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A new genus and species of Hoplapoderini from Madagascar (Coleoptera: Attelabidae: Apoderinae)

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Abstract

Madapoderus pacificus, a new genus and species of hoplapoderine attelabid beetles, is described from Madagascar. A key to the genera of Hoplapoderini and field observations on the host plant and reproductive behaviour of the new species are provided.

Key words: Attelabidae, Apoderinae, Hoplapoderini, Madagascar, new genus, new species, *Grewia*

Introduction

In May 2002, among specimens of Attelabidae collected in Madagascar by David Hauck some months earlier, I received two males belonging to the apoderine tribe Hoplapoderini that could not be assigned to any known genus. A study of the rich collection of Madagascan attelabids at the Muséum National d'Histoire Naturelle, Paris, a few months later confirmed this diagnosis. During a month-long collecting expedition in Madagascar in December 2003 and January 2004, I collected the new taxon again, at a different locality, and could carry out some observations on its behaviour.

Systematics

Tribe Hoplapoderini Voss, 1926

Voss (1926) defined his tribe Hoplapoderini largely on the basis of features of the head and elytra. The new Madagascan genus fits into this tribe due to its tapered head, with maximum width near the basis, and its tuberculate elytra. Voss also provided a key to the

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genera of the tribe, but this is largely inadequate because of its heavy reliance on the presence and shape of what he called "abdominal lobes" ("Abdominallappen"). Hustache (1939) disputed the taxonomic significance of this character, as it is difficult to identify and inconsistent within the various taxa. I concur with Hustache's assessment and propose the following modified key, which includes the new genus. I don't follow the division of the tribe into three subtribus, proposed by Legalov (2003).

Key to the genera of the tribe Hoplapoderini

1 Elytra densely, closely pubescent, generally metallically coloured. Central and South-ern Africa..... *Rhamnapoderus* Voss
1' Elytra without pubescence 2
2 Pronotum with two pairs of protuberances or spines. Africa and Madagascar..... ..... *Echinapoderus* Voss
2' Pronotum differently sculptured..... 3
3 Pronotum flat, unicoloured..... 6
3' Pronotum with protuberances or more or less conspicuous spots..... 4
4 Pronotum with one pair of protuberances or spines. Vertex of scutellum prominent, cone-shaped. Elytra with protuberances or spines also on apical spots. South-eastern Asia, from India to Borneo ..... *Hoplapoderus* Jekel
4 Pronotum without narrow protuberances 5
5 Pronotum with some swellings that cause an inverted Y-shaped depression in the mid-dle of each half of the pronotum. Scutellum without plate-shaped or cone-shaped pro-tuberances. Elytra with rounded protuberances also on apical spots. Central-Western Madagascar .....*Madapoderus* gen. nov.
5' Pronotum in most of the species red with two black, not prominent spots. Vertex of scutellum with a prominent plate. Elytra with protuberances or spines only on humeral, discoidal and/or subsutural spots, never on apical spots. India, China, Japan, Siberia, Indonesia .....*Paroplapoderus* Voss
6 Elytra with hump-shaped protuberances. Pronotum and elytra generally black. Siberia, Korea, Japan, China, Vietnam.....*Phymatapoderus* Voss
6' Elytra flat..... 7
7 Colour of the body entirely or partially red. Elytra more slender. Cameroon, Togo ....*Paratomapoderus* Voss
7' Colour of the body black or blue. Elytra more squat 8
8 Elytra with convex lateral intervals. Nepal, India, China, Myanmar, Vietnam ....*Tomapoderopsis* Legalov
8' Elytra without convex lateral intervals. India, China, Korea, Siberia; Benin, Ethiopia, Niger, Zambia..... *Tomapoderus* Voss

***Madapoderus* n. gen.**

Type species

Madapoderus pacificus sp. n., by present designation.

Diagnosis

A genus of Hoplapoderini of relatively large size (7.0–8.6 mm, excl. rostrum); colour bright brownish red. Head behind the eyes remarkably broad in both sexes. Antennae short, legs quite short and squat. The last tarsomere, especially in the fore and hind legs of the female, very long and curved. Scutellum flat, without protuberances. Pronotum with swellings forming an inverted Y-shaped depression in the middle of each half. Elytra broad, each with five round blunt protuberances.

Generic name

The name of this genus is derived from Madagascar (the country of origin of its type species) and the generic name *Apoderus*.

Systematic, biogeographic and phylogenetic considerations

The known species of Hoplapoderini from Madagascar, placed in the genus *Echinapoderus*, are closely related to the mainland species of the genus. This genus exists only in Africa and Madagascar.

The new genus, however, shows strong similarities to two exclusively Asian genera, *Hoplapoderus* and *Paroplapoderus*. With the species of *Hoplapoderus*, *H. gemmatus* (Thunberg, 1784) and *H. minutituberosus* Haq, Pajni & Gandhi, 1988, which bear tubercles instead of spines, *Madapoderus* shares, among other characters, the form and the position of the elytral protuberances. The morphology of the male genitalia is also remarkably similar in these two genera. In addition, *Madapoderus* was found to feed on *Grewia* (Malvaceae) and *H. gemmatus* was obtained from leaf rolls of a plant belonging to the Malvaceae, *Sida rhombifolia*, at Dehra Dun, in India (Gardner, 1934).

With *Paroplapoderus*, *Madapoderus* shares the broad shape of the head, the short and squat elytra and the short and stout legs. In the subgenus *Erycapoderus* Voss of *Paroplapoderus*, the dorsal face of the pronotum is also similar to *Madapoderus*.

Among the Madagascan Apoderinae such a relationship with Asian taxa is also peculiar to the tribe Trachelophorini, as Voss reported (1926, 1939): no species of this tribe is known from African mainland, while in Madagascar there are about thirty; several other species of the Trachelophorini exist in India and in Eastern Asia.

Voss proposed an African origin for the Hoplapoderini, from the primitive genus *Parapoderus* Voss (placed in the tribe Apoderini). From this genus, *Echinapoderus* would have diverged, before the separation from the African continent of the landmass corresponding to the present Madagascar and India. Voss supposed that *Echinapoderus* could later have given rise to *Hoplapoderus*, which spread from India over Asia.

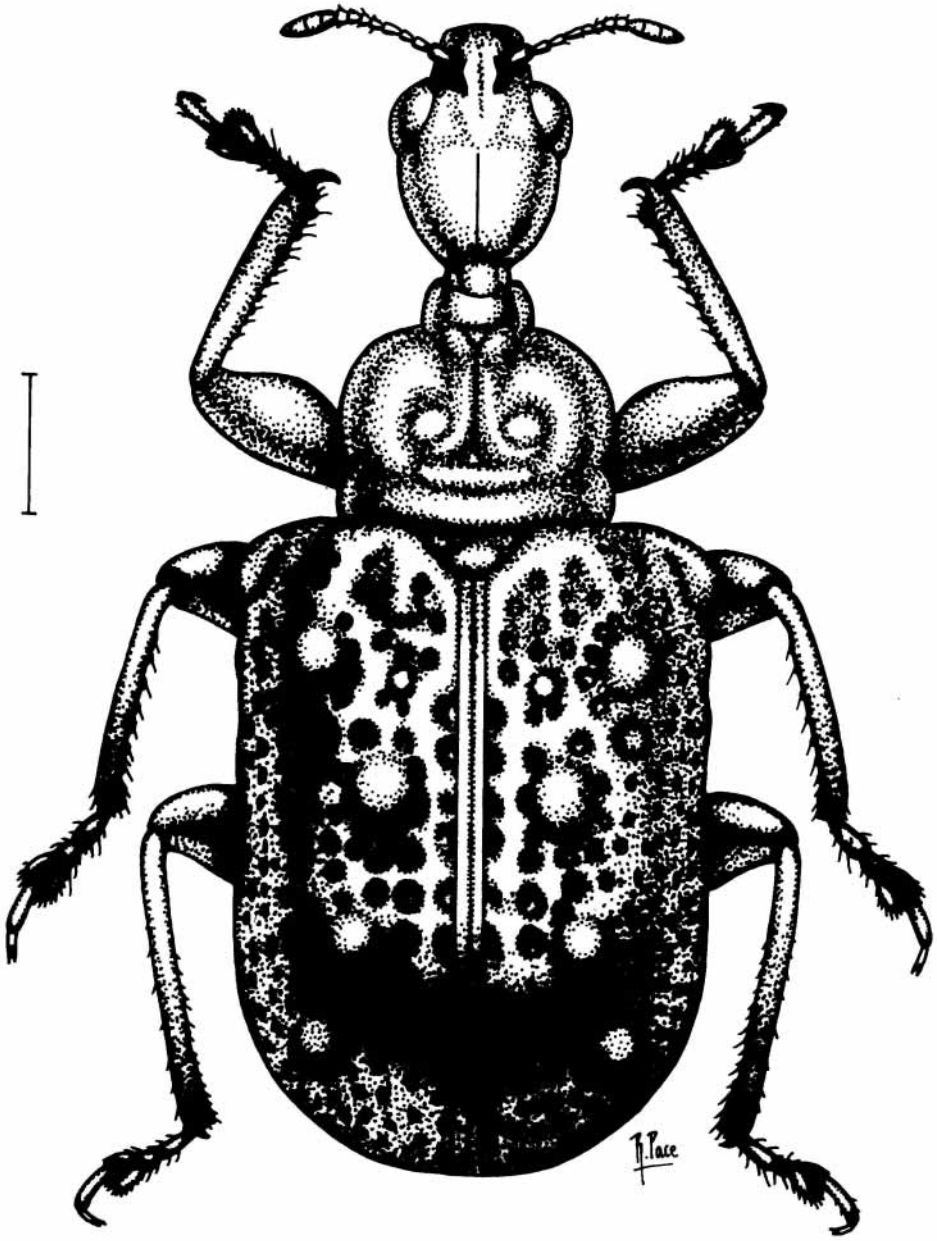
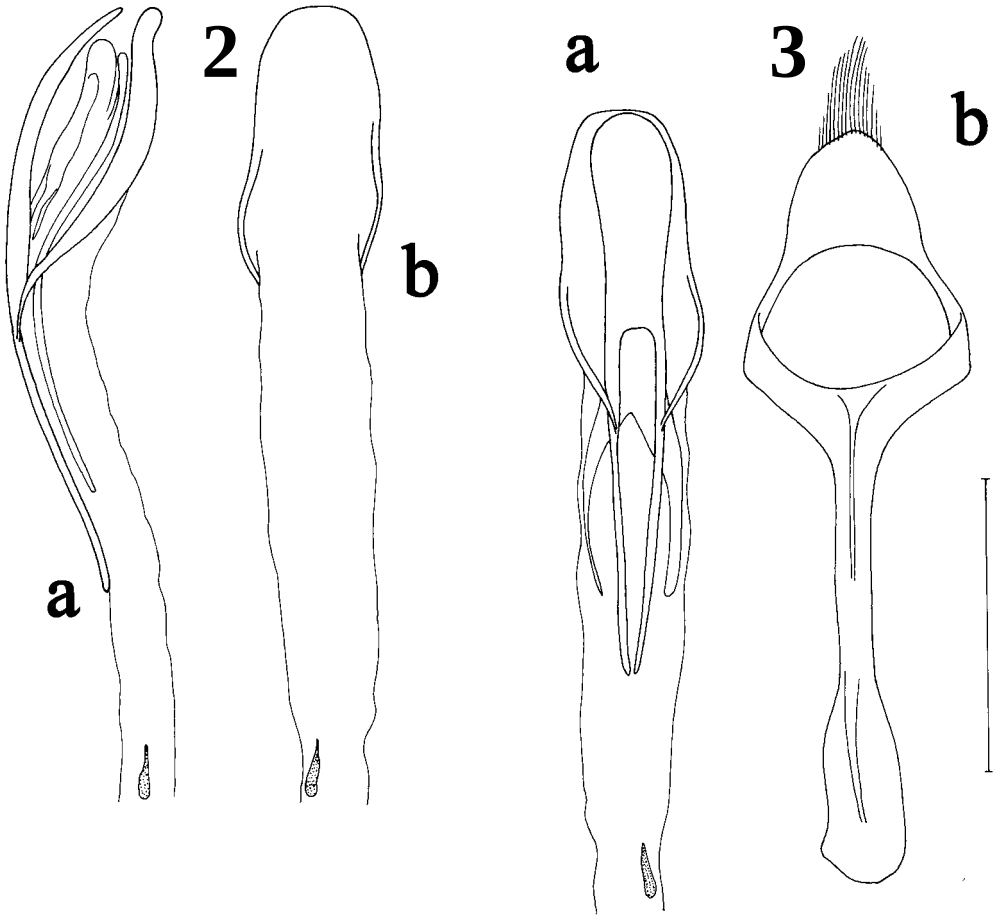
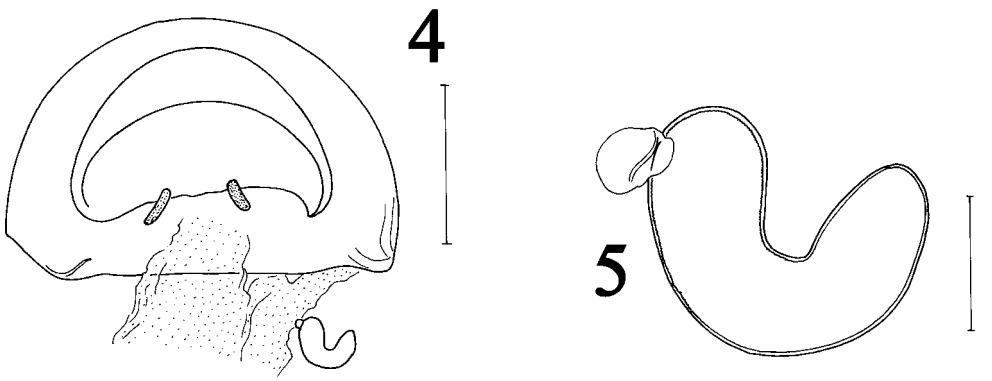


FIGURE 1. *Madapoderus pacificus* n. sp., holotype ♂ (scale line: 1 mm).

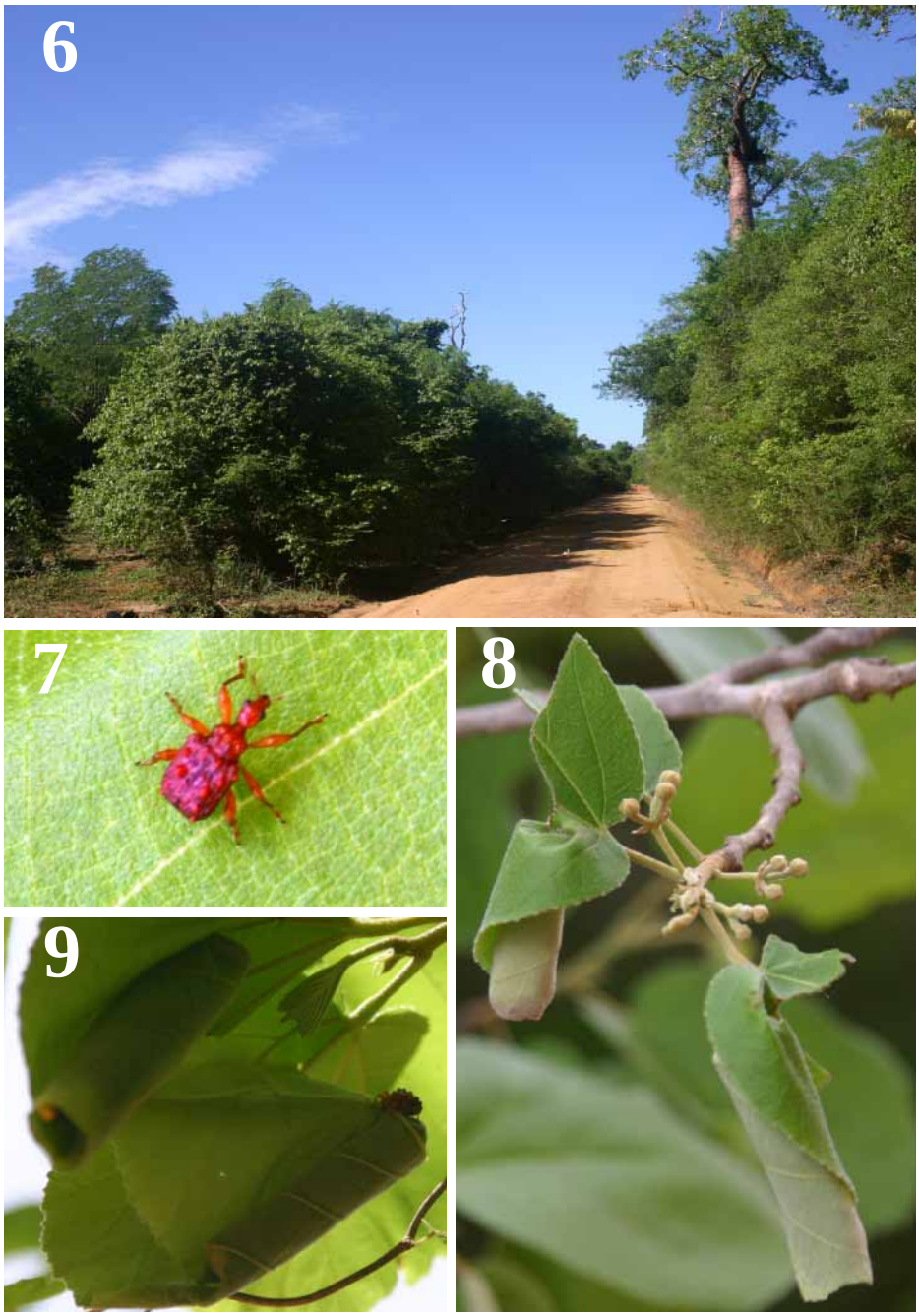
Madapoderus can be incorporated in this scenario as a derivative from an African ancestor and as a possible sister-group of *Hoplapoderus*. "There are certainly also taxa that evolved on Madagascar and subsequently reached other landmasses. Apart from long-distance dispersal, which could explain such dispersal events to, for example, Africa, it should also be remembered that India might have acted as a raft for species as it drifted toward Asia." (Gautier & Goodman, 2003).



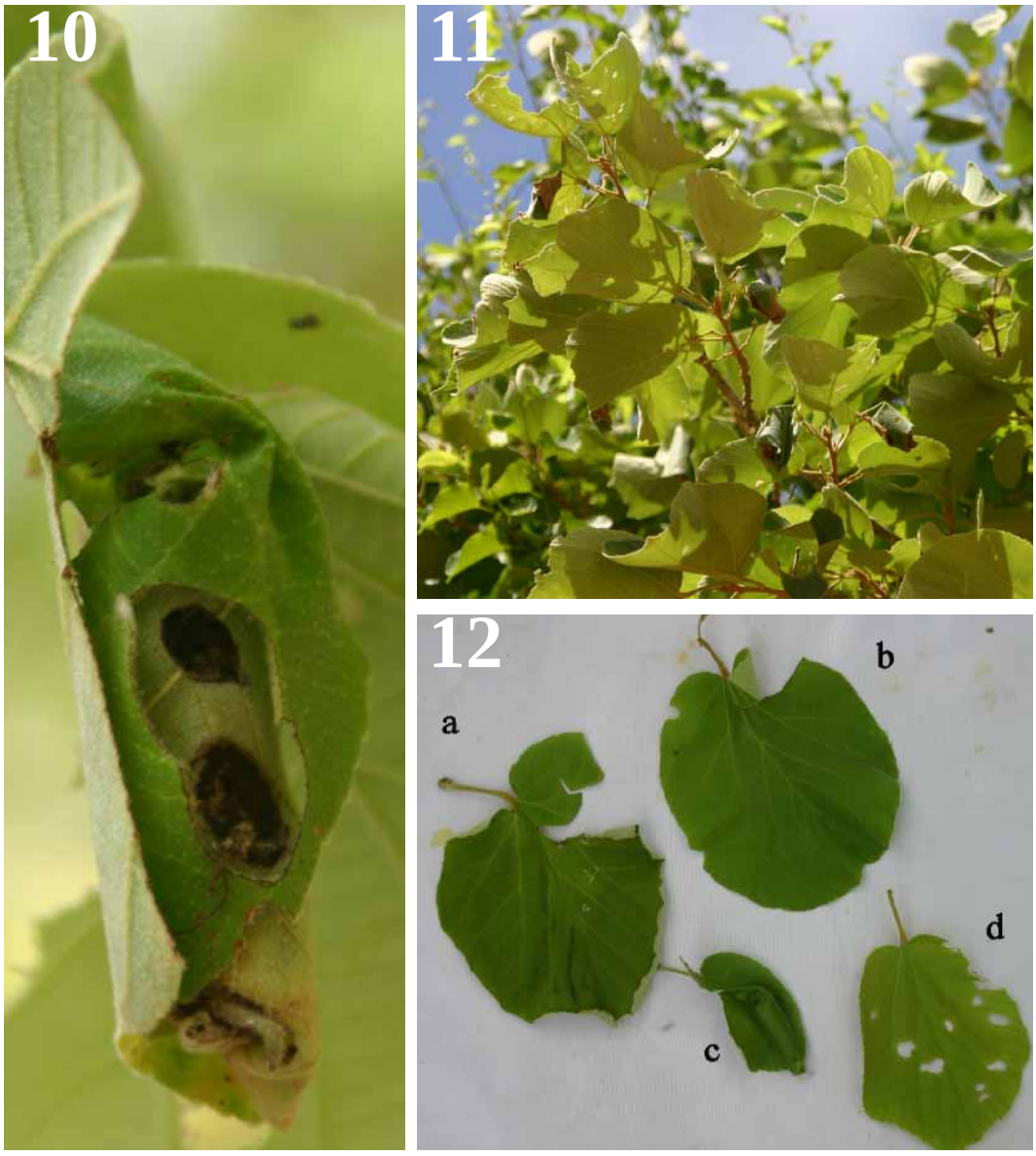
FIGURES 2–3. Male genitalia of *Madapoderus pacificus* n. sp., paratype ♂ (Miandrivazo): 2a aedeagus, lateral view; 2b aedeagus, ventral view; 3a aedeagus, dorsal view; 3b - tegmen (scale line: 1 mm).



FIGURES 4–5. Female genitalia of *Madapoderus pacificus* n. sp., paratype ♀ (Kirindy): 4 sternite VIII, tergite VIII and spermatheca (ventral view, scale line: 1 mm); 5 spermatheca (scale line: 0.1 mm).



FIGURES 6–9. *Madapoderus pacificus* n. sp.: 6 habitat (Kirindy); 7 a female on the leaf of the host plant *Grewia*; 8 leaf rolls on *Grewia* in situ; 9 a female rolling up a leaf, near a recently completed roll (photos by S. Biondi).



FIGURES 10–12. *Madapoderus pacificus* n. sp.: 10 a leaf roll with two emergence holes; 11 foliage of *Grewia* sp. showing several leaf rolls; 12 a, b: opened leaf rolls showing cuts made by females; c: intact leaf roll; d: adult feeding holes in leaf lamina (photos by S. Biondi).

***Madapoderus pacificus* n. sp.**

Material examined

Type locality. Central-Western Madagascar, Tulear province, 35 km north-east of Morondava, track Morondava Belo sur Tsiribihina, between Andranomena forest and Kirindy forest.

Type material. Holotype. ♂, W. Madagascar, Tulear prov., Kirindy Forest, 35 km NE Morondava, 29 XII 2003 / 3 I 2004, S. Biondi leg. Paratypes: 9 ♀, same data of the holotype; 2 ♂: SW Madagaskar, Morondava distr., Miandrivazo, 246 km W of Antsirabe, 5.1.2002, D. Hauck leg. The holotype and a pair of paratypes (one of the males collected by Hauck and one of the females collected by the author) have been deposited in the collection of the Museo Naturalistico Archeologico in Vicenza. The remaining specimens belong to the authors personal collection.

Etymology

This species name is based on the Latin adjective *pacificus* (= pacific) and refers to the absence of acute spines on the pronotum and on the elytra, also in opposition with the names of the Malagasy species of the genus *Echinapoderus*: *E. aculeatus* (Faust, 1899) (from Latin = with spines) and *E. enoplus* (Brancsik, 1893) (from Greek = armed).

Description

Male (holotype)

Habitus as in Fig. 1. Total length (excl. rostrum): 7.0 mm.

Colour. Head, prothorax and elytra bright brownish red. Abdomen and legs paler, almost yellow; parts of the mouth and claws black.

Head. Oval; in dorsal view very broad, shortest distance between eyes 1.5 times eye diameter; tempora rounded; front margin of eye very close to the insertion of the rostrum in lateral view; head maximum height in basal third; immediately behind the eyes a deep transversal furrow intersecting a median longitudinal furrow that limits the basal, smooth and shiny part of the head; two short longitudinal impressions between eyes, convergent towards antennal insertion. Eyes rather wide, in dorsal view protruding from head contour. Rostrum in dorsal view almost quadrate, slightly narrower than distance between eyes; in lateral view, dorsal contour almost straight, ventral contour convex; surface with deep, large punctures and long pale setae. Antennae inserted in a prominent zone of the dorsal surface of rostrum, near base, short; scape clavate, 2.5 times longer than wide; first funicular segment oval, half as long as scape; second a little narrower and shorter than the first; 3 as long as 1 but a little narrower; 4 shorter than 3, longer than broad; 5 almost quadrate; 6 and 7 transverse; club oblong-oval, pubescent, with first segment as long as wide, 2 and 3 transverse, 4 easily visible, short, cusp-shaped.

Thorax. Pronotum transverse, in dorsal view with lateral edges progressively rounded towards head; anterior margin in the shape of a cylindrical collar; posterior margin thick; median longitudinal impression deep, forming in its basal half a deep dimple and a second one, more superficial, near the anterior margin; each half of the pronotum with swellings that delimit a central, inverted Y-shaped depression; integument shiny and smooth, no punctation visible. Scutellum transverse, inversely ogival, the sides slightly slanting upwards and apex slightly swelled. Meso and metathoracic epimeres and pygidium

clothed in thin white setae. Elytra subrectangular, 1.5 times as long as wide; sides almost parallel behind humeri; the latter with a blunt, outward protuberance; strial punctures wide and deep, sometimes partially confluent; intervals irregular due to elytral tubercles, no punctation visible; each elytron with five tubercles besides the humeral one: the largest on second and third interval, equidistant from elytral base and apex; a little smaller one on fourth interval, between first and humeral tubercle; a third, also smaller one, on same interval at beginning of elytral declivity; a fourth, similar to second, in middle between first and third; a fifth, cone-shaped and smallest, on second interval, near elytral suture, inside of second. Legs quite short and squat; femora clavate, especially front and hind ones; tibiae short, especially middle ones, straight except at base; ventrally all with a row of equidistant denticles bearing each a stiff seta; apex with a single spur; first tarsomere clavate, 2 times as long as wide (a little longer in hind legs); second subtriangular, as long as wide; third deeply bilobate, wider and longer than second; last (ungueal) long and curved; claws connate at base.

Genitalia. As in Figs 2–3.

Female

Habitus as in Fig. 7. Genitalia as in Figs 4–5.

The female differs from the male, in addition to the primary sexual characters, only in the following characters:

body size; the female specimens are larger than male: total length (rostrum excluded) of each male specimen is 7.0 mm (holotypus), 7.0, 7.1; the average length of females 8.2 mm (minimum 7.9, maximum 8.6).

tibial apex with two spurs, as in most Apoderinae.

venter slightly convex (concave in male).

Variation

Miandrivazo (males only) and Kirindy specimens do not show any significant differences. The eight female specimens are also very homogeneous except for their length.

Distribution and ecology

The species is so far only known from two localities in the province of Tulear of central-western Madagascar, less than 100 km apart. The size of the Kirindy Forest population was estimated based on the number of leaf rolls found. It appeared to be limited to the edges of short stretch of the track (Fig. 6). In this narrow zone the number of rolls was remarkably high: each branch of the host plant could harbour several dozen of these rolls (Fig. 11). The biotope in which the new species was found is classified as primary dry deciduous forest. This forest type had a broad geographic range on the island in the past but nowadays occurs only in few restricted zones of western and northern Madagascar.

Life history

Observations on the habits of the new species were carried out at the type locality, during the end of December 2003 and in early January 2004.

Virtually nothing is known, regarding the feeding and reproductive behaviour of the about one hundred species of the tribe Hoplapoderini. No biological information is available in the literature for the African and Madagascan species; a little information is reported for some Asian species, mainly Japanese, but frequently it is only limited to identification of host plants.

Madapoderus pacificus is in all its stages of development associated with a species of the genus *Grewia* Linnaeus (Malvaceae): the identification of the species pending. This woody shrub or tree occurs in the primary dry deciduous forest of Kirindy, small specimens rarely also in thick forest, and flowering individuals commonly grow in forest clearings and along the edges of roads and tracks.

Adult *Madapoderus pacificus* feed on the leaves of this plant after their eclosion from leaf rolls, causing round feeding lesions as typical of Apoderinae in the leaf tissues but generally leaving the main veins intact (Fig. 12d).

After mating (not seen), females construct typical attelabid brood rolls from the leaves of their host plant (Figs. 8–12). At first, the female makes a cut into the leaf lamina, near the base of the leaf and perpendicular to the midrib. The cut can run from either the left or the right side and begin anywhere along the basal leaf margin, but it always reaches the midrib and often proceeds beyond it (Fig. 9). In the categorisation of attelabid leaf rolling techniques (Zuppa et al., 1994) *Madapoderus pacificus* thus falls into the same group as *Apoderus coryli* Linnaeus. The female briefly interrupts this rolling process to perforate the leaf roll and lay her eggs inside. In almost all the rolls that were opened there were two eggs (or two larvae, or two pupae); only one dissected roll contained a pupa and two mature larvae. Since a large basal portion of the leaf is left intact, the roll remains firmly attached to the leaf at all times and does not fall to the ground. The larva feeds and develops on the leaf tissues inside the roll, as in the rule in Apoderinae. The whole developmental cycle is quite rapid, lasting about twenty days of which the last two or three are spent as a pupa. Each adult emerges from its own round hole (Fig. 10). On emergence the integument of the adults is translucent pale yellow, and they remain on the leaves until it hardens and takes on its proper coloration, before commencing to feed and start a new generation. Field observations in this locality were carried out only during a few days, so I can affirm that the weevil complete at least two cycles in a year; however the speed of the life cycle indicates that the number could be higher.

Acknowledgements

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