New species of Cryptophagidae and Erotylidae (Coleoptera) from the Mascarene Islands

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Abstract: A new species *Micrambe reunionensis* sp. nov. (Cryptophagidae) is described from the island of La Réunion. *Cryptophilus integer* (Heer, 1841) and *Leucohimatium arundinaceum* (Forskal, 1775) (Erotylidae) proved new for the Mascarene faunal district.

Key words: Cryptophagidae, Erotylidae, *Cryptophilus, Leucohimatium, Micrambe,* La Réunion, Mascarene Archipelago.

Mascarene Islands: natural conditions

The Mascarenes is an island group in the south-western Indian Ocean, 700 km east of Madagascar. Commonly, it is subdivided into continental and oceanic islands, and oceanic islands are further divided into volcanic islands and coral islands. The archipelago includes three high volcanic islands (La Réunion, Mauritius and Rodrigues). Mauritius was the former home of dodo, the universal symbol of human-caused species extinction on the islands. The level of faunistic endemicity of Mascarenes is one of the highest. Mascarene Archipelago qualifies as an international biodiversity hotspot (Myers et al. 2000). Although recent history of the Mascarenes, since the first permanent human settlements in the XVIIth century, has been an endless series of ecological disasters and species extinctions, these islands still harbour up to 25% of their original forest cover (Cheke 1987). La Réunion is one of the 25 hot spots of biodiversity (Myers et al. 2000). However, the Mascarene biota, like most other oceanic island biotas, has suffered many recent extinctions.

Volcanic islands with higher elevations are relatively young. The most /ancient lavas from La Réunion are dated at 2.1 million years ago. La Réunion has been suitable for life since about 2–3 million years ago (Thébaud et al. 2009). La Réunion possesses one active and three extinct volcanoes. The island is dissected by huge caldera-like valleys (cirques) created by heavy rainfall erosion, with very deep gorges culminating in narrow outlets to the sea.

The Mascarene Islands have a tropical climate; that is, temperatures are warm and show little seasonal variation. Originally, La Réunion (including the lowlands) was covered by continuous forest (Rochat 2008). Today, only about 25% of the original natural habitats remain on the island. The lowland habitats have been nearly completely lost and the highland habitats are well preserved only due to their inaccessibility (Strasberg et al. 2005).

The soils of the island are based on porous volcanic basaltic lavas. Semi-dry sclerophyllous forests cover coastal areas of

La Réunion. Lowland rainforests occur from 750 to 1100 m. These forests have a canopy of tall trees up to 30 m high and represent the richest plant communities of the Mascarene Islands. Dense cloud forests of La Réunion grow between 800 and 1900 m on the eastern mountain slopes and between 1100 to 2000 m on the western slopes (Thébaud et al. 2009). At altitudes of 1800-2000 m, the water temperature on La Réunion averages only 15° C.

The greatest elevations above sea level are Piton des Neiges (3070 m), which is the highest peak in the Indian Ocean, and Piton de La Fournaise (2631 m), one of the most active volcanoes in the world (Thébaud et al. 2009).

Biogeography and endemism of the Mascarene Archipelago

The Mascarene Islands of today have never been connected to larger land masses, thus the biogeography and endemic biodiversity of these islands are the product of oceanic dispersal alone. The Mascarene biota has been long separated from Madagascar, since the Seychelles and Mascarenes are related more to the Asian continent than to Africa or Madagascar (Millot 1952, Paulian 1961, Gressitt 1974, Miller 1996). The insect fauna reflects this biogeographical situation, although insects are more easily dispersed across ocean barriers (Maguire 1963, Williamson 1981, Farrow 1984, Nathan 2001, Withers 2001).

Although the larger Mascarene Islands (Mauritius, Rodrigues and La Réunion) have been studied over the last 300 years, the fauna of these islands is less known._With regard to beetles and other insects, there are works of Vinson (1956, 1958, 1960, 1962, 1967), Starmuhlner (1976, 1977a,b, 1986), and Gerlach (2003). The Mascarene biota exhibits high levels of endemism in many groups of related taxa. About 65% of the Coleoptera (~1550 species) are endemic (Thébaud et al. 2009). 1032 species of Coleoptera (Motala et al. 2007) are known from Mauritius. About 2000 insect species are known from La Réunion, including 900 species of Coleoptera (with about 400 endemic species) (Gomy 2000), and not all specimens identified to the species level but concluded to be endemic.

Only a small number of specimens of Cucujoidea has been found and can be located in the works mentioned above, belonging to families Cryptophagidae and Erotylidae (as well as Cucujidae, Endomychidae, Cerylonidae, Nitidulidae and Latridiidae).

The Cryptophagid endemism is characteristic of oceanic islands. For example, today we know 17 species of Cryptophagidae recorded from the Madeiran Archipelago, three of these species being endemic (18%) (Esser 2008). The percentage of endemism in Mascarene Cryptophagidae and Erotylidae is very high: 100% (Motala et al. 2007), based on 1 endemic species of Cryptophagidae (Cryptophaginae) and 3 endemic species of Erotylidae (1 of Toramini, 2 of Cryptophilinae) found so far. Thus, only one species Cryptophagidae and three species of Erotylidae that are known on the Mascarenes (all endemic); 81 species of total Cucujoidea known from the Mascarenes and 15 species of them are endemic (Motala et al. 2007).

Material

Beetle material from the Mascarene Islands was assembled thanks to courtesy of Mr. Jacques Poussereau (Société Entomologique de France and l'ACOREP-France). This collection includes specimens from the families Cryptophagidae and

Erotylidae. About 80 specimens of these families in total have been collected between 2000-2011, and representing 3 species described in this paper. This material is kept partly at the Muséum National d'Histoire naturelle, Paris (MNHN), and partly at the Zoological Museum of Moscow State University (ZMMU). Detailed description of the specimens used to describe species in this article is provided below.

Systematic biology and ecology of the superfamily Cucujoidea

The beetle families Cryptophagidae and Erotylidae are classified within the Clavicornia of the superfamily Cucujoidea. Cryptophagidae & Erotylidae are represented in all major biogeographical regions, but species diversity is greatest in the tropical regions of Africa, Asia and the Americas.

Erotylidae. The family Erotylidae is recently revised (more 200 genera, more 3500 species), which solved many problems with the high-level classification of Erotylidae and its boundaries with Languriidae (Leschen & Wegrzynowicz 1998, Leschen 2003, Leschen, Buckley 2007). Most species of Erotylidae are mycophagous, however, some tribes (former Languriinae) are phytophagous.

Cryptophagidae. The family currently includes approximately 51 genera and over 600 described species arranged in three subfamilies (Leschen 1996). Most species of Cryptophagidae are mycophagous, however, other feeding strategies and food sources are also used (e.g., phytophagy, myxomycophagy) (Leschen 1999, 2006). Cryptophagidae is nidicolous beetles, which live in burrows and nests of another species of animal, and including a number of species closely associated with social insects: bees, bumblebees, ants and termites (Lyubarsky 1996, 2002, Leschen 1999, Haddad et al. 2008). Cryptophagidae have also been discovered in nests of mammals and birds (Waage 1979), as well as in lepidopteran larval nests (Branco et al. 2008). Many cryptophagids are pyrophilic beetles, i. e. attracted by forest fires, arriving first to disturbed habitats (Muona, Rutanen 1994, McCullough et al. 1998, Wikars, Schimmel 2001, Billings et al. 2004, Wikars et al. 2004, Moretti et al. 2004, Parker et al. 2006). Some genera have paired deep depressions at the ventral side of the pterothorax, which function as mycangia (Wikars, Elewi 1997). Maybe fungi that are persist in micangia and grow in new habitats and serve as food for these mycophagous beetles (Wheeler, Blackwell 1984, Grebennikov, Leschen 2010, Gullan, Cranston 2010).

Both adults and larvae of Cryptophagidae are commonly found on mold, fungi, under bark, as well as in decaying vegetation. Therefore, collection data for cryptophagids shows a strong bias for habitats close to the ground (e.g., leaf litter, fallen logs, stumps, dung etc.). In most cases where cryptophagids are considered pests, the beetles infest stored food products (Coombs, Woodroffe 1955, Triplehorn 1965, Eliopoulos, Athanassiou 2004), feeding primarily on molds and secondarily on the product itself. Other species are mainly scavengers living on debris and nest materials. These beetles are often found in bird nests and burrows of mammals. The pollen of flowering plants is also an important food source for the species of the genus *Antherophagus* Dejean, 1821. Very few cryptophagid species exhibit cave-dwelling or troglodytic habits.

Results: Taxonomic part

Total 74 specimens of Cryptophagidae species and 4 specimens of Erotylidae species were identified in this collection. In this

paper is described one new Cryptophagidae species, and 2 Erotylidae species were new for La Réunion. Detailed description of these 3 species follows below.

Erotylidae Latreille, 1802
Languriinae Crotch, 1873
Cryptophilus Reitter, 1874

Cryptophilus integer (Heer, 1841)

Material: La Réunion: Grande Anse piton lumieres. 29.01.2003 coll. J. Poussereau (1 spec.); RV trios basins Nids de belie 11.02.2004 coll. J. Poussereau (1 spec.).

Distribution: Worldwide. Species new for La Réunion fauna.

Leucohimatium Rosenhauer, 1856
Leucohimatium arundinaceum (Forskal, 1775)

Material: La Réunion: Petite ile 300 m lumieres 31.01.2003 coll. J. Poussereau (1 spec.); coll. Insectarium. N2/060109.0041 (1 spec.).

Remarks: Widespread species, larvae found on cereals, diseased loose smut, with reserves of grain imported into new territories.

Distribution: Palaearctic, Ethiopian, Australian regions. Found on the islands, such as the Madeira Archipelago (Wegrzynowicz, in: Catalogue of Palaearctic Coleoptera, 2007). Species new for La Réunion fauna.

Cryptophagidae Kirby, 1837
Cryptophaginae Kirby, 1837
Micrambe Thomson, 1863

Micrambe reunionensis sp. nov. (Fig. 1A–C)
Holotypus ♂ MNHN: La Réunion. Plaine des cafres Carriere 27ºkm Battage, 29.10.2002, coll. J. Poussereau. Paratypes: Piton de l'eau 1881 m battage fleurs, 25.01.2006, coll. J. Poussereau (5 spec., MNHN); Piton de l'eau 1881 m battage tamarin, 25.01.2006, coll. J. Poussereau (1 spec., MNHN); Piton de l'eau 2080 m battage tamarin, 25.01.2006, coll. J. Poussereau (8 spec., 6MNHN+2ZMMU); Saint-Paul, Palmiste 3, 17.05.2011, coll. Insectarium (3 spec., 2MNHN+1ZMMU); Saint-Paul, Tevelave 4, 19.05.2011, coll. Insectarium (1 spec., MNHN); Saint-Paul, Palmiste 4, 17.05.2011, coll. Insectarium (1 spec., MNHN); Piton de l'eau battage, 08.01.2003, coll. J. Poussereau (2 spec., MNHN); Plaine des cafres Caverne bateau Piege a viande, 02.04.2009, coll. J. Poussereau (1 spec., MNHN); Plaine des cafres, Caverne bateau, Battage mimosa, 29.03.2009, coll. J. Poussereau (1 spec., MNHN); Plaine des cafres, Caverne bateau, Battage mimosa, 27.03.2009, coll. J. Poussereau (2 spec., MNHN); Ft de Belouve Ch bras cabot Battage dombeys, 21.12.2010, coll. J. Poussereau (1 spec., MNHN); Nd de la paix 1700 m fleurs, 12.10.2000, coll. J. Poussereau (3 spec., MNHN); Nd de la paix 1700 m battage, 12.02.2001, coll. J. Poussereau (1 spec., MNHN); Entre-deux Coteau sec Fruit pourri, 18.04.2007, coll. J. Poussereau (2 spec., MNHN); RF sans soucis cryptomeria 1341 m lumieres, 24.12.2004, coll. J. Poussereau (3 spec., 2MNHN+1ZMMU); Mafate-plateau des tamarins battage, 09.03.2004, coll. J. Poussereau (2 spec., MNHN); Ndame la paix 1900 m, battage, 09.01.2008, coll. J. Poussereau (1 spec., MNHN); Piton des neiges, Gite cav duffour Ambaville blanch, 15.03.2005, coll. J. Poussereau (3 spec., 2 MNHN & 1 ZMMU); Riviere de l'est Camp marcelin battage, 06.07.2004, coll. Insectarium (11 spec., 10MNHN+1ZMMU); Salazie 420m, lumieres, 15.01.2003, coll. J. Poussereau (2 spec., MNHN+ZMMU); Le Maido, 2000 m, battage, 16.01.2002, coll. J. Poussereau (3 spec., MNHN); Petite ile Ft de bel air battage, 24.11.2004, coll. J. Poussereau (1 spec., MNHN); Petite lie Foret de bel air battage, 24.11.2004, coll. Insectarium (2 spec., MNHN); Les Makes it7/22 Ft de bon accueuil Battage, 21.04.2005, coll. Insectarium (1 spec., MNHN); Piton de l'eau Bouse de vache, 08.01.2003, coll. J. Poussereau (1 spec., ZMMU); Piton de l'eau battage, 08.01.2003, coll. J. Poussereau (1 spec., MNHN); Ft de Bebour 1350 Battage, 27.02.2002, coll. J. Poussereau (1 spec., MNHN); Bois de Nefles, St. Denis, Battage bs maigre, 22.10.2003, coll. Insectarium (2 spec., MNHN+ZMMU); L'Hermitage battage, 20.03.2001, coll. J. Poussereau (1 spec., MNHN); tean sec fruit lowri, coll. J. Poussereau (1 spec., MNHN).

Derivatio nominis: Because this species found in La Réunion, I have named it *reunionensis.*

Measurements: Body broadest at one third of elytral length. Length of body 1.5–1.9 mm.

Colouration: Monochromous and monotonous, light-brown or dark-brown.

Description: Head. Punctuation of head: small punctures (diameter less than 0.0012 mm). Distance between neighbouring punctures: dense, distance between punctures less than diameter of puncture. Antennae. Length of antenna relative to length of pronotum: with half-club reaching beyond base of pronotum. Breadth of 1st joint: narrow, breadth of 1st joint: less than 2/3 of length of eye. Shape of 1st joint of antenna: elongated, at least 1.5 times as long as broad. Breadth of 2nd joint relative to breadth of 1st: almost as broad as 1st joint. Shape of 2nd joint of antenna: elongated, at least 1.5 times as long as broad. Shape of 3rd joint of antenna: elongated, at least 2 times as long as broad. Length of 3rd joint relative to length of 2nd: equal, 3rd joint not longer than 2nd. Shape of 4th joint: slightly elongated, less than 1.5 times as long as broad. Length of 5th joint relative to its breadth: short, less than 1.5 times as long as broad. Length of 6th joint relative to its breadth: short, less than 1.5 times as long as broad or rounded. Length of 7th joint relative to its breadth: long, 1.5–2 times as long as broad. Length of 8th joint relative to its breadth: short, less than 1.5 times as long as broad or rounded. Club of antenna: of three segments, joints transversal. Length of 9th joint relative to its breadth: trapezoidal, slightly transverse. Breadth of 10th relative to its length: transversal, 1.5 times as wide as long. 11th joint: of acute-oval shape. Eyes. Size of eye (relative to medial length of head): less than half length of head. Diameter of facet: small, from 0.0008 to 0.0011 mm. Shape of eye: normal prominent or conical. Pronotum. Shape of pronotum: transversal, medial length relative to maximum width: 1.33–1.45 as wide as broad. Length of elytron: 2.52–2.84 times as long as length of pronotum. Callosity large, length of callosity occupying ¼ of lateral margin of pronotum. Elongate-oval patch of bare surface visible from above. Glandular duct visible from above. Point of callosity absent. Caudolateral angle (between posterior margin of callosity and lateral margin of pronotum) obtusangular. Angle between bare surface of callosity and longitudinal axis of body: 35–45 degrees. Thickness of callosity normal, height of callosity relative to lateral band: 1–1.5 times as thick as lateral band. Size of puncture: medium, diameter of puncture from 0.0008 to 0.0012 mm. Punctuation moderately dense, distance between neighbouring points somewhat less than diameter of puncture. Side margin without single lateral tooth, with 6 or 7 teeth. Lateral band normal, near one-third of scutellar length. Pronotum strongly narrowed posteriorly, with distinctly angular inflection. Posterior angles from right to obtuse. Basal furrow normal in width, basal pits present. Excavation of anterior margin absent, anterior margin slightly sinuated. Elytra. Pubescence on elytral disk usually simple, but sometimes double (i.e. hairs distinctly differ, some outstanding, longer and some adpressed, shorter). Short hairs shorter than length of scutellum and long hairs longer than breadth of scutellum. Length of elytra relative to maximum breadth: 1.3–1.4. Diameter of puncture: medium, from 0.0008 to 0.0011 mm. Densely punctured, distance between neighbouring punctures less than diameter of puncture. Tooth on shoulder absent. Wings. Membranous wings fully developed. Legs. Male 5–5–4, female 5–5–5. Posterior tarsus normal, length of posterior tarsus equal to length of posterior tibia. 2nd joint of posterior tarsus of male long, more than 1.5 times as long as broad. Length of 3rd joint of posterior tarsus of male: short, less than 1.5 times as long as broad. Length of posterior tarsus comparative to length of middle tarsus: equal. Aedeagus. Length of aedeagal apodema compared to its maximum breadth, from 2.8 to 3.9. Maximum breadth of apodema at middle or first third of length of apodema. Aedeagal lobe pointed apically,

aedeagal lobe with hook projection, hook pointed outwards. Shape of aedeagus: equal breadth from base to middle, usually slightly narrower apically. Length of aedeagus compared to its maximum breadth: from 1.2 to 1.7. Length of apodema compared to length of aedeagus: from 2.3 to 3.5. Parameres. Shape of paramere slender, height nearly 2 times or more than 2 times longer than base of paramere. Length of paramere compared to length of aedeagus: less than 0.5. Apical setae: long, two setae. Length of longest apical setae compared to length of paramere: long, setae more than 0.75 times as long as length of paramere.

Distribution: La Réunion (Mascarene Islands).

Differential diagnosis: This

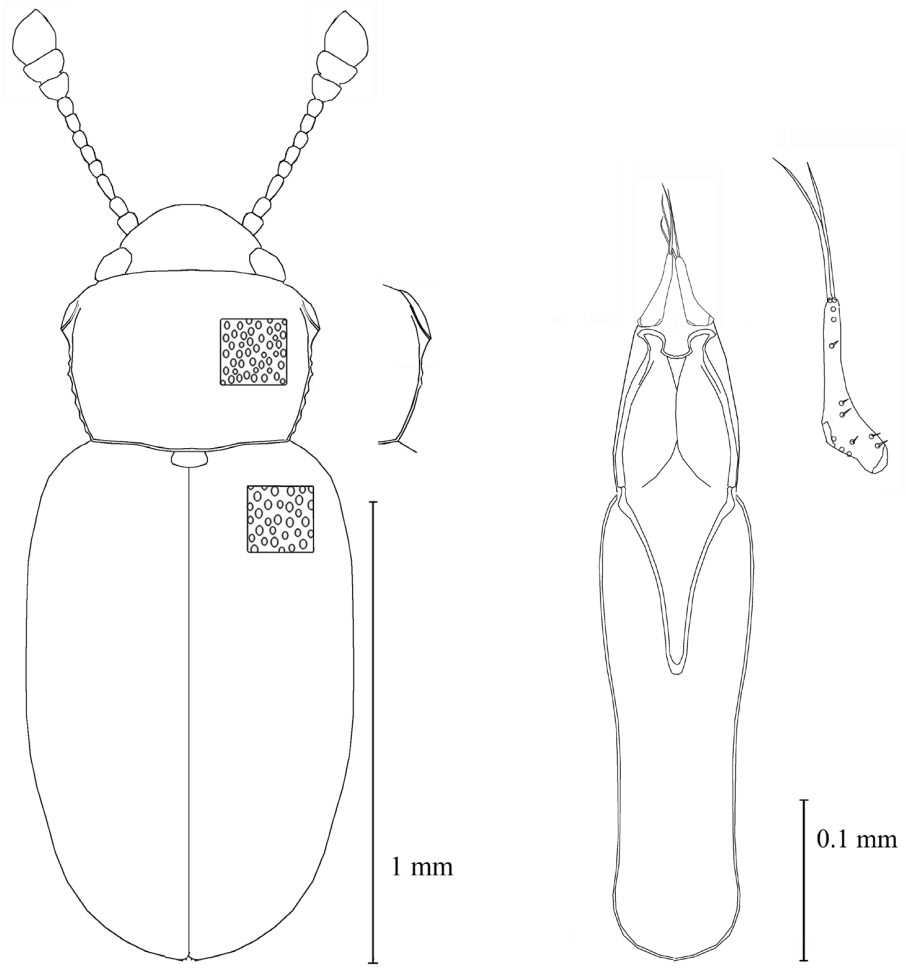

Figure 1. *Micrambe reunionensis* sp. nov. A – general view, B – aedeagus, C – paramere.

species differs from the majority of European species in structure of genitalia, in particular, its aedeagus has hook projection. It differs from the widespread *M. vini* in structure of lateral margin of pronotum, shorter antennae and different structure of genitals. This species differs from the African species combination of characters: double pubescent, obtuse angles corns, transverse pronotum, the number of teeth on the side edge of pronotum, and structure of genitals.

Summary and conclusions

This study challenge endemicity of the Mascarenes can better represent the degree of its endemism. Previously, only 100% endemics were known, as follows from the Introduction. However, both species of Erotylidae from collected material are widely distributed. This two species of Erotylidae identified here are likely to represent invasive (or introduced) species brought to the Mascarenes during European colonization. The only species found Cryptophagidae local endemic. These findings bring total number of Cryptophagidae species of the Mascarene Islands to 1, which is endemic species, and number of Erotylidae species to 4, 2 of which maybe are endemic to the Islands. Perhaps one of the previously mentioned for the Mascarene Islands of Erotylidae coincides with that given in the article. In such a case, total number of Erotylidae species of the Mascarene Islands to 3 species, 1 of which maybe is endemic.

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