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Two new ant species (Formicidae: Dorylinae, Ponerinae) from New Caledonia

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Abstract. Two new species of ants (Hymenoptera: Formicidae) collected from New Caledonia are described and figured based on worker specimens: *Leptogenys loarelae* Ramage sp. nov. (Ponerinae, Ponerini) and *Lioponera neocaledonica* Jouault, Ramage & Perrichot sp. nov. (Dorylinae, Cerapachyini). All specimens were collected from the South Province of Grande Terre. These two new species are primarily distinguished from the other New Caledonian relatives by the size and shape of petiole for *L. loarelae* Ramage sp. nov. and by the presence of dorsolateral margins on the mesosoma for *L. neocaledonica* Jouault, Ramage & Perrichot sp. nov. Keys to New Caledonian *Leptogenys* and *Lioponera* are provided.

Keywords. Hymenoptera, *Lioponera*, *Leptogenys*, taxonomy, identification keys.

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Introduction

New Caledonia, located in the southwest Pacific Ocean, is one of the 36 biodiversity hotspots identified worldwide by Conservation International (CEPF). It is an archipelago comprising the main island of

Grande Terre, which is divided in length by a central mountain range, as well as the Belep Islands to the North, the Loyalty Islands to the East, the Isle of Pines to the South, the Chesterfield Islands and Bellona Reefs to the West, and few islets, all with a tropical marine climate. New Caledonia is considered a part of Zealandia, a continental fragment originating from the former Gondwana, with addition of terranes that accreted after the break up of Gondwana about 84 million years ago (Ma). The current New Caledonian biota displays a high diversity and endemism resulting from a complex geological and biogeographical history, with Palaeocene and Eocene submersions followed by colonization and radiations of taxa of both Gondwanan and Indo-Malayan origins in the last 37 Ma (Grandcolas *et al*. 2008; Nattier *et al*. 2017). However, there is still a debate on whether the archipelago was entirely or partially submerged, with the survival of archaic groups on ephemeral islands (Heads 2019).

Emery's (1883) pioneer work on the ant fauna of New Caledonia resulted in the description of seven species. He was soon followed by André (1889) and Forel (1894) who added two and three species, respectively, and he himself described 37 additional species, most of them endemic to the archipelago (Emery 1914). Since then, most of the species described from New Caledonia were part of regional or global generic revisions (Viehmeyer 1924; Brown 1958; Wilson 1958; Brown & Kempf 1960; Bolton 2000; Baroni Urbani & de Andrade 2003; Lucky & Ward 2010; Heterick & Shattuck 2011; Shattuck 2011; Taylor 2018; Sparks *et al*. 2019), with, however, some works focusing on New Caledonia (Brown 1948; Wilson 1957; Ward 1984). Wheeler (1935), Taylor (1987) and Jennings *et al*. (2013) also produced local ant checklists. To date, the New Caledonian ant fauna comprises 134 species and subspecies, 55% of which apparently endemic (Antweb 2019). However, recent studies (Berman 2012; Berman & Andersen 2012; Berman *et al*. 2013a, 2013b; Antwiki 2019) show many species remaining to be described.

Here, we report new species of *Leptogenys* Roger, 1861 and *Lioponera* Mayr, 1879, two genera of epigaeic predatory ants collected from mountain forests of Grande Terre. We also provide identification keys for the New Caledonian species to facilitate future work on these two genera.

The genus *Leptogenys* is found throughout the world's tropical and subtropical zones with over 300 known extant species (Bolton 2019). Molecular phylogenetic analyses showed that *Leptogenys* is a monophyletic taxon within the *Odontomachus* genus group (Schmidt 2013). The diversification of this group probably occurred in Africa between 40 and 30 Ma and had an explosive nature (Schmidt 2013). *Leptogenys* is the most species-rich genus within the subfamily Ponerinae and its members display a diversity of foraging strategies and reproductive systems (Schmidt & Shattuck 2014). Important taxonomic work has been done on this genus: Lattke (2011) revised the New World fauna, Rakotonirina & Fisher (2014) the Malagasy fauna, Xu *et al*. (2015) the Oriental species and Arimoto (2017) the *modiglianii* species group. Keys for the Indian fauna are found in Bharti & Wachkoo (2013) and for *Leptogenys* of the Arabian Peninsula in Sharaf *et al*. (2017). Most species of *Leptogenys* are known as specialized predators of isopods (Dejean & Evraerts 1997; Dejean 1997). The presence of ergatoid gynes and gamergates has been established in most of the studied species, but flying queens were also found in two Asian species (Peeters 2012). Ergatoid queens and gamergates is an alternative to breedings with winged breeders. Indeed, it guarantees a strategy of rapid and less expensive reproduction by the fission of colonies. However, it is obvious that dispersal capabilities, particularly at long distances, are lost in the fission of colonies (Schmidt 2013). Reproductive methods of this type remain unclear since winged gynes have been reported for two Asian species (Ito & Okawahara 2000).

The genus *Lioponera* was synonymized with *Cerapachys* Smith, 1857 by Brown (1975), but revived from synonymy by Borowiec (2016). *Lioponera* is found in Africa, Asia and Oceania, mainly in tropical and subtropical zones, and is currently known to comprise 74 species (Antweb 2019). Australia hosts

a major radiation of *Lioponera*, with 43 reported species. *Lioponera* is sister to the clade comprising *Lividopone* Bolton & Fisher, 2016, *Parasyscia* Emery, 1882 and *Zasphinctus* Wheeler, 1918 (Brady *et al*. 2014). Phylogenetic studies suggest that the genus may have originated in Africa and later spread to the Indomalayan and Australasian regions (Borowiec 2019). *Lioponera* occurs only in the Old World and all species observed thus far prey on other ants.

Material and methods

Taxon sampling

The material examined in this study is based on sampling carried out in the South Province of Grande Terre. One specimen was collected in 2010 by Maïa Berman during her PhD on ant ecology (Fire project) at Charles Darwin University (Australia) (Berman 2012). All other specimens were collected by VP in 2011, during experimental fieldwork for actuo-paleontological studies of resin-producing araucarian forests of New Caledonia (e.g., Beimforde *et al*. 2017). Both samplings were conducted with permission obtained from the Direction de l'Environnement de la Province Sud (permit 1357-2010/ARR/DENV to Alan Andersen/Maïa Berman and 17778/DENV/SCB to VP).

Repositories

Collections are referred to by the following acronyms:

ANIC = Australian National Insect Collection, Canberra
CASENT = California Academy of Sciences, Entomology, San Francisco, USA
MNHN = Muséum national d'histoire naturelle, Paris, France

Specimen examination

The taxonomic analysis was conducted using an AMSCOPE stereo microscope equipped with a micrometer, at magnification 40×. Series of photographs were taken at different focal planes using a Canon EOS 60D camera mounted on a Nikon SMZ 1500, stacked using CombineZP or Helicon Focus and processed with Adobe Photoshop.

Abbreviations

Morphological terminology for measurements and indices includes the following abbreviations:

DPW = Dorsal petiole width: maximum width of the petiole in dorsal view
ED = Eye diameter: maximum length of eye as measured normally in oblique view of the head to show full surface of eye
HL = Head length: maximum length of head in dorsal view, measured in straight line from the anterior-most point of the clypeus flank to the midpoint of the frontovertexal margin
HW = Head width: maximum width of head in dorsal view
MH = Mesosoma height: in side view, maximum height measured from the lowermost point of the mesopleuron (in front of middle coxa) to the dorsal edge of the mesosoma
MSL = Mesosoma length: length of mesosoma in lateral view, the anterior surface of the pronotum proper (excluding the collar) to the posterior extension of the propodeal lobes
PH = Petiole height: height of the petiole measured in lateral view from the apex of the ventral (subpetiolar) process vertically to a line intersecting the dorsalmost point of the node
PL = Petiole length: length of the petiole from the anterior process to the posteriormost point of the tergite, where it surrounds the gastral articulation
PW = Pronotal width: maximum width of pronotum in dorsal view
SL = Scape length: maximum length of the scape excluding the basal neck and condyle
T1L = first abdominal tergite length, maximum length in dorsal view

T1W = first abdominal tergite width, maximum width in dorsal view
T2L = second abdominal tergite length, maximum length in dorsal view
T2W = second abdominal tergite width, maximum width in dorsal view
TL = total length

Indices

CI = Cephalic index: HW/HL × 100
DPI = Dorsal petiole index: DPW/PL × 100
LPI = Lateral petiole index: PH/PL × 100
SI = Scape index: SL/HW × 100

Results

Class Insecta Linnaeus, 1758
Order Hymenoptera Linnaeus, 1758
Family Formicidae Latreille, 1809
Subfamily Ponerinae Lepeletier de Saint-Fargeau, 1835
Genus *Leptogenys* Roger, 1861

Leptogenys loarelae Ramage sp. nov.
urn:lsid:zoobank.org:act:819E8C18-56F7-4CB5-AE07-00B5406D924A
Fig. 1

Diagnosis

Leptogenys loarelae Ramage sp. nov. can be distinguished from other New Caledonia species of *Leptogenys* by the unique combination of the following features: integument smooth and shining, mostly black colored with blueish reflection; third antennal segment markedly elongate, more than twice the length of pedicel; mandible elongate, triangular; petiole elongate, nearly three times longer than broad in dorsal view.

Etymology

The specific epithet refers to the first name of Thibault Ramage's daughter, Loarel. The species epithet is to be treated as a noun in the genitive case.

Type material

Holotype

NEW CALEDONIA • wingless ♀; Grande Terre, Province Sud, Sarraméa, Plateau de Dogny trail; 21°37′10.7″ S, 165°52′31.9″ E; 897 m; 16 Nov. 2011; V. Perrichot leg. [VP209]; mixed mountain forest, hand picking on ground; MNHN.

Description

Worker holotype

Measurements (in mm). TL 11.5; HL 2.06; HW 1.3; SL 2.56; ED 0.5; PW 1.16; MSL 3.65; PL 1.83; PH 0.8; DPW 0.63; CI 62.9; SI 197.4; LPI 43.6; DPI 34.5.

Head. Elongate, sub-trapezoidal, lateral sides diverging anteriorly (Fig. 1B); lateral margin barely convex; posterior margin weakly concave medially, posterior lateral corners rounded. Clypeus triangular, with blunt apex and sligthly concave side margins. In full-face view, eye large, oval, maximum diameter greater than twice the maximum width of scape; placed at head midline. Antennae with scape long and slightly enlarged medially, surpassing posterior margin of head by its $^{2}/_{5}$th; funicular segments elongate;

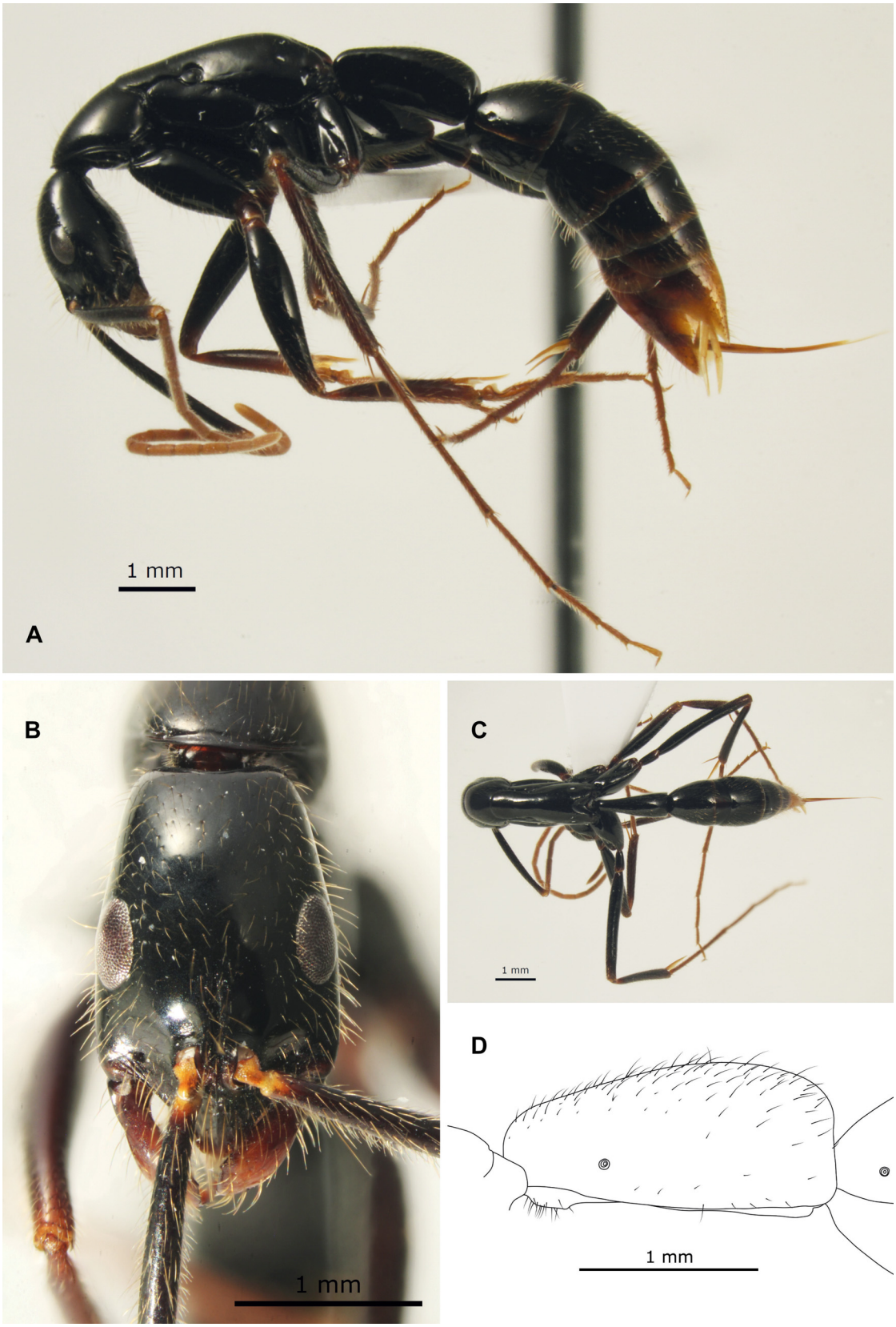

Fig. 1. *Leptogenys loarelae* Ramage sp. nov., holotype, ♀ (MNHN). **A**. Body in profile view. **B**. Head in full-face view. **C**. Body in dorsal view. **D**. Reconstruction of petiole in left profile view.

third antennal segment markedly elongate, more than twice the length of the second. Mandible triangular, elongate, shorter than head width; masticatory margin edentate.

Mesosoma (Fig. 1A, C). Elongate, compressed laterally, widest at pronotum; mesosomal dorsal surface in profile slightly convex. In dorsal view, mesonotum as long as broad. Propodeal spiracle slit-like. Petiole (Fig. 1A, C–D) elongate, nearly three times as long as broad, trapezoidal, widest at apex; dorsal surface of petiolar node convex, posterior surface slightly concave, anterodorsal and posterodorsal corners angular. Subpetiolar process small, trapezoidal; located beneath anterior $1/5^{th}$ of the petiole (Fig. 1D). Gaster elongate.

Integument. Smooth and shining, very finely and sparsely punctate; mostly black with blueish reflection, except mandibles, antennal radicel and funicular articles, tarsomeres and hypopygium and pygidium reddish brown. Dorsum of body covered by erect and suberect yellow setae; setae longer on head, scape, pronotum, procoxa and gaster, but shorter on remaining body.

Key to the *Leptogenys* species (workers) of New Caledonia (modified from Wilson 1958)

1. Large species (HW > 1.2 mm) 2
– Small species (HW ≤ 1.2 mm) 3

2. Mandibles exceptionally long, their length measured from insertion to tip exceeding the head width (Fig. 2A) .....***Leptogenys rouxi*** Emery, 1914
– Mandibles shorter, their length much less than the head width (Fig. 1B) .... ***Leptogenys loarelae*** Ramage sp. nov.

3. Head entirely covered by coarse punctures (Fig. 2C) .....***Leptogenys punctata*** Emery, 1914
– Head entirely smooth and shining (Fig. 2B) 4

4. Larger species, head width ≥ 0.9 mm; in dorsal view, posterior corners of petiolar node forming distinct angles of 45–50° (Fig. 3A) .....***Leptogenys acutangula*** Emery, 1914
– Smaller species, head width not exceeding 0.75 mm; in dorsal view, posterior corners of petiolar node thick and broadly rounded (Fig. 3B) .....***Leptogenys sagaris*** Wilson, 1958

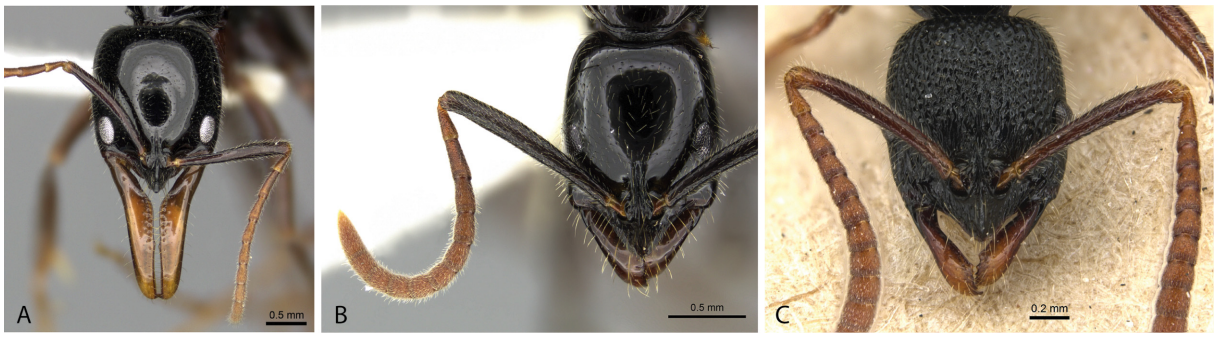

Fig. 2. Comparison of head, in full-face view, of species of *Leptogenys* of New Caledonia. **A**. *L. rouxi* Emery, 1914 (CASENT0270571). **B**. *L. acutangula* Emery, 1914 (CASENT0270535). **C**. *L. punctata* Emery, 1914 (CASENT0903948). Images: A–B by Estella Ortega, C by Will Ericson.

Subfamily Dorylinae Leach, 1815
Genus *Lioponera* Mayr, 1879

Lioponera neocaledonica Jouault, Ramage & Perrichot sp. nov.
urn:lsid:zoobank.org:act:7612551C-6C0A-4931-9D06-8FC8062DB5E3
Figs 4, 5B

Diagnosis

Lioponera neocaledonica Jouault, Ramage & Perrichot sp. nov. is mostly characterized by the combination of the following features: mesosoma dorsolaterally conspicuously marginate, propodeal declivity without dorsal margin; posterolateral corners of petiole not projected into spines. The two latter features easily serve to distinguish *L. neocaledonica* Jouault, Ramage & Perrichot sp. nov. from the other New Caledonian species *L. cohici* (Wilson, 1957) (Fig. 5A) and *L. dumbletoni* (Wilson, 1957) (Fig. 5C).

Etymology

The specific epithet refers to New Caledonia where the species was discovered.

Type material

Holotype

NEW CALEDONIA • wingless ♀; Grande Terre, Province Sud, Sarraméa, Plateau de Dogny trail; 21°37′31″ S, 165°52′5″ E; 441 m; 16 Nov. 2011; V. Perrichot leg. [VP188]; mixed mountain forest, hand picking on ground; MNHN.

Paratypes

NEW CALEDONIA • 2 wingless ♀♀; same collection data as for holotype; MNHN • 1 wingless ♀; Grande Terre, Province Sud, Montagne des Sources; 22°09′35.1″ S, 166°35′42.4″ E; 394 m; 23 Oct. 2010; M. Berman leg. [CSIRONC0055]; ANIC 32-146088.

Description (holotype)

Measurements (in mm; holotype in brackets). TL 4.12–4.15 (4.15); HL 0.8–0.85 (0.85); HW 0.7–0.77 (0.77); SL 0.45–0.52 (0.52); ED 0.2–0.25 (0.2); PW 0.65–0.72 (0.7) ; MH 0.52–0.62 (0.62); MSL 1.025–1.12 (1.12); PL 0.45–0.55 (0.55); PH 0.4–0.42 (0.42); DPW 0.67–0.7 (0.7); T1W 0.65–0.77 (0.77);

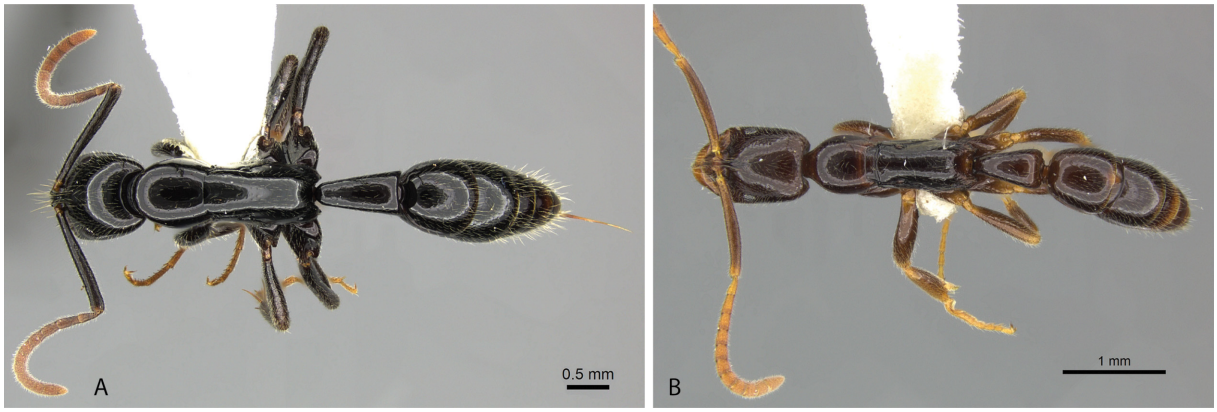

Fig. 3. Comparison of the body in dorsal view of *Leptogenys* species of New Caledonia. **A**. *L. acutangula* Emery, 1914 (CASENT0270535). **B**. *L. sagaris* Wilson, 1958 (CASENT0270576). Images: A by Estella Ortega, B by Ryan Perry.

T1L 0.5–0.62 (0.62); T2W 0.75–0.82 (0.82); T2L 0.6–0.65 (0.65). Indices: CI 84–91 (91); SI 64–69 (67); LPI 76–94 (77); DPI 127–150 (127).

Head (Fig. 4C). Sub-rectangular, slightly longer than broad, widest above midline of head; lateral sides slightly convex; vertexal margin slightly concave, posterior lateral corners slightly rounded. Parafrontal ridges angular. Compound eyes of medium size, situated below midline of head. Mandible elongate, triangular, masticatory margin with 10 small teeth. Antennae with scape short and clavate, reaching up to two fifth of posterior margin of head.

Mesosoma (Fig. 4A–B, D). Stout, roughly rectangular in dorsal view, with conspicuous dorsolateral margins, the margins notched around promesonotal junction; mesosomal dorsal surface convex, propodeal declivity without dorsal margin.

Metasoma. Petiole (Fig. 4A–B, E) broader than long, slightly trapezoidal, widest at two thirds of length; anterior petiolar surface concave; dorsal petiolar surface convex, with dorsolateral margins well developed and convex, without anterodorsal and posterodorsal margins; posterior petiolar surface slightly convex; anterodorsal and posterodorsal corners angular. Subpetiolar process small, triangular, with stout acute somewhat hooked apex; fenestra absent. Gaster elongate (Fig. 4A–B), with distinct girdling constriction (cinctus) between abdominal segments III and IV. Abdominal segment II trapezoidal, slightly broader than long, widest at one third of length; dorsal surface slightly convex; dorsolateral margins well developed and strongly convex; anterodorsal margin sinuate; anterodorsal corner broadly rounded; posterolateral corner angular. Sting exerted, upcurved.

Integument. Mostly black except last two funicular articles, tarsomeres, and posterior margins of abdominal segments IV to V brown. Body finely and sparsely punctate; reticulation present on sides of the mesosoma, becoming shallower from propleura to propodeum; cinctus, abdominal segment IV, base of abdominal segments V, VI and pygidium transversally, finely and shallowly striate. Body covered with suberect hairs; scape with abundant appressed hairs; tibiae with scattered decumbent hairs; tarsi with abundant decumbent to appressed hairs; declivous face of propodeum with short, dense and appressed hairs.

Remarks

The potential presence of ergatogynes in *Lioponera* (Wilson 1957; Borowiec 2016) prevents assignment of the present specimens to workers or ergatogynes.

Key to the species of *Lioponera* of New Caledonia (modified from Wilson 1957)

1. Large species (HW > 1.1 mm), with long scapes reaching nearly to posterior corners of head; mesosomal dorsolateral margins absent .....***Lioponera dumbletoni*** (Wilson, 1957)
– Small species (HW < 1.1 mm), scapes barely surpassing eyes; mesosomal dorsolateral margins present (Fig. 4A, D) 2

2. Mesosomal posterodorsal margin present; posterolateral corners of petiole projected into spines (Fig. 5A) ..... ***Lioponera cohici*** (Wilson, 1957)
– Mesosomal posterodorsal margin absent (Fig. 4D); posterolateral corners of petiole not projected into spines (Fig. 5B) .....***Lioponera neocaledonica*** Jouault, Ramage & Perrichot sp. nov.

Discussion

The new species described above were mostly collected along the trail from Sarraméa to the Plateau de Dogny, except the specimen collected from the Montagne des Sources. Both localities are situated in the central mountain range of New Caledonia and display humid forests growing on an ultramafic

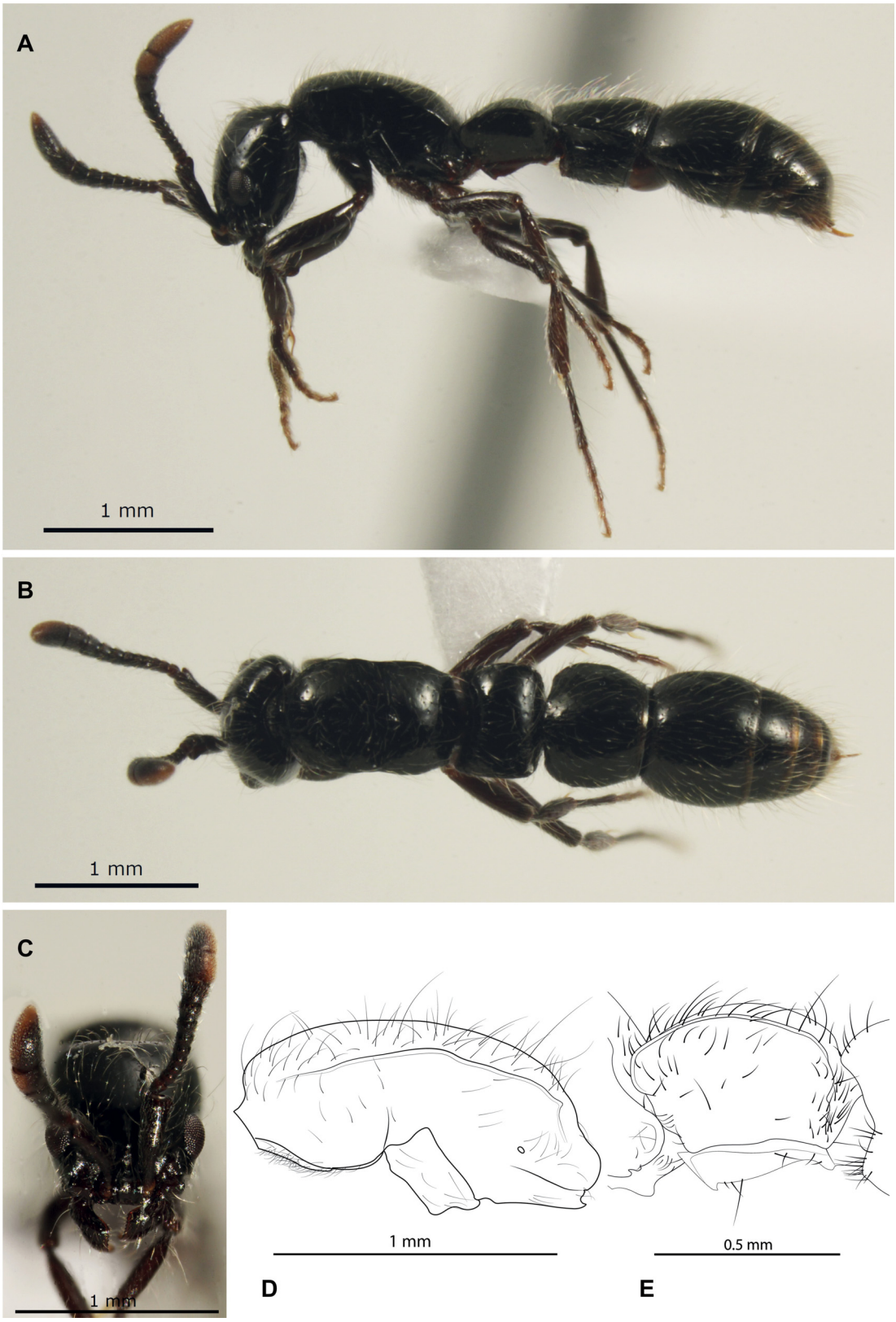

Fig. 4. *Lioponera neocaledonica* Jouault, Ramage & Perrichot sp. nov., holotype, ♀ (MNHN). **A**. Body in profile view. **B**. Body in dorsal view. **C**. Head in full-face view. **D**. Reconstruction of mesosoma in left profile view. **E**. Reconstruction of petiole in left profile view.

ground. The trail to Plateau de Dogny shows three different plant zonations along a gradient of elevation from 20 to 1030 m. There, *Lioponera* was collected on the forest soil at an elevation of 441 m, which corresponds to a mixed humid forest supporting abundant shrubs of the remarkable, endemic basal angiosperm species *Amborella trichopoda* Baill. (Amborellaceae) as well as ferns of the Marattiaceae, namely *Ptisana rolandiprincipis* (Rosenst.) Christenh. (Fig. 6). *Leptogenys* was collected on the soil at an elevation of 897 m, which corresponds to a humid forest harbouring plenty of trees of the likewise endemic *Austrotaxus spicata* Compton (Taxaceae).

Specialized predation on oniscoid isopods seems to dominate in the genus *Leptogenys*, although there have been reports on other preys such as earwigs or termites (Bolton 1975; Steghaus-Kovac & Maschwitz 1993; Dejean 1997; Dejean & Evraerts 1997). Some Oriental species have an army ant lifestyle and are generalists (Witte & Maschwitz 2000). Unfortunately, no data exist on the diet of the New Caledonian

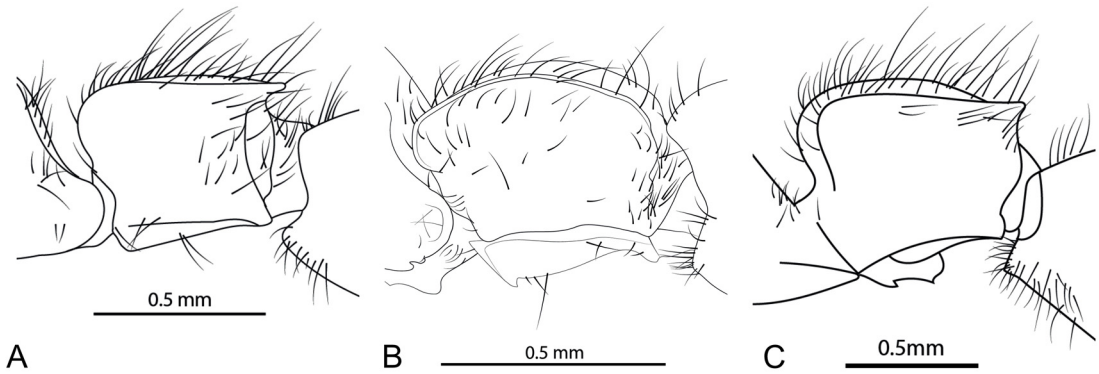

Fig. 5. Comparison of petioles in *Lioponera* species of New Caledonia. **A**. *L. cohici* (Wilson, 1957) (CASENT0249291). **B**. *L. neocaledonica* Jouault, Ramage & Perrichot sp. nov. (MNHN). **C**. *Lioponera dumbletoni* (Wilson, 1957) (CASENT0249292).

Fig. 6. Type locality of the new species. **A**. General view from the trail to Plateau de Dogny (Sarraméa, New Caledonia). **B**. Habitat of *Lioponera neocaledonica* Jouault, Ramage & Perrichot sp. nov.

Leptogenys. *Leptogenys loarelae* Ramage sp. nov., together with *L. acutangula* and *L. sagaris* from New Caledonia, shares affinities with the *Leptogenys* fauna of Australia and Papua New Guinea. *Leptogenys keysseri* Viehmeyer, 1914, from Papua New Guinea, is largely similar to *L. loarelae* Ramage sp. nov., but its petiole is much more narrowed anteriorly.

Species of *Lioponera* are predators of other ants, like most other Dorylinae (Borowiec 2016). At least one species in Australia exhibits a preference in preying on *Pheidole* Westwood, 1839 (Hölldobler 1982), and in Japan one species seems to prey on *Monomorium* Mayr, 1855 (Idogawa & Dobata 2018). In New Caledonia, Wilson (1957) observed *Lioponera cohici* raiding colonies of a species of *Pheidole*, while he found remains of an undetermined species of *Lordomyrma* Emery, 1897 in a nest of *Lioponera dumbletoni*. Data on the diet of *Lioponera neocaledonica* Jouault, Ramage & Perrichot sp. nov. are missing.

Based on these two new discoveries, it is certain that important inventorial and taxonomic work remains to be done in New Caledonia. This first publication will serve as a basis for future work on the myrmecofauna of New Caledonia.

Acknowledgements

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