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Laurent Soldati, Gael Kergoat, Fabien L. Condamine. Preliminary report on the darkling beetles (Coleoptera, Tenebrionidae) collected during the SANTO 2006 expedition to Vanuatu and description of a new species from the genus *Uloma* Dejean, 1821. *Zoosystema*, 2012, 34 (2), pp.305-317. 10.5252/z2012n2a8 . hal-01218258

HAL Id: hal-01218258

<https://hal.science/hal-01218258v1>

Submitted on 20 Oct 2015

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Preliminary report on the Tenebrionidae (Insecta, Coleoptera) collected during the SANTO 2006 expedition to Vanuatu, with description of a new species of the genus *Uloma* Dejean, 1821

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Soldati L., Kergoat G. J. & Condamine F. L. 2012. — Preliminary report on the Tenebrionidae (Insecta, Coleoptera) collected during the SANTO 2006 expedition to Vanuatu, with description of a new species of the genus *Uloma* Dejean, 1821. *Zoosystema* 34 (2): 305-317. <http://dx.doi.org/10.5252/z2012n2a8>

ABSTRACT

KEY WORDS

Insecta,
Coleoptera,
Tenebrionidae,
Uloma,
Vanuatu,
Santo,
new species,
inventory.

An annotated list of Tenebrionidae Latreille, 1802 (Coleoptera Linnaeus, 1758) collected by one of the authors (LS) during the SANTO 2006 expedition is given. It concerns the period covered by the section “Fallow & Aliens” during October 2006. These faunistic data are completed with the description of a new species: *Uloma vanuatensis* L. Soldati n. sp. Furthermore, biogeographic hypotheses on the colonisation of the Vanuatu archipelago are presented to explain the origin of the tenebrionid fauna.

RÉSUMÉ

Rapport préliminaire sur les Tenebrionidae (Insecta, Coleoptera) récoltés lors de l'expédition SANTO 2006 au Vanuatu et description d'une nouvelle espèce du genre Uloma Dejean, 1821.

MOTS CLÉS

Insecta,
Coleoptera,
Tenebrionidae,
Uloma,
Vanuatu,
Santo,
espèce nouvelle,
inventaire.

Une première liste commentée d'espèces de Tenebrionidae Latreille, 1802 (Coleoptera Linnaeus, 1758) récoltés par l'un des auteurs (LS) lors de l'expédition SANTO 2006 est établie. Elle concerne la période couverte par le module terrestre « Friche & Alien » pendant le mois d'octobre 2006. Ces données faunistiques sont complétées par la description d'une nouvelle espèce pour la science : *Uloma vanuatensis* L. Soldati n. sp. De plus, des hypothèses biogéographiques sont présentées pour expliquer sur l'origine du peuplement de l'archipel du Vanuatu.

INTRODUCTION

Although the tenebrionid fauna of the different islands and archipelagos in the southwestern Pacific is quite well documented (Gebien 1920; Kaszab 1939, 1955, 1982a, b, 1986), there is no comprehensive study on the Tenebrionidae Latreille, 1802 of Vanuatu. The same holds for most of the other beetle families as only a few citations scattered in various scientific publications can provide a glimpse of the species inhabiting this archipelago.

Two species were described from this area: *Thesilea mallicolensis* Kulzer, 1951, from the island of Mallicolo (Malekula) and *Corticeus (Cnemophloeus) levis* Bremer, 1993, from Espiritu Santo. One short biogeographic analysis lists some genera present in Vanuatu in the introduction to the fauna of the Tenebrionidae of New Caledonia (Kaszab 1982b: 7), but there is no information at species level. Finally, another article, focusing mainly on the question of endemism in the tenebrionid beetles of Santo, was published in the book *The Natural History of Santo* (Soldati 2011).

About twenty species of Tenebrionidae were collected within the frame of the section “Fallow & Aliens” of the SANTO 2006 expedition, organised by the Muséum national d’Histoire naturelle, Paris (MNHN), the Institut de Recherche pour le Développement (IRD) and Pro-Natura International (PNI), a non-governmental organisation. For a narrative and background of the expedition, see Bouchet *et al.* (2011a), and for a review of the geography and natural history of Santo, see Bouchet *et al.* (2011b). As all the collected material has not yet been identified, a preliminary list is given below with the description of a new species of the genus *Uloma* Dejean, 1821, which is thought to be endemic to the archipelago.

MATERIAL AND METHODS

SAMPLING

The section “Fallow & Aliens” of the SANTO 2006 expedition, focused mainly on assessing the balance between native and introduced species in several habitats of the Espiritu Santo Island. For this purpose, three different areas showing a decreasing human influence were prospected:

The first inventoried area is located in the surroundings of Luganville (southeast of Santo), on the lands of the Centre technique de Recherches agronomiques du Vanuatu (CETRAV). In this area, since the beginning of the 20th century, agriculture and breeding turned natural habitats into fields, coconut plantations and pastures. However, there are still several small patches of natural forest.

The second prospected zone is Vathe Conservation Area in Big Bay, where there is a mixture of primary and secondary forests.

The third and last area, which is the least affected by human activities, is Butmas, a small village located in the centre of the island, where the natural rainforest is still well preserved.

Most of the Tenebrionidae were collected either during the day, beating the shrubs and dead branches, or by lifting the barks and carefully examining dead trees, decaying trunks and fungi (especially *Polyporus* spp.), or during the night by exploring the forest with a headlamp.

DNA SEQUENCING

A fragment of mitochondrial DNA of *Uloma vanuatuensis* L. Soldati n. sp. was sequenced. The ribosomal RNA 12S (12S) was preferentially selected because it is often used in the phylogenetic studies of Coleoptera Linnaeus, 1758. Dissection under binocular stereo-microscope made it possible to take the internal parts of the specimen. The DNA was then extracted from internal parts by using a Qiagen DNeasy tissue kit. For sequencing the 12S, the following couple of primers (forward and transfers) were used: SR-J-14233 – AAG AGC GAC GGG CGA TGT GT – and SR-N-14588 – AAA CTA GGA TTA GAT ACC CTA TTA T – (Simon *et al.* 1994). Amplifications were carried out by PCRs (Polymerase Chain Reactions) with the following settings: an initial denaturation phase of 2 min at 94°C, followed by 35 cycles each one made up by three stages: a 1 min denaturation step at 94°C, a 1 min hybridisation step at 52°C, and a 1 min elongation step at 72°C. A final elongation step from 7 to 10 min at 72°C ended the PCRs. Once amplified, PCR products were sent to Macrogen (Seoul, South Korea) to be sequenced in both directions (forward and reverse). The forward and reverse sequences

were assembled to form a single sequence by using Geneious Pro 5.1.7 (Drummond *et al.* 2010).

ABBREVIATIONS

coll. LS collection Soldati, Montpellier;
HNHM Hungarian Natural History Museum, Budapest;
MNHN Muséum national d'Histoire naturelle, Paris;
CBGP Centre de biologie pour la gestion des populations, Montferrier-sur-Lez;
SAM South Australian Museum, Adelaide.

SYSTEMATICS AND FAUNISTICS

All the specimens of Tenebrionidae collected during the SANTO 2006 expedition have not been identified yet. So, an almost complete list is hereby provided for the collections made in October by the section "Fallow and Aliens".

The taxonomic classification adopted here follows that of Löbl & Smetana (2008).

Subfamily DIAPERINAE Latreille, 1802

Tribe DIAPERINI Latreille, 1802

Genus *Platydema* Laporte & Brullé, 1831

Platydema simbangense Kaszab, 1939

Platydema simbangense Kaszab, 1939: 197.

MATERIAL EXAMINED. — **Vanuatu.** Espiritu Santo Isl., Luganville, CETRAV in Saraoutou, ecotone between dense rainforest and coffee tree plantation, beating dead branches covered with fungi, 2-10.X.2006, leg. L. Soldati, 4 ♂♂ (MNHN), 4 ♂♂ (coll. LS). — Espiritu Santo Isl., Butmas, rainforest, 21.X.2006, leg. L. Soldati, 1 ♂ (MNHN), 1 ♀ (coll. LS).

DISTRIBUTION. — New Guinea (type locality Simbang), Solomon Island (Schawaller 2008) and Vanuatu (new record).

Platydema novaeguineense Gebien, 1920

Platydema novaeguineense Gebien, 1920: 259.

MATERIAL EXAMINED. — **Vanuatu.** Espiritu Santo Isl., Luganville, CETRAV in Saraoutou, ecotone between dense rainforest and coffee tree plantation, in fungi

growing on a rotten log, 2-10.X.2006, leg. L. Soldati, 2 ♂♂ (MNHN), 1 ♂ (coll. LS).

DISTRIBUTION. — Described from New Guinea (type locality: Doré), this species is also present in the Solomon Islands (Schawaller 2008). First record for Vanuatu.

Tribe HYPOPHLAEINI Billberg, 1820

Genus *Corticeus* Piller & Mitterpacher, 1783

Corticeus (Cnemophloeus) cephalotes
(Gebien, 1913)

Hypophloeus cephalotes Gebien, 1913: 28-29.

MATERIAL EXAMINED. — **Vanuatu.** Espiritu Santo Isl., Luganville, CETRAV in Saraoutou, ecotone between dense rainforest and coffee tree plantation, under bark, 2-10.X.2006, leg. L. Soldati, 1 ♂ (MNHN).

DISTRIBUTION. — Oriental region, Papuan subregion, northern Australia and Comoro Islands (Bremer 1999). Solomon Islands (Vanikoro). First record for Vanuatu.

Corticeus (Cnemophloeus) levis Bremer, 1993

Corticeus levis Bremer, 1993: 521, fig. 8.

MATERIAL TYPE. — Malao village in Big Bay area, Esperito (*sic*) Santo, New Hebrides, 6-16 Sept. 71, leg. J. Buckerfield R.S.P.S.E. sex unknown (probably a ♀), holotype (SAM).

MATERIAL EXAMINED. — **Vanuatu.** Espiritu Santo Isl., Luganville, CETRAV in Saraoutou, ecotone between dense rainforest and coffee tree plantation, under bark, 2-10.X.2006, leg. L. Soldati, 1 ex. (sex unknown) (MNHN), 1 ex. (sex unknown) (coll. LS). — Espiritu Santo Isl., Big Bay, Matantas, Vatthe Area Conservation, 12-17.X.2006, under the bark of a big dead trunk lying on the ground, leg. L. Soldati, 1 ♂, 10 ex. (MNHN) and 6 ex. (coll. LS) (sex unknown).

DISTRIBUTION. — So far, this species is only known from Espiritu Santo (Vanuatu) and is considered as endemic of this island (Soldati 2011).

REMARKS

Corticeus (Cnemophloeus) levis has never been mentioned since the original description until one of the authors discovered it once again during the SANTO 2006 expedition.

Subfamily TENEBRIONINAE Latreille, 1802
Tribe AMARYGMINI Gistel, 1848
Genus *Amarygmus* Dalman, 1823

Amarygmus hydrophiloides Fairmaire, 1849

Amarygmus hydrophiloides Fairmaire, 1849: 450.

MATERIAL EXAMINED. — **Vanuatu.** Espiritu Santo Isl., CETRAV Arboretum, beating shrubs, 5.X.2006, leg. L. Soldati 1 ♂ and 3 other ex. (sex unknown) (MNHN). — Espiritu Santo Isl., littoral forest of Saraoutou, 9.X.2006, on a dead trunk, leg. L. Soldati, 3 ex. (MNHN), 2 ex. (coll. LS) (sex unknown).

DISTRIBUTION. — One of the most common species of *Amarygmus* in the Papuan and Polynesian regions, it was first described by Fairmaire (1849) from Wallis and the Tonga-Tabou islands.

Tribe *Opatrini* Brullé, 1832
Genus *Diphyrrhynchus* Fairmaire, 1849

Diphyrrhynchus halorageos (Montrouzier, 1860)

Acanthosternus halorageos Montrouzier, 1860: 290.

MATERIAL EXAMINED. — **Vanuatu.** Espiritu Santo Isl., Luganville, Surunda beach, seashore, 8.X.2006, leg. L. Soldati, 10 ♂♂, 24 ♀♀ (MNHN), 2 ♂♂, 2 ♀♀ (coll. LS). — Espiritu Santo Isl., Big Bay, Matantas, Vatthe Area Conservation, 12-17.X.2006, leg. L. Soldati, 2 ♂♂, 3 ♀♀ (MNHN).

DISTRIBUTION. — New Caledonia, Loyalty Islands, île des Pins, Vanuatu and Australia (Kaszab 1982b).

REMARKS

As its specific epithet suggests, this little nocturnal darkling beetle lives in the coastal sand and hides during the day at the base of *Haloragis prostrata* J. R. Forst. & G. Forst.

Genus *Brachyididium* Fairmaire, 1883

Brachyididium irroratum (Fauvel, 1867)

Gonocephalum irroratum Fauvel, 1867: 188, note 1.

MATERIAL EXAMINED. — **Vanuatu.** Espiritu Santo Isl., Butmas, Melanesian village in rainforest, UV light trap,

21.X.2006, leg. L. Soldati, 14 ♂♂, 10 ♀♀ (MNHN), 4 ♂♂, 4 ♀♀ (coll. LS).

DISTRIBUTION. — Described from Lifu Island, it occurs in the Loyalty Islands and also in the Vanuatu archipelago (Kaszab 1982b).

Tribe TOXICINI Lacordaire, 1859
Genus *Toxicum* Latreille, 1802

Toxicum quadricorne (Fabricius, 1801)

Trogosita quadricornis Fabricius, 1801: 153.

MATERIAL EXAMINED. — **Vanuatu.** Espiritu Santo Isl., Luganville, CETRAV in Saraoutou, ecotone between dense rainforest and coffee tree plantation, at night on dead trunks, 2-10.X.2006, leg. L. Soldati, 1 ♂ (coll. LS); Luganville, CETRAV in Saraoutou, 1-11.X.2006, at night with a headlamp, on the decaying trunk of an old mango tree (*Mangifera indica* L.), leg. L. Soldati, 2 ♂♂ (MNHN), 1 ♀ (coll. LS); same data, but 18-20.X.2006, 1 ♂ (MNHN), 1 ♂ (coll. LS).

DISTRIBUTION. — Indomalayan realm: Indochina, Sunda Islands, Andaman Islands, Sulawesi; Micronesia: Palau, Truk, Marshall Islands, Ponape; Melanesia: New Guinea (Irian Jaya and Papua New Guinea), Solomon Islands and Vanuatu (Merkel 1989).

Tribe TRIBOLINI Gistel, 1848
Genus *Tribolium* MacLeay, 1825

Tribolium castaneum (Herbst, 1797)

Colydium castaneum Herbst, 1797: 282.

MATERIAL EXAMINED. — **Vanuatu.** Espiritu Santo Isl., Luganville, CETRAV in Saraoutou, 23-28.X.2006, at light, leg. L. Soldati, 1 ♂ (MNHN).

DISTRIBUTION. — *Tribolium castaneum* is a cosmopolitan species and one of the most important stored product pests around the world. It is known to infest the following commodities: barley, bran, cacao, ginger, maize, millet, manioc, nutmeg, peanut, pepper, rice, sorghum, tapioca and yam (Delobel & Tran 1993). This species can also damage entomological collections.

Tribe ULOMINI Blanchard, 1845
Genus *Uloma* Dejean, 1821

Uloma vanuatuensis L. Soldati n. sp.
(Figs 1-3)

TYPE MATERIAL. — Holotype: Vanuatu, Santo Isl., Luganville, CETRAV in Saraoutou, 2-10.X.2006, 30 m alt., 15°27'05"S, 167°11'04"E, leg. L. Soldati, ♂ (MNHN EC2280).

Paratypes (7 ♀♀, 3 ♂♂): same data as holotype, 1 ♀ (MNHN EC2281). — Santo Isl., Saraoutou, littoral forest, rotten log, 9-10.X.2006, 15°26'38"S, 167°12'52"E, leg. L. Soldati, 2 ♀♀ (CBGP), 1 ♂ and 1 ♀ (Coll. LS). — Espiritu Santo Isl., Big Bay, Matantas, Vatthe Area Conservation, 12-17.X.2006, leg. L. Soldati, 2 ♀♀ (MNHN EC2282- EC2283), 1 ♂ (coll. LS) and 1 ♀ paratype (CBGP). — *Uloma* n. sp. aff. *cavifrons* Kasz. Santo, Zoltán Kaszab det., 1 ♂ (HNHM).

DISTRIBUTION. — This *Uloma* is currently known only from the island of Espiritu Santo in the Vanuatu archipelago, where it may be endemic.

ETYMOLOGY. — This new species is named in reference to its origin, the Vanuatu archipelago.

DIAGNOSE. — *Uloma vanuatuensis* L. Soldati n. sp. belongs to a characteristic New Guinean species-group. It is closely related to *Uloma bituberosa* Kirsch, 1875. It has the same very characteristic type of aedeagus, found in *U. bituberosa* and its subspecies *hamata* Gebien, 1920 described from New Guinea, New Pomerania (now New Britain, the largest of the Bismarck Islands) and Palau (Gebien 1920), and *sydneyana* Kaszab, 1982, described from Sydney, Australia (Kaszab 1982a). However, it clearly differs from *U. bituberosa* and its subspecies by the presence of two conical tubercles on the clypeus in males (Fig. 2B) and the different shape of the pronotum (Fig. 1D), whose bumps on the sides of the anterior impression of males are much lower: they are not projected forward up to the front edge or beyond it, and they are not hook-shaped inwards.

DESCRIPTION

Length 10-11.5 mm; width 3.5-4 mm. Pitchy dark brown, sometimes slightly reddish (teneral specimens), brilliant. Antennae, mouthparts, legs and prosternal apophysis reddish-brown.

Head (Fig. 2B)

Transverse, genae narrower than eyes, first subparallel in a very short distance, then obliquely narrowed in curved line forward up to the clypeo-genal suture, which is limited laterally by two short faint grooves and disappears completely in the middle, in the area

that normally separates the front from the clypeus. Clypeus transversely enlarged, swollen (standing out from frons despite absence of visible suture) and its anterior edge slightly concave.

Male: vertex sloping steeply forward and separated from front by a transverse depression as wide as space between eyes. Frons plane with a slight impression in front in the middle, in area of contact with the clypeal bead. Clypeus densely covered with tangled microgranulation and adorned with two small conical tubercles (Fig. 2B, tub), between them with a narrow arc-shaped strip (Fig. 2B, st) whose microchagreened/matte surface contrasts sharply with the shiny rest of upper head. Punctuation is very fine, sparse and superficial in the middle of frons and becomes progressively denser on genae and toward clypeus, and stronger and coarser on the temporae.

Female: vertex coarsely punctate, convex and separated from temporae and frons by a transverse depression more or less pronounced, but still clearly visible. Contrary to ♂, frons is also convex transversely and much more strongly punctate. Clypeus also swollen, but its surface only punctate, smooth and shiny, neither with conical tubercles nor microgranulation.

Antennae (Fig. 2A) without notable features, antennomeres gradually becoming transverse and expanded from antennomere 5 which is slightly asymmetrical. Mentum (Fig. 2A) heart-shaped, smooth and covered with coarse but shallow punctuation, with distinct midlongitudinal triangular depression, deepest anteriorly and gradually becoming shallower backward, and two short oblique lateral grooves near the base, arranged symmetrically in relation to midline.

Pronotum

1.3 times wider than long, sides weakly arcuate, almost parallel, widest at basal third. Rim on the anterior margin disappears completely in the middle; base immarginated, with exception of two small folds located at the level of the two concave curves of external margin and the posterior angles. Anterior angles smooth and slightly protruding forward, posterior ones obtuse. Whole upper surface of the pronotum very finely and regularly punctate, slightly denser on the sides.

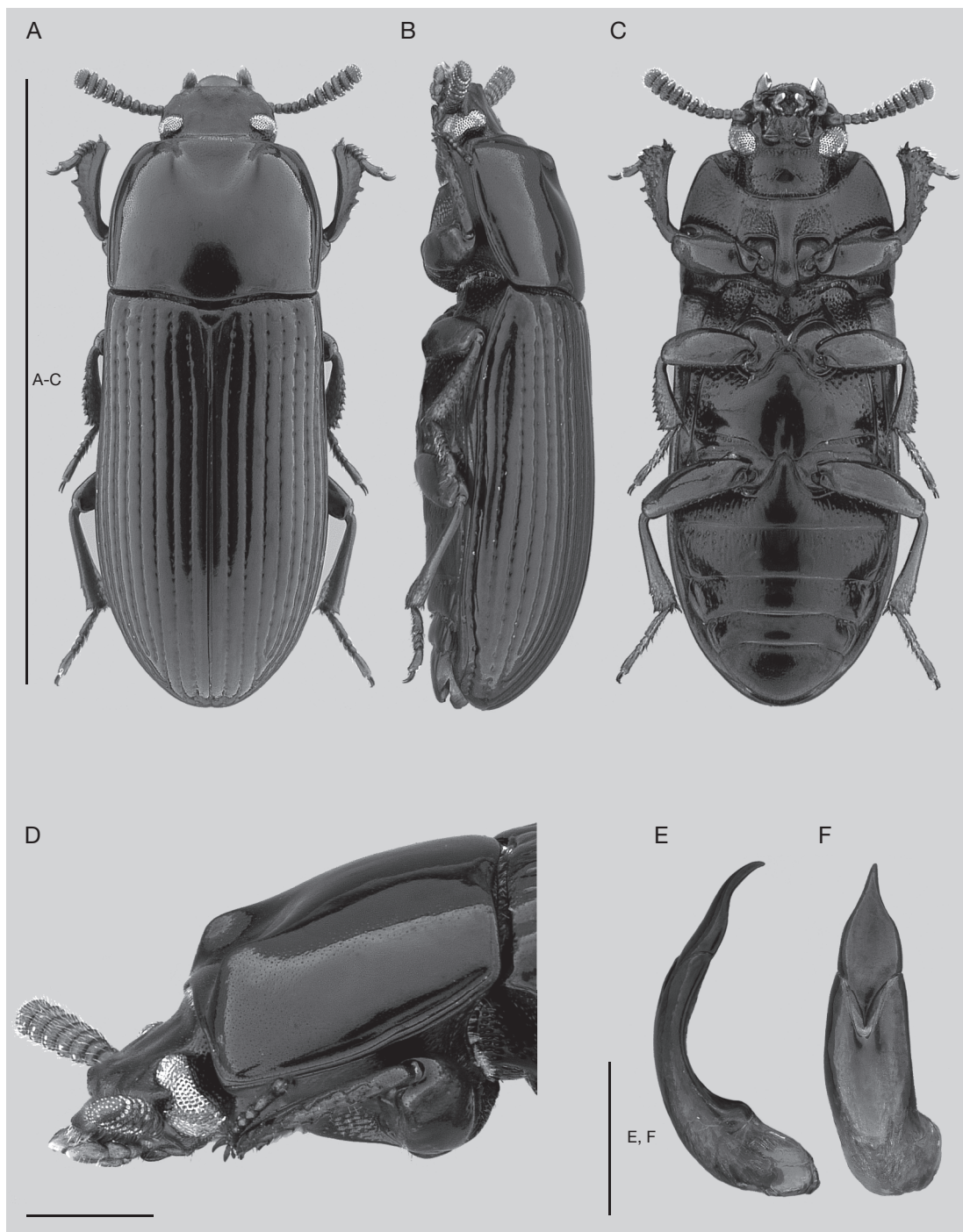


FIG. 1. — *Uloma vanuatus* L. Soldati n. sp. holotype ♂ (MNHN EC2280): **A**, habitus (dorsal view); **B**, habitus (lateral view); **C**, habitus (ventral view); **D**, forebody (lateral view); **E**, aedeagus (lateral view); **F**, aedeagus (tergal face). Scale bars: A-C, 10 mm; D-F, 1 mm. Photographs: L. Soldati.

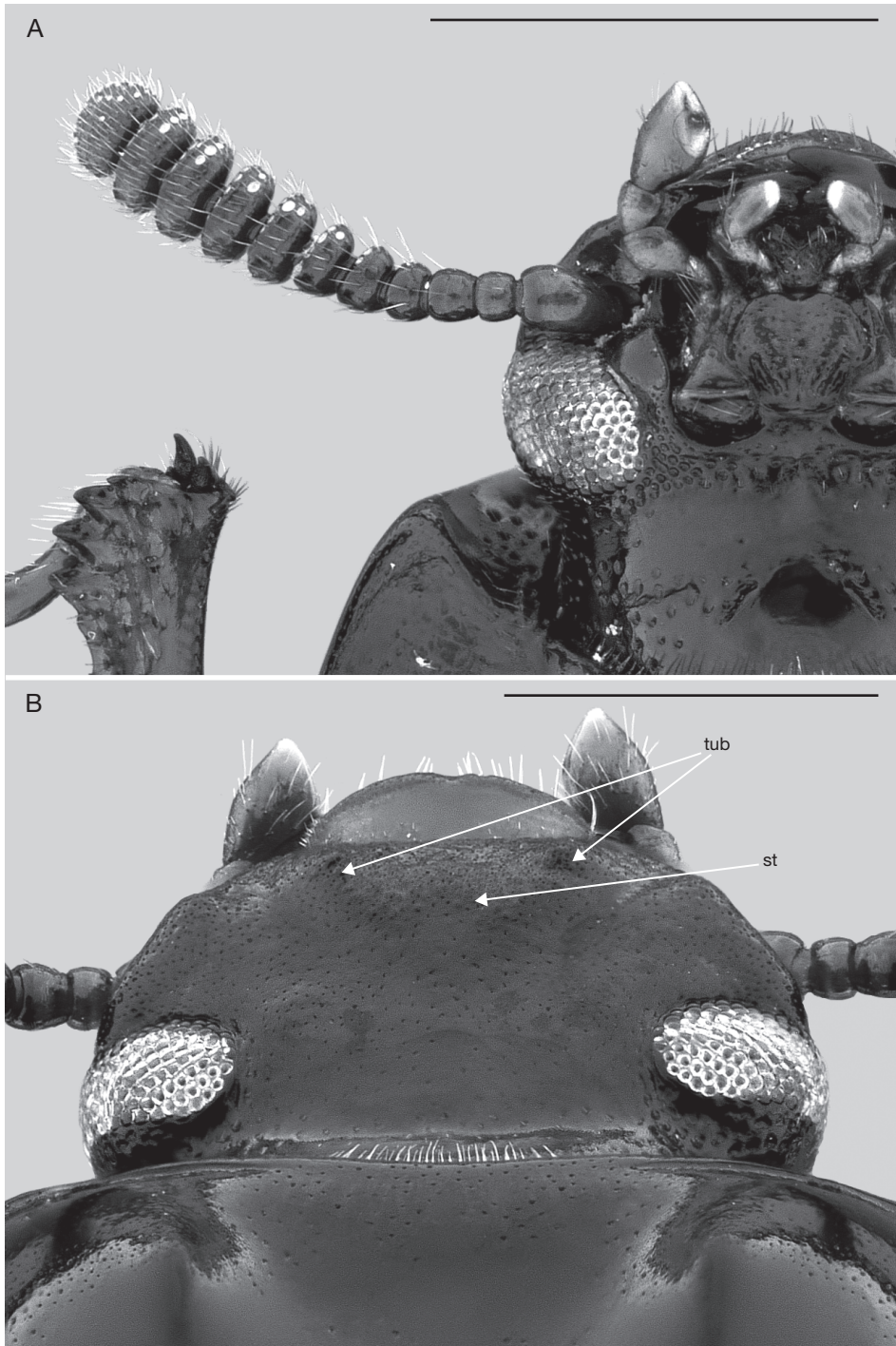


FIG. 2. — *Uloma vanuatensis* L. Soldati n. sp. holotype ♂ (MNHN EC2280): **A**, head (ventral view); **B**, head (dorsal view). Abbreviations: tub, conical tubercle; st, arc-shaped strip. Scale bars: A, 1.5 mm; B, 1 mm. Photographs L. Soldati.

Male: antero-median depression of pronotum rather moderate, shallow, not reaching half of pronotal length and becoming gradually shallower toward posterior end in circular arch without any granule to delimit its posterior edge. The lateral bumps that initiate the depression's sides forward are quite low, not projected to anterior edge and simply sloping inwards, without forming lamellar hook-shaped expansions. Bottom of depression somewhat more strongly punctate than rest of pronotal surface.

Female: pronotum regularly convex, without antero-median depression. Prosternal apophysis in lateral view regularly curved beneath anterior coxae.

Elytra

Elytra quite flattened on disc, sides parallel, humeral angles right but rounded at the top. Lateral margin visible only in anterior half in dorsal view. Each elytron bears nine grooved striae of punctures and a scutellar striola. Strial punctures are slightly wider than grooves. Elytral intervals nearly flat on disc and becoming convex laterally and toward apex, covered with extremely fine and superficial punctuation.

Abdomen

Abdominal ventrites (Fig. 3B) very finely and densely punctate on a narrow mid-longitudinal strip and on the entire anal ventrite where punctuation becomes progressively bigger and sparser. On each side of this longitudinal strip, surface of ventrites 1-4 is finely microshagreened and striate longitudinally. Moreover, each ventrite is dotted with porous punctures mainly concentrated on leading edge. The terminal ventrite without lateral microshagreened and striate areas, but porous punctures present, and its outer margin very finely bordered except on both sides, in front of the base. Anterior tibiae (Fig. 3A) carinate on their upper surface up to the middle and slightly excavated at base on the inner side.

Aedeagus: on tergal face (Fig. 1F), parameres parallel in basal half, then suddenly narrowed and pointed toward apex; base triangular backwards. In lateral view (Fig. 1E), apical half of parameres strongly curved.

REMARKS

Uloma vanuatuensis L. Soldati n. sp., like all its congeners, is a saproxylic insect living and developing

beneath bark and in decaying wood. Unfortunately, neither the larvae nor the food preferences (type of tree species) are known.

Subfamily STENOCHIINAE Kirby, 1837

Tribe CNODALONINI Gistel, 1856

Genus *Bradymerus* Perroud, 1864

Bradymerus costatus (Fairmaire, 1849)

Bolitophagus costatus Fairmaire, 1849: 421, pl. 11, figs 1, 2.

MATERIAL EXAMINED. — **Vanuatu**. Espiritu Santo Isl., Luganville, CETRAV in Saraoutou, 1-11.X.2006, at night with a headlamp, on decaying trunk of an old mango tree (*Mangifera indica*), leg. L. Soldati, 2 ♂♂, 1 ♀ (MNHN), 2 ♂♂, 1 ♀ (coll. LS); same data, but 18-20.X.2006, 2 ♂♂, 2 ♀♀ (MNHN), 2 ♂♂, 2 ♀♀ (coll. LS).

DISTRIBUTION. — Originally described from Wallis Island, this species is also present in the Fiji Islands (Kaszab 1955). First record for Vanuatu.

Bradymerus lobicollis Gebien, 1920

Bradymerus lobicollis Gebien, 1920: 240, figs 14, 15.

MATERIAL EXAMINED. — **Vanuatu**. Espiritu Santo Isl., Luganville, CETRAV in Saraoutou, ecotone between dense rainforest and coffee tree plantation, beating dead branches, 2-10.X.2006, leg. L. Soldati, 2 ♂♂, 1 ♀ (MNHN), 1 ♂, 1 ♀ (coll. LS).

DISTRIBUTION. — New Guinea and Samoa Islands (Kaszab 1955), this species also occurs in the Solomon Islands. First record for Vanuatu.

Genus *Chariotheca* Pascoe, 1860

Chariotheca striata Kaszab, 1955

Chariotheca striata Kaszab, 1955: 502, figs 78, 182.

MATERIAL EXAMINED. — **Vanuatu**. Espiritu Santo Isl., Luganville, CETRAV in Saraoutou, ecotone between dense rainforest and coffee tree plantation, under bark, 2-10.X.2006, leg. L. Soldati, 2 ♂♂ (MNHN), 2 ♂♂ (coll. LS); CETRAV Arboretum, beating shrubs, 5.X.2006, leg. L. Soldati, 1 ♂ and 2 other ex. (sex unknown) (MNHN).

DISTRIBUTION. — Described from the Fiji Islands (Kaszab 1955), this is the first record for Vanuatu.

REMARKS

This nocturnal species is quite commonly collected while beating dead branches or shrubs during the day.

Chariotheca cuprina (Fairmaire, 1849)

Olisthaena cuprina Fairmaire, 1849: 451.

MATERIAL EXAMINED. — **Vanuatu**. Espiritu Santo Isl., Luganville, CETRAV in Saraoutou, ecotone between dense rainforest and coffee tree plantation, under bark, 2-10.X.2006, leg. L. Soldati, 2 ♂♂ (MNHN), 1 ♂ (coll. LS).

DISTRIBUTION. — Originally described from Wallis Island and known from the Fiji Islands (Kaszab 1955), this species also occurs in Vanikoro (Solomon Islands) and in Santo (Vanuatu).

Genus *Promethis* Pascoe, 1869

Promethis sulcigera (Boisduval, 1835)

Upis sulcigera Boisduval, 1835: 256.

MATERIAL EXAMINED. — **Vanuatu**. Espiritu Santo Isl., Luganville, CETRAV in Saraoutou (15°26'47"S, 167°12'32"E), 1-11.X and 18-20.X.2006, at night with a headlamp, on the decaying trunk of an old mango tree (*Mangifera indica*), leg. L. Soldati, 2 ♀♀ (MNHN), 2 ♀♀ (coll. LS).

DISTRIBUTION. — Described from “île d’Amboine” (Ambon, Indonesia), this widespread species is also known from Taiwan, Philippines, Moluccan Islands, New Guinea and the surrounding islands and Australia (Queensland) (Kaszab 1988a). It is also present in the Solomon Islands, the Samoa Islands, Palau and the Vanuatu Archipelago (Aoba, Malo, Malekula [Mallicolo] and Epi, Erronango islands) (Kaszab 1988b).

Tribe THESILEINI Kaszab, 1982

Genus *Thesilea* MacLeay, 1825

Thesilea mallicolensis Kulzer, 1951

Thesilea mallicolensis Kulzer, 1951: 148.

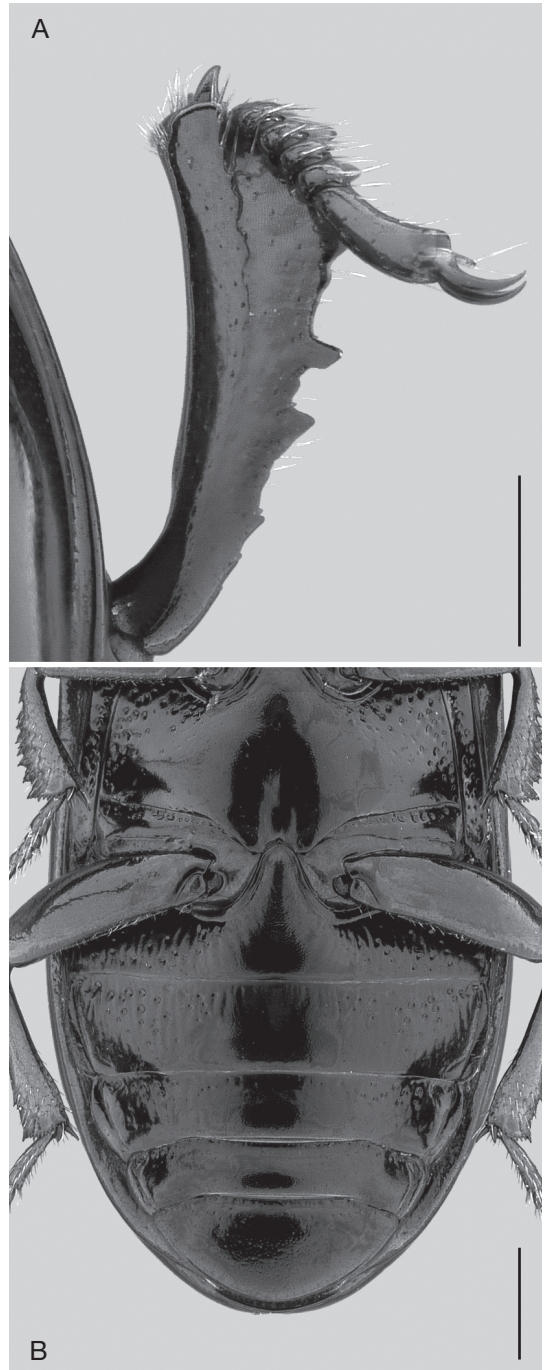


FIG. 3. — *Uloma vanuatensis* L. Soldati n. sp. holotype ♂ (MNHN EC2280): **A**, anterior tibia (upper face); **B**, metathorax and abdomen (ventral view). Scale bars: A, 0,5 mm; B, 1 mm. Photographs: L. Soldati.

MATERIAL EXAMINED. — **Vanuatu.** Espiritu Santo Isl., Luganville, CETRAV in Saraoutou, ecotone between dense rainforest and coffee tree plantation, beating shrubs, 2-10.X.2006, leg. L. Soldati, 2 ♂♂ and 15 other ex. (MNHN), 5 ex. (coll. LS) (sex unknown). — Espiritu Santo Isl., Butmas, in rainforest, 21.X.2006, leg. L. Soldati, 1 ♂ (MNHN), 1 ♂ (coll. LS).

DISTRIBUTION. — Originally described from Mallicolo (Malekula Island) in the French New Hebrides (now Vanuatu), this species also occurs in the neighbouring island of Espiritu Santo.

BIOGEOGRAPHY OF VANUATU AND ASSUMPTIONS ON THE ORIGIN OF THE TENEBRIONIDAE IN THE ARCHIPELAGO.

The Vanuatu islands and that of Santo in particular are known to be recently emerged volcanic islands (about 4 million years), and can thus be qualified oceanic islands (Gillespie & Roderick 2002). This geological evidence suggests that the local fauna most likely originated by dispersal and not by vicariance. After their arrival, some of the species may have then evolved to endemic species. This leads us to raise the following question: which is (are) the origin(s) of this fauna? In other words, what were the borrowed colonisation routes to reach the archipelago of the Vanuatu?

With reference to the Tenebrionidae, one can say that there were nearly (because of the human-mediated introduction of species like *Tribolium castaneum*) as many colonisation events as different genera existing in Vanuatu, which are not considered as sister clades. Note that if a genus is represented by more than one species, we cannot exclude the hypothesis of multiple colonisation events as well (e.g., Balke *et al.* 2007). If we replace Vanuatu in a geographical context, one can put forth biogeographic hypotheses as for the source of these dispersals. Indeed, these events can come from several areas around the archipelago.

First of all, several genera of Tenebrionidae could originate from New Guinea, which probably holds the greatest diversity of Tenebrionidae of the Australasian region (Gebien 1920). Its geographical position makes it obvious that its fauna is part of

the Melanesian arch. In particular, dispersals to the Vanuatu could be facilitated by the Solomon Islands, as they are themselves strongly influenced by New Guinean fauna (Merkel 1989; Bremer 1993). This assumption is corroborated by the presence of the genus *Amarygmus* in the Vanuatu, whose centre of diversity is located in New Guinea and certain representatives in the Solomon Islands (Gebien 1920). Species of *Amarygmus* are also known from the Fiji Islands (Kaszab 1955), which attests of a colonisation front going towards southeast. In the same way, if *Uloma* of the area and the presently described Vanuatu species are examined, morphological affinities show that *U. vanuatusensis* L. Soldati n. sp. is closely related to a species group of *Uloma* from New Guinea (i.e. the *U. bituberosa* group; Gebien 1920). New Caledonia, the nearest insular territory to Vanuatu (400 km), has the greatest *Uloma* diversity with respect to its surface (Kaszab 1982b, 1986). However, no New Caledonian species are morphologically related to *U. vanuatusensis* L. Soldati n. sp. On the contrary, the Fijian species, *Uloma cavicollis* Fairmaire, 1849, shows several morphological features bringing it closer to *U. vanuatusensis* L. Soldati n. sp. As in the case of *Amarygmus*, it seems that the presence of *Uloma* in Vanuatu is the result of a southeastern oriented dispersal using Solomon Islands as stepping-stones. It is interesting to note that this dispersal has not yet reach New Caledonia whose *Uloma* representatives seem to originate from Australia (Matthews and Bouchard 2005). Consequently, it appears clearly that New Guinea played a crucial role in the species assemblage of Tenebrionidae in Vanuatu via a dispersal that followed the Melanesian arch. The genera *Bradymerus* (*B. lobicollis*), *Platydemus* (*P. novaeguineense*), *Promethis* (*P. sulcigera*) and *Toxicum* (*T. quadricorne*) are most probably originating from New Guinea, too.

Then, other genera can come from the Fiji Islands, a wide archipelago including approximately 80 species of Tenebrionidae (Kaszab 1955). Its proximity to Vanuatu suggests that faunal exchange could have been frequent and that resulted in several genera occurring in both archipelagoes. For example, a Melanesian connection was probably established concerning the genus *Chariotheca* with two species

(*C. striata* and *C. cuprina*) occurring both in the Fiji Islands and in Vanuatu. These dispersals pursued westward to reach New Caledonia (Kaszab 1982b, 1986), but also northward to the Solomon Islands, where the genus is also present.

Lastly, New Caledonia could have also influenced the fauna of Vanuatu. Emerged approximately 34–37 million years ago (Pelletier 2006), it has some genera in common with the Vanuatu archipelago. Even though New Caledonia and Vanuatu exhibit many affinities for the plants for instance (Pillon 2011), most tenebrionid species from the two areas are different (Kaszab 1955, 1982b, 1986). Moreover, several widespread Australasian genera (*Amarygmus*, *Promethis* and *Toxicum*) are found in Vanuatu but not in New Caledonia (Matthews & Bouchard 2005). In the same way, many New Caledonian genera do not occur in Vanuatu. This low level of affinity demonstrates the scarcity of the past exchanges between these two areas in spite of their proximity. This can be explained by two major hypotheses: First, one can imagine that competition or poor adaptation prevented some tenebrionid genera from colonising one or the other archipelago. New Caledonia, for example, is covered by ultramafic soils that have strongly constrained the diversification of plants (Pillon *et al.* 2010). Second, it can be thought that dispersal opportunities between the two archipelagoes were limited for poor dispersers (wingless species), or that abiotic (e.g., marine currents) or biotic factors prevented these dispersal events. Testing these assumptions would require a more thorough knowledge of the biodiversity of the region, as well as an estimate of their phylogenetic relationships among species existing between the distinct areas through a historical biogeography approach (interspecific level) or phylogeography (intraspecific level).

In conclusion, the tenebrionid fauna of Vanuatu represents a reserve of species, which provides an interesting and still incompletely known biogeographic history with questions about its origin and evolution. Thanks to this first inventory, we highlight multiple and independent origins to explain the colonisation of the archipelago. However, understanding of the evolutionary and ecological processes, which have contributed to the community assemblage, remains

a fascinating challenge that requires a more thorough sampling over the entire Australasian region. Even if it appears that New Guinea is the major source of this biodiversity, it would be very interesting to test these biogeographic hypotheses within a phylogenetic perspective including dense taxon sampling for each genus. Phylogenetic and dating analyses would then provide additional evidence for better apprehending when and how appeared the Tenebrionidae of Vanuatu.

Acknowledgements

The SANTO 2006 expedition to Vanuatu was organised by the MNHN, the Institut de Recherche pour le Développement and Pro-Natura International. It operated under a permit granted to Philippe Bouchet (MNHN) by the Environment Unit of the Vanuatu Government. We wish to thank the members of the section « Fallows & Aliens » of which one of the authors (LS) owned, and more especially M. Pascal (INRA Rennes), O. Lorvelec (INRA Rennes), M. Pignal (MNHN) and our entomologist friends B. Gatimel (IAC, Nouméa) and H. Jourdan (IRD, Nouméa). LS wishes to thank the Nivan guides C. Johnson and Faustin for their constant kindness and availability during his stay. We are also particularly indebted to our friend and colleague Dr O. Merkl, curator of the Coleoptera collection of the HNM for his kind help and hospitality when we visited him in Budapest to study the Tenebrionidae of New Caledonia and other Pacific regions, and to the other reviewer of this paper, Dr W. Schawaller (Staatliches Museum für Naturkunde, Stuttgart).

REFERENCES

- BALKE M., PONS J., RIBERA I., SAGATA K. & VOGLER A. P. 2007. — Infrequent and unidirectional colonization of megadiverse *Papuadytes* diving beetles in New Caledonia and New Guinea. *Molecular Phylogenetics Evolution* 42: 505–516.
- BOISDUVAL J. B. A. D. DE 1835. — *Voyage de découvertes de l'Astrolabe exécuté par l'ordre du Roi, pendant les années 1826–1827–1828–1829, de M. Dumont d'Urville. Faune entomologique de l'océan Pacifique, avec l'illustration des insectes nouveaux recueillis pendant*

- le voyage. Deuxième partie. Coléoptères et autres ordres.* J. Tastu, Paris, VII, 716 p.
- BOUCHET P., LE GUYADER H. & PASCAL O. 2011a. — The “Making of” Santo 2006, in BOUCHET P., LE GUYADER H. & PASCAL O. (eds), *The Natural History of Santo*. Patrimoines Naturels 70. Muséum national d’Histoire naturelle, Paris; IRD, Marseille; Pro-Natura International, Paris: 529-548.
- BOUCHET P., LE GUYADER H. & PASCAL O. (eds) 2011b. — *The Natural History of Santo*. Patrimoines Naturels 70. Muséum national d’Histoire naturelle, Paris; IRD, Marseille; Pro-Natura International, Paris, 572 p.
- BREMER H.-J. 1993. — Neue Arten des Genus *Corticus* Piller & Mitterpacher, 1783, aus der papuanisch-melanesischen Region, II. Mitteilung (Coleoptera, Tenebrionidae, Hypophloeini). *Entomofauna* 14: 509-528.
- BREMER H.-J. 1999. — Revision der orientalischen *Corticus*-Arten (Col., Tenebrionidae, Hypophloeini). II. Teil. *Acta Coleopterologica* 15: 31-92.
- DELOBEL A. & TRAN M. 1993. — *Les Coléoptères des denrées alimentaires entreposées dans les régions chaudes*. Faune tropicale XXXII. ORSTOM/CTA Éditions, Paris, 424 p.
- DRUMMOND A. J., ASHTON B., BUXTON S., CHEUNG M., COOPER A., DURAN C., FIELD M., HELED J., KEARSE M., MARKOWITZ S., MOIR R., STONES-HAVAS S., STURROCK S., THIERER T. & WILSON A. 2010. — Geneious 5.1.7. Available from <http://www.geneious.com>
- FABRICIUS J. C. 1801. — *Systema eleutheratorum secundum ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus*. Tomus I. Bibliopolii Academici Novi, Kiliae, XXIV, 506 p.
- FAIRMAIRE L. 1849. — Essai sur les coléoptères de la Polynésie (suite). *Revue et Magasin de Zoologie pure et appliquée* (2) 1: 445-460.
- FAUVEL A. 1867. — Catalogue des coléoptères de la Nouvelle-Calédonie et dépendances avec descriptions, notes et synonymies nouvelles. *Bulletin de la Société linnéenne de Normandie* (2) 1: 172-214, pl. 1, figs 13-17.
- GEBIEN H. 1913. — Sauter’s Formosa-Ausbeute. Tenebrionidae (Coleopt.). *Archiv für Naturgeschichte* 9A: 1-60, 1 pl.
- GEBIEN H. 1920. — Coleoptera Tenebrionidae, in *Nova Guinea, Résultats de l’expédition scientifique néerlandaise à la Nouvelle-Guinée*, vol. XIII, Zoologie, livre 3. Librairie et Imprimerie E. J. Brill, Leiden: 213-500.
- GILLESPIE R. & RÖDERICK G. 2002. — Arthropods on islands: colonization, speciation, and conservation. *Annual Review of Entomology* 47: 595-632.
- HERBST J. F. W. 1797. — *Natursystem aller bekannten in- und ausländischen Insekten, als eine Fortsetzung der von Büffonschen Naturgeschichte. Der Käfer siebenter Theil*. Geh. Commerzien-Raths Pauli, Berlin, 346 p.
- KASZAB Z. 1939 — Tenebrioniden aus Neu-Guinea. *Nova Guinea* n.s. 3: 186-267.
- KASZAB Z. 1955. — Tenebrioniden der Fiji-Inseln. *Proceedings of the Hawaiian Entomological Society* 15: 423-563.
- KASZAB Z. 1982a. — Revision der australischen *Uloma*-Arten (Coleoptera : Tenebrionidae), *Acta Zoologica Academiae Scientiarum Hungaricae* 28 (3-4): 233-291.
- KASZAB Z. 1982b. — Die Tenebrioniden Neukaledoniens und der Loyauté-Inseln (Coleoptera), *Folia Entomologica Hungarica* 43 (2): 1-294.
- KASZAB Z. 1986. — Tenebrioniden (Coleoptera) aus Neukaledonien. *Annales Historico-Naturales Musei Nationalis Hungarici* 78: 151-175.
- KASZAB Z. 1988a. — Katalog und Bestimmungstabelle der Gattung *Promethis* Pascoe, 1869 (Coleoptera, Tenebrionidae). *Acta Zoologica Academiae Scientiarum Hungaricae* 34 (2-3): 67-170.
- KASZAB Z. 1988b. — Faunistische Angaben der Gattung *Promethis* Pascoe, 1869 (Coleoptera, Tenebrionidae). *Folia Entomologica Hungarica* 49: 55-116.
- KULZER H. 1951. — Vierter Beitrag zur Kenntnis der Tenebrioniden. *Entomologischen Arbeiten aus dem Museum G. Frey* 2: 116-171.
- LÖBL I. & SMETANA A. 2008. — *Catalogue of Palaearctic Coleoptera*, vol. 5. *Tenebrionoidea*. Apollo Books, Stenstrup, 670 p.
- MATTHEWS E. G. & BOUCHARD P. 2005. — *Tenebrionid Beetles of Australia: Description of Tribes, Keys to Genera, Catalogue of Species*. ABRIS, Canberra; Advance Press Pty Ltd, western Australia; 398 p.
- MERKL O. 1989. — Melanesian representatives of *Toxicum* and *Cryphaeus* (Coleoptera, Tenebrionidae: Toxicini). *Acta Zoologica Academiae Scientiarum Hungaricae* 35 (3-4): 235-254.
- MONTROUZIER P. 1860. — Essai sur la faune entomologique de Nouvelle-Calédonie (Balade) et des îles des Pins, Art, Lifu, etc. *Annales de la Société entomologique de France* (3^e Série) VIII: 229-308.
- PELLETIER B. 2006. — Geology of the New Caledonia region and its implications for the study of the New Caledonian biodiversity, in PAYRI C. E., RICHER DE FORGES B. (eds), *Compendium of Marine Species from New Caledonia Documents Scientifiques et Techniques*, II 4. Institut de Recherche pour le Développement, Nouméa: 17-30.
- PILLON Y. 2011. — *Geissois* (Cunoniaceae), another example of the Melanesian connection, in BOUCHET P., LE GUYADER H. & PASCAL O. (eds), *The Natural History of Santo*. Patrimoines Naturels 70. Muséum national d’Histoire naturelle, Paris; IRD, Marseille; Pro-Natura International, Paris: 93-94.
- PILLON Y., MUNZINGER J., HAMIR H. & LEBRUN M. 2010. — Ultramafic soils and species sorting in the flora of New Caledonia. *Journal of Ecology* 98: 1108-1116.
- SCHAWALLER W. 2008. — The species of *Platydemia* Laporte & Brullé (Coleoptera: Tenebrionidae) from New Guinea and the Moluccan Islands, with de-

- scription of 11 new species. *Stuttgarter Beiträge zur Naturkunde*, n. s. 1: 413-429.
- SIMON C., FRATI F., BECKENBACH A., CRESPI B., LIU H. & FLOOK P. 1994. — Evolution, weighting and phylogenetic utility of mitochondrial gene sequences and a compilation of conserved polymerase chain reaction primers. *Annals of the Entomological Society of America* 87: 651-701.
- SOLDATI L. 2011. — Endemic, native, alien or cryptogenic? The controversy of Espiritu Santo darkling beetles (Insecta: Coleoptera: Tenebrionidae), in BOUCHET P., LE GUYADER H. & PASCAL O. (eds), *The Natural History of Santo*. Patrimoines Naturels 70. Muséum national d'Histoire naturelle, Paris; IRD, Marseille; Pro-Natura International, Paris: 500-503.

*Submitted on 5 September 2011;
accepted on 5 April 2012.*