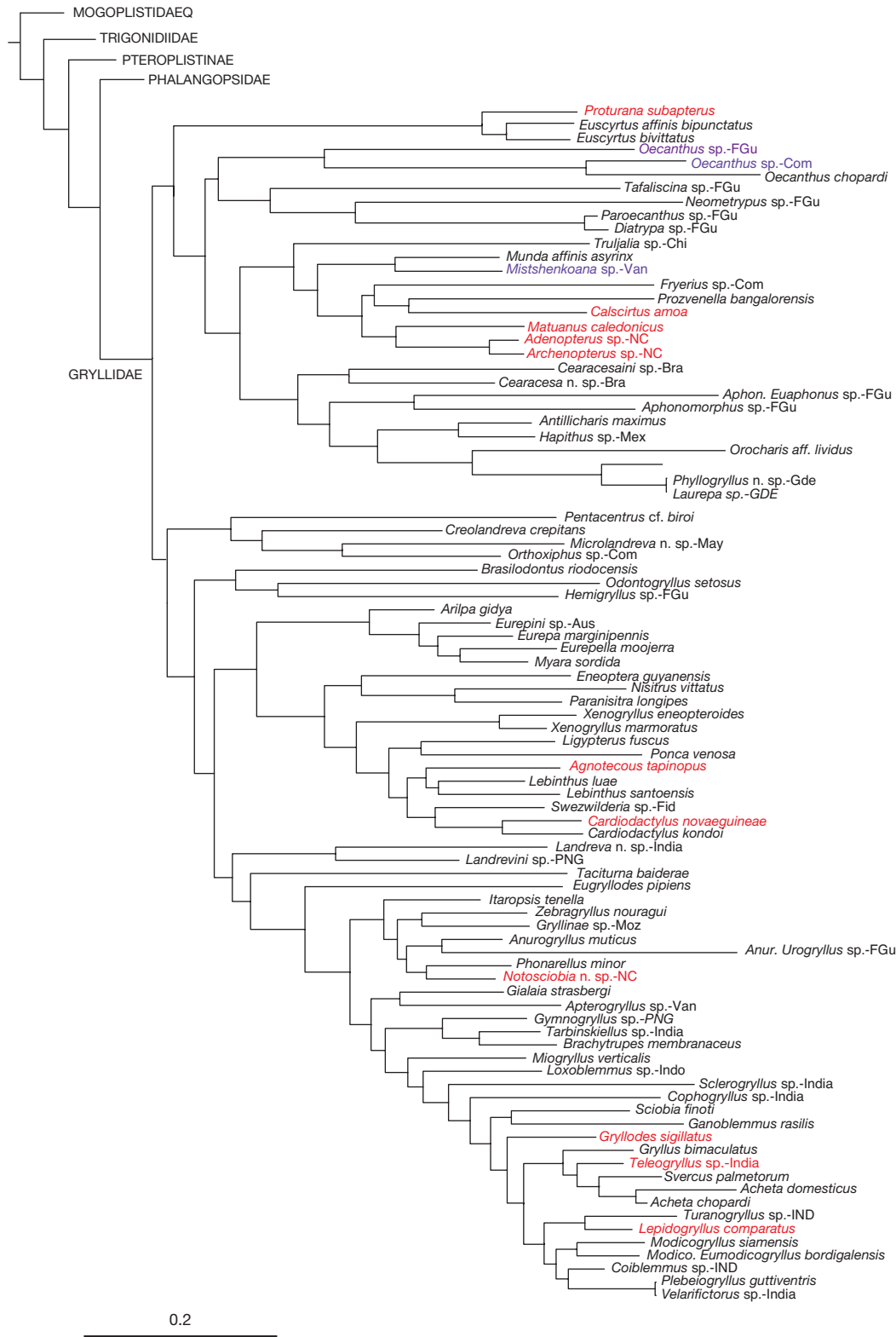


Fig. 17. — Continuation.

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