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Phasmids of Mauritius: *Mauritiophasma* n. gen., *Monoiognosis* n. gen., *Epicharmus* Stål 1875 and discussion on their remarkable eggs (Phasmatodea)

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Abstract

Mauritiophasma n. gen. (Phasmatidae: Acanthomimini), which includes the sole species *M. motalai* n. sp., is described; *Mauritiophasma* is close to the genus *Anophelepis* Westwood 1859, which is transferred to the tribe Acanthomimini. Another genus, *Monoiognosis* n. gen. (Anareolatae, *incertae sedis*), is described; it includes 2 species: *M. bipunctata* n. sp. (type species) and *M. spinosa* n. species. *Epicharmus guerinii* (Phasmatidae: Xeroderinae) is synonymised with *E. marchali*. All these taxa are endemic to Mauritius at the generic level. They all feature eggs glued to a support by an operculum, a character new for Phasmatodea, believed to be the result of convergent evolution.

Résumé

Mauritiophasma n. gen. (Phasmatidae, Acanthomimini), qui comprend l'unique espèce *M. motalai* n. sp., est décrit ; *Mauritiophasma* est proche du genre *Anophelepis* Westwood 1859, lequel est transféré dans la tribu Acanthomimini.. Un autre genre, *Monoiognosis* n. gen. (Anareolatae, *incertae sedis*) est décrit ; il comprend 2 espèces : *M. bipunctata* n. sp. (espèce type) et *M. spinosa* n. sp. *Epicharmus guerinii* est mis en synonymie avec *E. marchali*. Ces taxons sont endémiques de Maurice au niveau générique. Ils présentent tous des œufs collés à un support par l'operculum, caractéristique nouvelle pour les Phasmatodea, considérée comme le résultat d'une évolution convergente.

Key words

Phasmatodea, Acanthomimini, Lanceocercata, Pachymorphinae, Xeroderinae, *Anophelepis*, *Mauritiophasma*, *Monoiognosis*, *Mauritiophasma motalai*, *Monoiognosis bipunctata*, *Monoiognosis spinosa*, *Epicharmus marchali*, *Epicharmus guerinii*, eggs, convergent evolution, Mauritius, Australia

Introduction

The stick insects of Mauritius have been briefly discussed in the literature (Orian 1957, Vinson 1968) with 10 species reported from the island as follows:

Epicharmus guerinii (Westwood 1859)
Epicharmus marchali (Audinet-Serville 1838)
Monandroptera acanthomera (Burmeister 1838)
Monandroptera olivacea Redtenbacher 1908
Monandroptera scolopendra Redtenbacher 1908
Phyllium bioculatum Gray 1832
Rhaphiderus alliaceus Stål 1875
Rhaphiderus dumerilii (Gray 1835)
Rhaphiderus scabrosus (Percheron 1829)
Sipyloidea sipylus (Westwood 1859).

Chopard (1938: 174-175) indicated that another species occurred on the island, referring to strange eggs of an undetermined phasmid from Mauritius. Whilst referring to nymphs seen in Mauritius, Orian (1957: 517) commented "several species of this genus [*Graeffea*] probably occur in the Upland Forests"; later, Vinson (1968: 106) added: "L'on prend assez souvent dans les forêts indigènes de Maurice des petits phasmes, malheureusement presque toujours immatures".

Indeed, 2 specimens of a new species (*Apterograeffea marshallae* Cliquennois & Brock 2002) from Round Island (a small island off the mainland) were discovered in July 2001 in the collection of the Natural History Museum, London before being collected on the same island in May 2002 (Cliquennois & Brock 2002). An earlier collecting trip to Mauritius in March 2001 led to the discovery of 3 new species belonging to 2 new genera.

This paper deals with the description of these species, their taxonomic position, along with *Epicharmus* Stål 1875 (Phasmatidae, Xeroderinae), the other genus endemic to Mauritius. Another paper (Cliquennois & Brock 2004) deals with Monandropterini, a taxon which is not endemic to the island.

Abbreviations for depositories

BMNH	Natural History Museum, London, United Kingdom
MHNG	Muséum d'Histoire naturelle, Geneva, Switzerland
MHNR	Muséum d'Histoire naturelle, Saint-Denis, Réunion, France
MNHN	Muséum national d'Histoire naturelle, Paris, France
MSIRI	Mauritius Sugar Industry Research Institute, Le Réduit, Mauritius
NHMW	Naturhistorisches Museum, Vienna, Austria
NHRS	Naturhistoriska Riksmuseet, Stockholm, Sweden
OXUM	Oxford University Museum, Oxford, United Kingdom

Phasmatidae: Phasmatinae: Acanthomimini

This tribe was erected by Günther (1953: 555) for the Australian genera *Acanthomima* Kirby 1904 and *Carnacia* Sjöstedt 1918. Günther characterised this tribe in his key to Phasmatinae by the following features: cerci of females short and slender, males without ocelli, elytra and wings of females strongly reduced, head flat, middle and hind femora at most with a few small spines at apex.

There has been no revision of the tribe since the publication of Günther. Based on genera with the tribal characteristics mentioned above, we propose enlarging the tribe. General family/suborder characteristics also agree, namely 1) absence of sunken areola on mid and hind tibiae, 2) fore femora dorsally serrated and 3)

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short antennae. *Anophelepis* and *Mauritiophasma* n. gen. are more closely related to each other than to *Acanthomima* (see keys below).

Tribe Acanthomimini Günther 1953

Acanthomima Kirby 1904a: 438

Type species: *Anophelepis rhipheus* Westwood 1859 by original designation.

= *Ectus* Redtenbacher 1908: 437 (synonymised by Günther 1953: 555).

Type species: *Ectus solitarius* Redtenbacher 1908 by monotypy.

rhipheus Westwood 1859: 70, pl. 8: 10, 10a, 10b [*Anophelepis*]. Syntypes: 2 ♀♀, Western Australia, Swan River (BMNH).
= *solitarius* Redtenbacher 1908: 437, pl. 21: 1 [*Ectus*] (synonymised by Vickery 1983: 3). Holotype ♀, Western Australia, Swan River (NHMW).

Anophelepis Westwood 1859: 68. Here transferred (from Platycraninae *sensu* Günther, which possess large cheeks, broader than eye, which are not characteristic of *Anophelepis*).

Type species: *Anophelepis telesphorus* Westwood 1859 by subsequent designation (Kirby 1904b: 382).

= *Carnacia* Sjöstedt 1918: 50 (synonymised by Vickery 1983: 4).

Type species: *Carnacia obscura* Sjöstedt, 1918 by monotypy.

telesphorus Westwood 1859: 69, pl. 8: 3, 7, 7a [*Anophelepis*]. Syntypes: 1♂ and 1 ♀, Western Australia, Swan River (BMNH).
= *obscura* Sjöstedt 1918: 51, pl. 6: 4a-c [*Carnacia*] (synonymised by Vickery 1983: 4). Holotype ♀ nymph, Western Australia, Carnac Island (NHRS).

Mauritiophasma n. gen.

Type species: *Mauritiophasma motalai* n. sp.

motalai n. sp. [*Mauritiophasma*]. Holotype ♂ and paratypes: see below.

Key to genera

1. Antennae much shorter than fore femora (basal segment very broadened), female without protuberance on abdomen. Male unknown . . . . . *Acanthomima*
Antennae reaching or slightly exceeding apex of fore femora (basal segment slightly broadened), female with a posterior protuberance on abdominal tergites V and VI 2
2. Female lacking femoral lobes; protuberance on abdominal tergites V and VI not transverse. Male with an elongated head; mid femora longer than pronotum and mesonotum combined . . . . . *Anophelepis*
Female with apical lobes on mid and hind femora; protuberance on abdominal tergites V and VI transverse. Male with a rounded head laterally, not elongate; mid femora shorter than pronotum and mesonotum combined . . . . . *Mauritiophasma* n. gen.

Discussion on Acanthomimini with regard to recent proposed higher classification

Bradler (2001a, 2001b) proposed the monophyletic group Lanceocercata for many Australasian stick insects. The main characters on which he based his proposals are 1) cerci leaf-like flattened, often lancet-like, elongated and 2) the absence of a vomer in males, functionally replaced by spiny forceps ('dornenfeld') on the inner margins of tergite X, used during copulation to grasp the female operculum. Bradler (2001a) includes the following taxa: Acanthoxylini, Pachymorphini, Phasmatini, Tropidoderinae, Xeroderinae and members of Platycraninae (excluding type-genus *Platycrana*).

There have only been 2 cladistic studies on the Phasmatodea (Whiting *et al*. 2003 and Tilgner 2002), along with Bradler's brief papers.

The tribe Acanthomimini discussed above may be a member of the Lanceocercata, if this is proved to be a valid group. As the male of the type genus, *Acanthomima*, is unknown, the position is unclear. Whilst the 2 genera *Anophelepis* and *Mauritiophasma* gen. n., are known by both sexes, they lack the typical lancet-like cerci of Lanceocercata, although males possess a forceps which may be homologous to those Bradler described.

Whilst Bradler's work lacks detail and is in need of further research and clarification, his work on the structure of male genitalia has clear taxonomic significance. It is hoped that phasmid specialists will make comprehensive studies on the classification of the order, using modern methods. The largely endemic New Zealand phasmid fauna, which is at least partially placed in Lanceocercata by Bradler, has recently been reclassified, based on conventional taxonomy (Jewell & Brock 2003) and issues raised in that paper are being subjected to review by specialists in genetics.

Although clearly members of different genera, *Acanthomima rhipheus* and *Anophelepis telesphorus* have the same type locality (Swan River, Western Australia), hence it is no surprise that the genera belong to the same tribe. *Mauritiophasma* gen. n. appears to be closely linked with these genera. There is an east-west directed stream in the Indian Ocean which passes near coastal Western Australia and arrives close to Mauritius; it is possible that the Australian ancestor of this phasmid colonised this volcanic island, thanks to a floating raft, by means of eggs glued to branches. The eggs of *Mauritiophasma* gen. n. are rather problematical: the issue is discussed in the final part of this paper.

Günther (1953) placed Acanthomimini close to New Guinean Stephanacridini in his key to tribes of the subfamily Phasmatinae. Both taxa share short hindwings in females, but Stephanacridini are easily distinguished from Acanthomimini by the length of their antennae, much longer than the fore femora, at least for the male, by the fully developed hindwings in males, the swollen head, the female operculum exceeding the end of the abdomen, the short legs, strongly spiny and lobed, and by these insects' larger size, exceeding 140 mm in females.

Mauritiophasma n. gen.

Medium sized, slender brachypterous stick insects. Head dorsally flattened (♂) or rounded (♀), narrowing posteriorly (♂ especially), with small tubercles (♀) or only small granules (♂); gula present. Antennae short, barely reaching (♀) or exceeding a bit (♂) apex of fore femora, with 19 to 25 articles. Pro- and mesonotum with granules and/or tubercles, mesonotum elongate.

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Fore wings slender, leaf-like; hind wings very short, not or barely exceeding posterior margin or median segment. ♀ with a transverse protuberance on hind margin of tergites V and VI. Cerci lamellate, short, slender. ♂ without vomer, with spiny forceps under tergite X. Operculum (♀) simple. Legs elongate (♀) or very elongate (♂), fore femora serrulate, middle and hind femora nearly unarmed (♂) or only with small spines but with apical lobes (♀).

Type species.— *Mauritiophasma motalai* n. sp.

Etymology.— Named after Mauritius island of which it appears to be an endemic genus.

***Mauritiophasma motalai* n. sp.**
(Figs 1-8, 33)

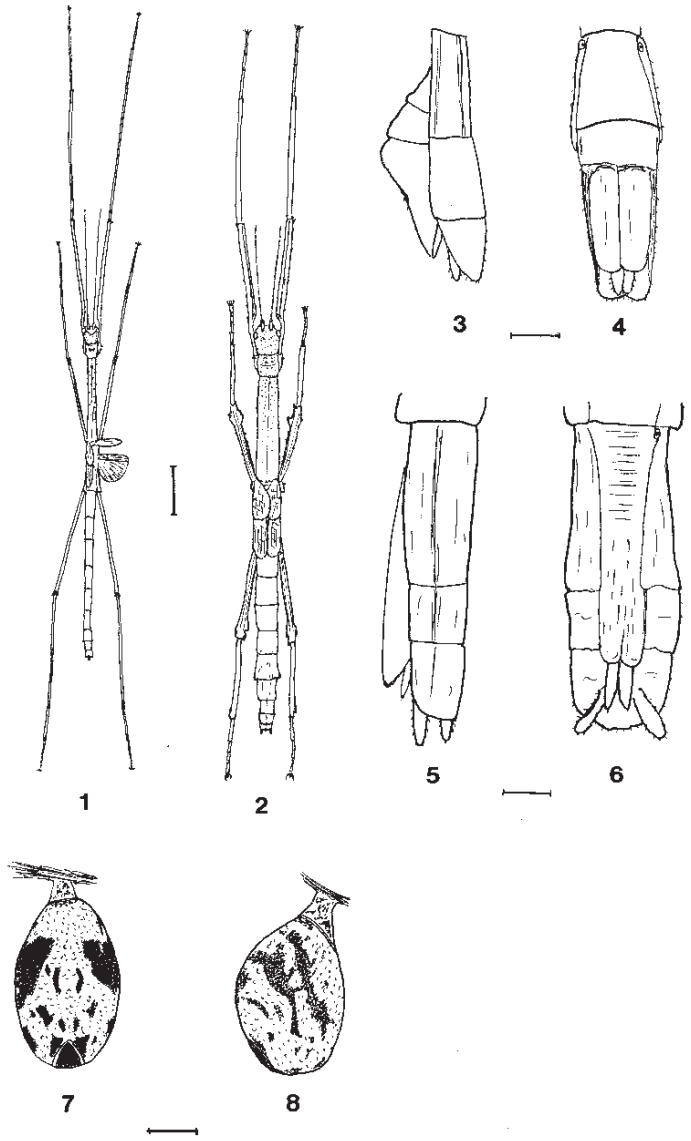
Holotype.—♂ Mauritius, Brise Fer-Mare Longue, 500m, 10-16.iii.2001, leg. N. Cliquennois (NCMR27[1]). Paratypes: 2♂♂ (NCMR5 and 8), 9♀♀ (NCMR1-3, 10-12, 21, 52 and 54) same data; 2 ♂♂ (NCMR56 and 57), Henrietta, Le Mondrain, 530 m, 16.v.2002, leg. N. Cliquennois; 1 ♀ (NCMR55), Mare Longue, 500 m, 10.v.2002, leg. N. Cliquennois. The holotype and paratypes NCMR10 and 52 are deposited in MNHN, paratypes NCMR21, 54 and 57 in BMNH, paratypes NCMR1, 5 and 12 in MHNR, paratypes NCMR2, 3, 8 and 11 in the collection of P.D. Brock (Slough, United-Kingdom) and paratypes NCMR55 and 56 in the collection of S. Motala (Port-Louis, Mauritius). The MNHN houses also 2 female nymphs with the following data: "I. Maurice, Curepipe, 28 sept. 1926, O. Carié" and "Mauritius, Ray. Mamet". Eggs (about 50 in all) are deposited in every collection mentioned above and in the collection of John Sellick (United Kingdom).

Male: Medium-sized filiform stick insect, general color brown, brachypterous, with some tubercles and granules on the thorax.

Holotype male.—
Head: Narrowing posteriorly, slightly longer than wide, top flattened, with some small granules and with a short longitudinal median fissure level with the eyes. Occiput marked with a median gash and 2 lateral gashes. Head light brown marked with 2 darker brown lines beginning at the eyes and joining in the center, almost forming a 'V', with a narrow dark-brown band from eyes to back of head, with a lateral parallel broader band beneath eyes and black patch ventrally on each side of gula. Eyes dark brown, spherical, quite large and protruding. Antennae slightly exceeding apex of fore femora, with 22 articles. Basal article vaguely flattened, the 2nd very short, rounded, the 3rd cylindrical, as long as the first 2 articles combined (which are lighter brown than the remainder of articles).

Table 1. Measurements of *M. motalai* (in mm).

	male holotype	male paratypes	female paratypes
Body	71.5	63-69	71-86
Head	3.5	3.5	4.5-5.5
Antennae	28	26-28	19.5-23
Pronotum	3.5	3-3.5	4.5-5.5
Mesonotum	19	16.5-17	19-23.5
Metanotum and median segment	9.5	8.5-9.5	11-13
Median segment	6	5.5-6	6.5-8
Fore femora	26.5	24-26.5	20.5-25
Mid femora	16.5	16.5	12-14.5
Hind femora	22	18-22	14.5-18
Fore tibiae	30	26-28	20-26
Mid tibiae	15	14.5-15	9.5-12
Hind tibiae	22.5	18-22	13-15.5
Cerci	1.5	1-1.5	2



Figs 1-8. *Mauritiophasma motalai*. 1. Paratype male. 2. Paratype female. 3. Male apex of abdomen, lateral view. 4. Male apex of abdomen, ventral view. 5. Female apex of abdomen, lateral view. 6. Female apex of abdomen, ventral view. 7. Egg, dorsal view. 8. Egg, lateral view. (Figs 1 to 2, scale bar = 10 mm; Figs 3 to 8, scale bar = 1 mm).

Thorax: Pronotum almost as long as head, approximately 1.5× longer than wide, crossed by transverse median fissure armed with 4 small tubercles on its anterior margin and a pair of central larger tubercles anteriorad of the fissure; otherwise segment with several slight granulations; light brown. Mesonotum elongate, slightly over 5× length of pronotum, subcylindrical, with uneven spine-like tubercles and granulations of varying size, mainly in anterior

[1] NCMR: Nicolas Cliquennois, Mauritius.

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part; posterior quarter nearly smooth; dark brown anteriorly, lighter posteriorly. Metanotum and median segment combined are half length of mesonotum. Meso- and metasternum with a few small granules, uniformly brown. Forewings slender, leaf-like, just exceeding hind margin of metanotum, brown, with network of veins. Hindwings not quite reaching hind margin of median segment. Base of pre-anal part of hindwings with pale red blotch, remainder same as forewings. Hindwings brownish black with several obscure whitish spots.

Abdomen: Elongate, smooth, but sternites 2 and 3 with minute granulations. Tergites II-V of the same length, with nearly parallel lateral margins; tergites VI and VII slightly shorter; tergites VIII and IX of the same length, half as long as tergite V, slightly widened; tergites VII and VIII with small depression just before hind margin; end of tergite IX and anal segment with median longitudinal fissure; anal segment very short, slightly indented, with one big granule on each side of median fissure. Spiny forceps of anal segment more or less semicircular, on inner margin, with a row of 5 to 7 spines, ventrally hidden by cerci. Cerci lamellate, short, barely visible from above, with rounded apex. Subgenital plate reaching middle of anal segment, domed, compressed laterally near middle, with rounded apex.

Legs: Long and gracile, nearly entirely unarmed, although all femora with pair of short apical spines. Fore femora strongly incurved at base, triangular in cross-section, with 5 to 7 well-spread small serrations on upper carina, and many minute teeth on ventroposterior carina. Mid and hind femora trapezoidal in cross section with the 2 dorsolateral carinae close to each other, with many minute teeth on the ventrolateral carinae and a small distal tooth on the ventroanterior carina. Hind femora with a few minute subapical teeth on medioventral carina. All tibiae unarmed. First tarsomere of fore and hind tarsi longer than combined length of remaining tarsomeres; first tarsomere of mid metatarsus slightly shorter than combined length of remaining tarsomeres. Color: mid and hind legs pale greenish brown with brown basal band on femora, tibiae and tarsomeres; mid femora and mid tibiae with dark brown apex. Forelegs dark brown; tarsi pale with darker areas.

Paratype males.— (Figs 1, 3, 4) Compared with the holotype, variations are minor, mainly size, number of granules and tubercles, size of the hindwings, which cover more or less the hind part of the median segment; subgenital plate sometimes slightly indented.

Female: Medium-sized dark brown insect (head, pronotum and often posterior part of mesonotum whitish), brachypterous, with some tubercles and granules on the thorax.

Paratype females.— (Figs 2, 5, 6)

Head: Slightly narrowing posteriorly, slightly longer than wide, top rounded, with granules and small tubercles, sometimes with a longitudinal median fissure. Occiput with a median gash and 2 lateral gashes more or less marked, sometimes lacking. Usually whitish brown colored, usually with large brown mark between the eyes. Eyes dark brown, spherical, quite large and prominent. Antennae short, sometimes not exceeding apex of fore femora, with 19 to 25 articles, the basal article lamellate, not very widened, with a longitudinal median carina, the 2nd article rounded, only one third length of first, the third article cylindrical, narrower than the second and about twice as long.

Thorax: Pronotum as long as head, 1.5× longer than wide, with a well marked transverse median fissure, armed with 2 small tubercles on the anterior margin of the fissure, and with many small granulations. Mesonotum elongate, more than 4× longer than pronotum, subcylindrical, with small tubercles and granules, stronger and more numerous anteriorly than posteriorly; posterior third sometimes nearly smooth. Metanotum and median segment combined about half-length of mesonotum. Mesopleurae, meso- and metasternum granulated. Forewings exceeding posterior margin of metanotum but not reaching middle of median segment, hind wings not quite reaching center of tergite II. Base of pre-anal part of hindwings pale red, hindwings brownish-black, tessellated with whitish blotches.

Abdomen: Tergites II-VII approximately of same length, VI and VII usually a little shorter, tergite VIII nearly as long as tergites IX-X combined, anal segment slightly longer than tergite IX. Lateral margins of tergites II-VI nearly parallel, remaining tergites narrowing posteriorly. Tergites II-VI higher than tergites VII-X. Tergites II-IV rarely with small posterior central depression. Tergites II-VII sometimes with an approximately triangular lobule at hind corners, that feature being the most constant, in descending order, for the tergites VII, VI, V and IV, rare for the tergites II and III. Tergite VI with a raised hind margin (sometimes, hind margin of tergite V raised as well to a lesser extent), often overhanging anterior margin of the tergite VII. End of anal segment truncate, more or less indented, followed by small epiproct. Cerci short, hardly visible from above, straight, laterally compressed, slightly narrowing posteriorly, with rounded apex. Operculum narrow, slightly convex, barely exceeding hind margin of tergite IX, with slightly or well-indented apex. Valvulae exceeding apex of operculum.

Legs: Dark brown with whitish bands. Fore femora strongly incurved at the base, triangular in cross section; dorsal carina serrate, strongly in proximal part; ventromedian and ventroposterior carinae serrulate, the latter in addition usually with a spiny lobe at apex or with a stronger tooth. Mid and hind femora trapezoidal in cross-section; ventrolateral carinae and dorsoanterior carina of these femora with lobe at apex, usually toothed for ventral carinae. Dorsal carinae and ventroanterior carina of mid femora serrulate. Dorsal carinae and ventroanterior carina of hind femora with very few little teeth toward the base; medioventral carina smooth or with some denticules and granules, stronger towards the apex. Fore tibiae sometimes with a few minute teeth on proximal part of dorsal carina. Hind tibiae with vaguely serrulate dorsal carinae, with a small lobe at apex of dorsoanterior carina. First tarsomere of forelegs nearly as long as remaining tarsomeres together; first tarsomere of mid and hind legs about half shorter than remaining tarsomeres together. Three first tarsomeres of all legs with raised dorsal apical spine.

Egg (Figs 7, 8): Capsule ovoid, dark grey on posterior pole, lateral surfaces and on dorsal surface with whitish marks, with 2 almost triangular white spots on ventral surface, whitish on ventral surface (length: 3.5 mm, height: 2.3 mm, width: 2.1 mm). Chorion with pitted appearance under a microscope, with very minute stick-like projections. Micropylar plate very small, in the shape of an elongate ellipse, dark, placed near the posterior pole. Operculum circular, whitish near ventral surface, grey near dorsal surface, with minute spine-like projections, glued to a branch or a leaf by the apex of the pseudocapitulum.

Etymology.— Named after M. Saoud Motala (Mauritian Wildlife Foundation, Mauritius).

Distribution.— Mauritius. Known from the plateau between Mare Longue and Brise Fer (500 m) and from the Mondrain reserve (530

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m) in Henrietta. Both are relics of the Mauritian rain forest. Collected in the 1920's in Curepipe (now urbanised).

Foodplants.— This species has only been seen eating *Ludia mauritiana* (Flacourtiaceae) on which it is quite common. It accepts *Doratoxylon apetalum* (Sapindaceae) in captivity.

Anareolatae: ***Monoiognosis*** gen. n., ***incertae sedis***

Monoiognosis gen. n. belongs in "Anareolatae", keying close to Acanthoxylini, Clitumnini (= Baculini *sensu* Günther) or Pachymorphinae *sensu* Günther, using Bradley & Galil's classification (1977).

This new genus does not belong to the 2 former taxa: it is easily distinguished from Acanthoxylini by its cerci (not widened in *Monoiognosis*) and by the male abdominal anal-segment forceps (constituted only by small inner spines on the posterior angles of anal segment in *Monoiognosis*), and from Clitumnini of which males have the anal segment divided into 2 hemitergites.

The subfamily Pachymorphinae *sensu* Günther (1953) is really questionable as Günther admitted himself. He divided this subfamily into 3 tribes on the basis of unclear characters: Gratidiini, Hemipachymorphini and Pachymorphini.

South African Hemipachymorphini are little known and are being researched (Brock, in progress).

African and Asian Gratidiini possess a vomer in the male, therefore are not closely related to *Monoiognosis*.

Pachymorphini were recently (Bradler 2001a) proposed to be a member of Lanceocercata already discussed above. But here again the systematic position of this taxon remains obscure. *Pachymorpha* Gray 1835, (type genus of Pachymorphini) as treated in Otte & Brock (2003) appears to be polyphyletic. The type species of *Pachymorpha*, the Australian *Bacillus squalidus* Gray 1833 and other related Australian species, have been compared with *Monoiognosis* and are readily distinguished as follows:

Monoiognosis gen. n.	*Pachymorpha*
Head smooth between eyes	Head with 2 spine-like projections between eyes
Antennae usually reaching or slightly exceeding apex of fore femora, 23 to 25-segmented	Antennae very short, 10 to 11-segmented
♀ anal segment not longer than wide	♀ anal segment much longer than wide
Fore femora dorsobasally serrated	Fore femora dorsobasally smooth
Tarsi elongate	Tarsi very short

The other genera currently placed in Pachymorphini (*Acanthoderus* Gray 1835, *Micrarchus* Carl 1913, *Microphasma* Zompro 1999, *Mimarchus* Carl 1913 and *Niveaphasma* Jewell & Brock 2003) also differ from *Monoiognosis* for some of the reasons mentioned in the table above.

Although Mauritius is geographically near Madagascar, studies on the Madagascan phasmid fauna do not indicate any links with *Monoiognosis* n. gen. *Pachymorpha madagassa* Brunner 1907, only known by the female holotype (NHMW), seems to be very close to Australian *Pachymorpha* and one may question whether the type locality is erroneous.

Possibly this new Mauritian genus has Australian affinities: it may belong in Lanceocercata as it matches most of the characteristics given by Bradler (2001a). However, as this taxon needs to be clarified and arranged, it is difficult to discuss further.

Monoiognosis gen. n. lay eggs similar in general appearance to those of *Mauritiophasma* n. gen. Whilst this at first indicated a possible close relationship between these 2 genera, this theory has been discounted (see discussion on eggs, page 11.)

***Monoiognosis* gen. n.**

Head slightly longer than wide, with parallel lateral margins, dorsally flattened, with well-marked longitudinal median fissure and minute granules; gula present. Antennae short, not or slightly exceeding apex of fore femora, with 23 to 25 articles. Pronotum as long as or slightly longer than head, with minute granules. Mesonotum 3 (♂) or 2.5 (♀) × longer than pronotum, granulated, often with tubercles anteriorly. Metanotum and median segment combined nearly as long as mesonotum, slightly granulated. Median segment not or barely distinct. Abdomen slightly granulated, often with minute to medium posterior protuberance on tergites V-VII, with some longitudinal wrinkles (♀). Tergite II about 2× longer than wide (♂) or nearly square (♀). Tergites III-VII approximately of same length, X short. Tergite X (♂) tectiforme, apex vaguely pointed with 2 lateral indentations; tergite X (♀) rounded. Cerci short, flattened. Subgenital plate (♂) reaching middle of tergite X, with an indented apex. Operculum (♀) flattened, barely reaching hind margin of tergite IX. Legs elongate; fore femora triangular in cross-section; mid and hind femora quadrate in cross-section; all femora with some small subapical teeth, dorsoanterior carina of fore femora serrulate proximally; first tarsomere of fore tarsi longer than remaining tarsomeres combined.

Egg: Capsule ovoid, flattened laterally, circled with a white strip on dorsal and ventral surfaces, with a rounded mark on lateral surfaces. Micropylar plate small, placed near posterior pole. Egg glued to support by a pedicel attached to the operculum. Apex of pedicel a narrow, elongate plate.

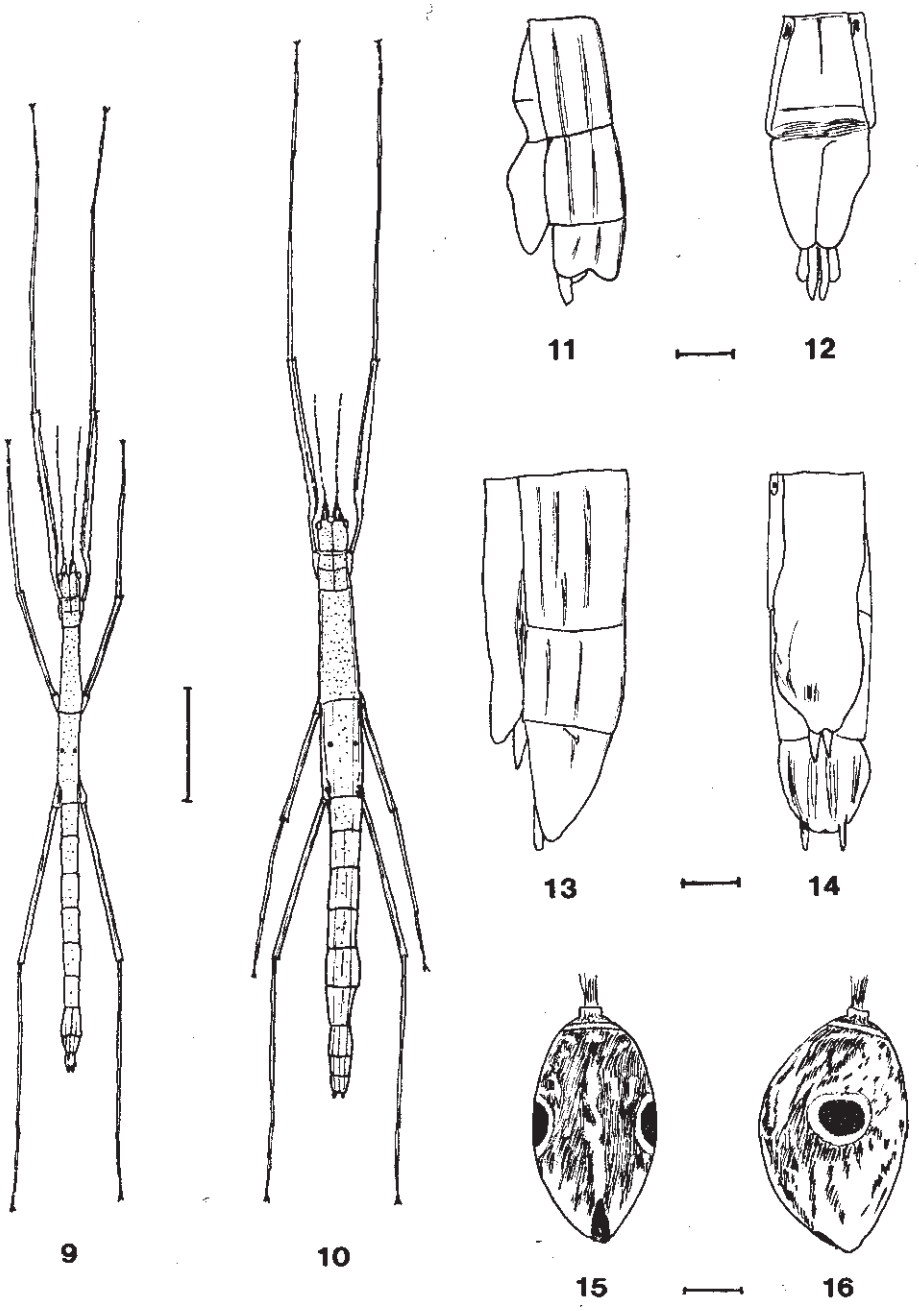
Type species.— Monoiognosis bipunctata sp. n.

Etymology.— Formed from the Greek words "μόνος": "only", "ώόν": "egg" and "γνώσις": "knowledge"; the name refers to the fact that the eggs of one of the two species belonging to this genus were known and commented on before the species itself (Chopard 1938: 174-175).

Key to adults of *Monoiognosis*

- Pronotum with a pair of strong conical spines. Mesonotum with 3 to 5 strong conical spines. No black points on metanotum. . . . . ***M. spinosa* sp. n.**
- Pronotum unarmed. Mesonotum usually unarmed, rarely with some tubercles. Metanotum with pair of black points . . . . . ***M. bipunctata* sp. n.**

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Figs 9-16. *Monoiognosis bipunctata*, 9. Paratype male, 10. Paratype female, 11. Male apex of abdomen, lateral view, 12. Male apex of abdomen, ventral view, 13. Female apex of abdomen, lateral view, 14. Female apex of abdomen, ventral view, 15. Egg, dorsal view, 16. Egg, lateral view. (Figs 9, 10 scale bar = 10 mm; Figs 11-16 scale bar = 1 mm).

Monoiognosis bipunctata sp. n.
(Figs 9-16, 34)

Holotype male.— Maurice, Brise Fer - Mare Longue, alt. 500m, 10-15.iii.2001, leg. N. Cliquennois (NCMR36). **Paratypes:** 19 ♀♀ and 9 ♂♂: 10 ♀♀ (NCMR23, 25, 26, 44-50) and 6 ♂♂ (NCMR30, 31, 37, 38, 40 and 41), same data; 1 ♂ (NCMR4), Montagne Bambous, 15.iii.2001, leg. Jennifer Ah-King; 1 ♂ (NCMR63) and 3 ♀♀ (NCMR64-66), Les Mares, Pigeon Wood, 11.v.2002, leg. N. Cliquennois; 3 ♀♀ (NCMR67-69), Mare Longue, 10.v.2002, leg. N. Cliquennois. 1 ♀, Mauritius, leg. Raymond Mamet (MNHN). 1 ♀, Maurice, Parc de la Rivière Noire, PK 6, belvédère (kiosque) sur les gorges, 13.viii.2002, leg. and coll. Sylvain Hugel; 1 ♂, 1 ♀ and 1 egg (in alcohol), same data. All the specimens are adult except NCMR45. The holotype and paratypes NCMR4, 26, 47, 48 and 64 are deposited in MNHN, paratypes NCMR41, 44 and 65 in BMNH, paratypes NCMR63, 66 and 68 in MHNG, paratypes NCMR25, 37, 45 and 69 in MSIRI, paratypes NCMR38, 46 and 67 in MHNR and paratypes NCMR23, 30, 31, 40, 49 and 50 in the collection of P.D. Brock. Eggs (about 80 in all) are deposited in every collection mentioned above and in the collection of John Sellick (United Kingdom).

Male: small filiform wingless insect, typically stick-like, brown, usually dark brown, sometimes lighter on thorax, with 2 black points on posterior half of the metanotum.

Holotype male.—

Head: Very slightly longer than wide, with parallel lateral margins, dorsally flattened, with minute granules, with well marked longitudinal median fissure and minute gashes on occiput; gula granulated. Eyes small, ovoid, light brown. Antennae short, exceeding a little apex of fore femora, with 23 articles, the first one lamellate,

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Table 2. Measurements of *Monoiognosis bipunctata* sp. n. (in mm).

	Male holotype	Male paratypes	Female paratypes
Body	44.5	43-50.5	54-59
Head	2.5	2.5-3	3.5-4
Antennae	15.5	15-17	13-16
Pronotum	2.75	2.5-3	3.5-4
Mesonotum	8	7.5-9	9.5-10.5
Metanotum and median segment	7.5	7-8.5	9-10
Median segment	2?	?	?
Fore femora	17	16-20	17-18.5
Mid femora	9.5	9-11	10-11
Hind femora	14	13.5-16	13.5-15
Fore tibiae	19	17.5-21	18.5-22
Mid tibiae	9	8.5-11	9.5-10
Hind tibiae	15	15-18	15-17
Cerci	1	1	1.5

not very wide, the second 1.5× shorter, narrower, cylindrical, with rounded apex, the third more elongate, a little longer than the second, thinner, cylindrical.

Thorax: Pronotum as long as head, slightly longer than wide, with lateral margins parallel, with transverse median fissure and minute granules. Mesonotum 3× longer than pronotum, subcylindrical, with scarce small granulations, 3 small tubercles and a minute one, on the anterior part along the median line. Metanotum and median segment combined nearly as long as mesonotum, with minute granules, and stronger ones on anterior part of the metanotum. Median segment indistinct. Meso- and metasternum very finely granulated.

Abdomen: Elongate, nearly smooth, except some minute granules on tergites II-VII. Tergites V and VI with a minute protuberance centrally on their hind margin. Tergite II about 2× longer than wide. Tergites III-VII approximately of same length, tergite II and particularly tergite VIII shorter. Tergite IX and anal segment combined as long as tergite II. Anal segment tectiform, apex vaguely pointed with 2 lateral indentations. Anal segment with minute spines on inner side of posterior angles. Cerci very short, barely visible from above, thin, elongate, lamellate, with truncate apex. Subgenital plate reaching middle of anal segment, not very convex, with median carina; apex with slight indentation, forming 2 small lobules.

Legs: Elongate, nearly smooth. Fore femora triangular in cross-section; mid and hind femora quadrate in cross-section. All femora with some small subapical teeth on medioventral carina. Dorsoanterior carina of fore femora proximally serrulate. All tibiae unarmed. First tarsomere of fore tarsi longer than remaining tarsomeres combined, first tarsomere of mid tarsi shorter than these combined and first tarsomere of hind tarsi as long as these combined.

Paratype males.— (Figs 9, 11, 12) Some variation in spination and granulation; pronotum sometimes with a pair of small granules on each side of a longitudinal median fissure; mesonotum with up to 5 tubercles (MR31), usually without tubercles but with bigger granules instead. MR4 with 2 tubercles on anterior part of metanotum. Abdomen sometimes with stronger granules. Minute protuberance on tergites V and VI sometimes lacking. Indentation of subgenital plate more or less marked, sometimes nearly lacking.

Female: Small insect, sturdier than male, generally dark brown, with 2 black points on posterior half of the metanotum.

Paratype females.— (Figs 10, 13, 14)

Head: Slightly longer than wide, with parallel lateral margins, dorsally flattened, with well marked longitudinal median fissure, some minute granules and sometimes with 2 small tubercles or stronger granules centrally on occiput; gula with some minute granules. Eyes small, ovoid, light brown. Antennae short, barely reaching or slightly exceeding apex of fore femora; with 24 to 25 articles, the first one lamellate, the second shorter and narrower, cylindrical, the third thinner and 1.5× longer than second.

Thorax: Pronotum as long as head, slightly longer than wide, most of the time with a longitudinal median fissure, at least on the anterior part, with an anterior and a median transverse fissures and with minute granules. Mesonotum more than 2.5× longer than pronotum, with minute to medium granules stronger near anterior margin and near median line, sometimes ranked in lines, rarely with small tubercles on anterior part, along median line. Metanotum and median segment combined nearly as long as mesonotum, with granules usually smaller than those of the mesonotum. Median segment indistinct.

Abdomen: Narrowing posteriorly from tergite VII, with some longitudinal wrinkles. Tergites II-VII with minute to medium granulations, especially along median line, rarely with minute posterior protuberance on tergite V and/or on tergite VI. Tergite II square, tergites III-VII approximately of same length, tergites II and VIII shorter, tergite IX and anal segment equal in length, the latter ones combined as long as tergite VII. Apex of anal segment rounded. Cerci short, a bit visible from above, thin, slightly compressed laterally, with rounded apex. Operculum flattened, barely reaching hind margin of tergite IX, apex with slight indentation. Valvulae slightly exceeding end of operculum.

Legs: Elongate. All femora with a pair of apical spines and some small subapical spines on the medioventral carina. Fore femora triangular in cross-section, mid and hind femora quadrate in cross-section. Base of fore femora incurved. Dorsoanterior carina of fore femora serrulate proximally. Ventroposterior carina of fore femora all along with minute teeth. Dorsal carinae of mid and hind femora with minute teeth, particularly on the proximal part, stronger on the posterior carina; ventrolateral carinae sometimes with a few very minute distal teeth; medioventral carina sometimes with minute teeth set all along. All tibiae unarmed. First tarsomere of fore tarsi slightly longer than the remaining tarsomeres combined, first tarsomere of mid tarsi nearly half length of remaining tarsomeres combined, first tarsomere of hind tarsi as long as remaining tarsomeres combined.

Egg: (Figs 15, 16) Capsule ovoid, flattened laterally, slightly tapering at posterior pole when viewed laterally, tinged with a variable mix of brown, white and black; dorsal surface usually brown with white patch above micropylar plate or with whitish strip flecked with black anteriorly, ventral surface with white strip, lateral surfaces with brown disk bordered with black and circled with white. Capsule length 3.5 to 4 mm, height 2 to 2.5 mm, width 2 mm. Micropylar plate black, small, lanceolate, placed near posterior pole. Operculum circular, brown; pseudocapitulum short and cylindrical, covered by orange-brown short pedicel attached to branch or leaf; apex of pedicel a narrow, elongate plate with a central ridge.

Etymology.— The species name refers to the 2 black points that both males and females bear on the metanotum.

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Distribution.— Mauritius. Known from the plateau between the Brise Fer mountain and Mare Longue, from Montagne Bambous, and from Pigeon Wood, near Les Mares. Very common.

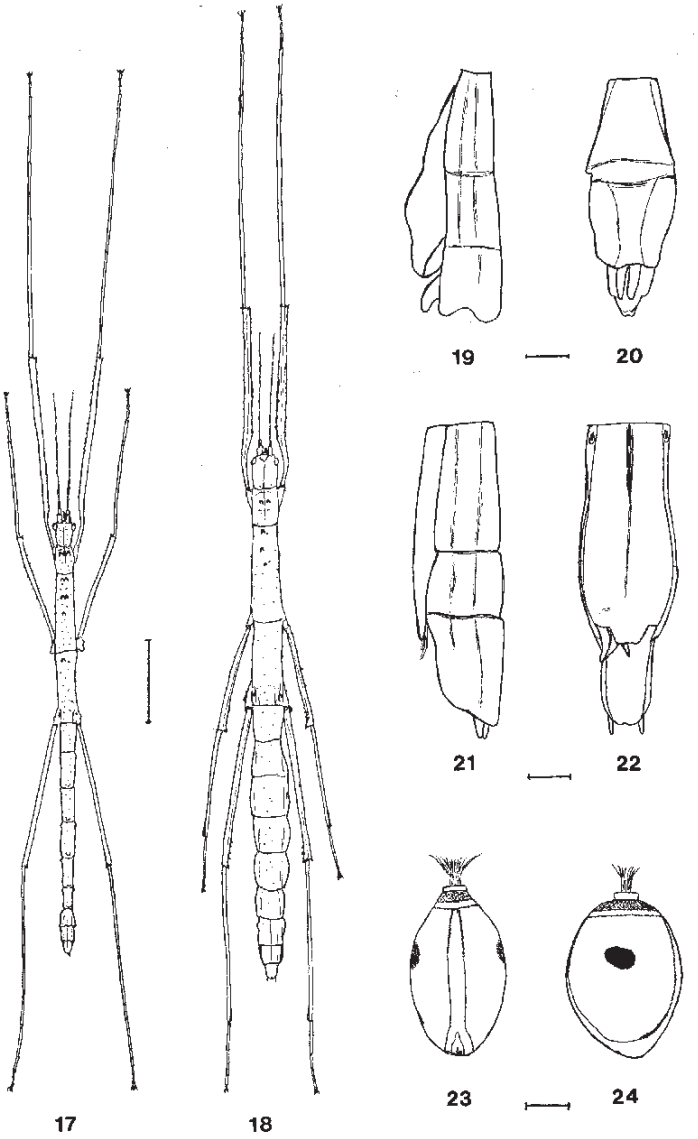
Foodplants.— This species has mainly been found feeding on *Psidium cattleianum* (Myrtaceae), an exotic invasive plant. Also found on undetermined indigenous species of Myrtaceae: *Syzygium* sp., *Eugenia* sp. and *Monimiastrum* sp. In captivity, this species accepts *Syzygium cumini* and *Psidium guajava* (both Myrtaceae).

Monoiognosis spinosa sp. n.
(Figs 17 to 24, 35)

Holotype male.— Maurice, Plateau de Mare Longue, alt. 500m, 15.iii.2001, leg. N. Cliquennois (NCMR33). **Paratypes:** 2♀♀ (NCMR43 and 51), same data. 2♂♂ (NCMR34 and 35), 1♀ (NCMR20), same data, except the date: 11.iii.2001. The holotype and paratype NCMR20 are deposited in MNHN, paratypes NCMR34 and 51 in MHNR and paratypes NCMR43 and 35 in BMNH. Eggs (about 50 in all) are deposited in every collection mentioned above and in the collection of John Sellick (United Kingdom).

Male: small filiform wingless stick insect, with some spines on the thorax, dark brown in general; thorax, head, proximal half of antennae and legs usually light brown.

Holotype male.— (Figs 17, 19, 20)
Head: Slightly longer than wide, with parallel lateral margins, dorsally flattened, with well-marked longitudinal median fissure and 2 lateral fissures behind eyes, with some minute granules, stronger on the occiput. Gula with very minute granules. Eyes small, ovoid, protruding, brown. Antennae short, not reaching apex of fore femora, with 23 articles, the first lamellate, not very broad, the second 1.5× shorter, narrower, cylindrical, the third as long as the previous one, thinner.
Thorax: Pronotum longer than head, nearly 2× longer than wide, with a longitudinal and a transverse median fissure not very marked, with 2 strong conical spines centrally and a few minute granules posteriorly. Mesonotum 3× longer than pronotum, subcylindrical, with sparse small granules, with 5 strong conical spines on anterior half, first 4 in pairs, on each side of the median line. Metanotum and median segment combined only a little shorter than mesonotum; metanotum with strong conical spine and another weaker anteriorly, the remaining surface with scarce minute granulations; median segment nearly indistinct, nearly half long as the metanotum. Meso- and metasternum finely granulated.
Abdomen: Elongate, nearly smooth, with a few minute granulations on tergite II-VI, tergites V-VI and, to lesser extent, tergite VII, with a small protuberance posteriorly. Tergite IX with 2 small protuberances on posterior margin. Sternites 2 to 7 very finely granulated. Tergite II about 2× longer than wide. Tergites II-VII approximately of same length, tergites VIII-IX shorter, anal segment very short. Tergites VIII-IX very slightly widened. Anal segment tectiform, apex vaguely pointed with 2 lateral indentations. Anal segment with minute spines on inner side of posterior angles. Cerci very short, not visible from above, thin, lamellate, with rounded apex. Subgenital plate reaching middle of anal segment, not very convex, with 2 lateral carinae and an indented apex.
Legs: Elongate. Fore femora nearly triangular in cross-section, mid and hind femora quadrate in cross-section. All femora with pair of apical spines and 3 to 4 subapical black spines on medioventral carina. Upper carinae of fore femora finely serrulate proximally. Dorsoposterior carina of mid and hind femora with minute teeth on proximal part. Ventroanterior carina of mid femora with distal spine. All tibiae unarmed. First tarsomere of fore tarsi longer than the remaining tarsomeres combined, first tarsomere of mid tarsi shorter than remaining tarsomeres combined, first tarsomere of hind tarsi as long as remaining tarsomeres combined.



Figs 17-24. *Monoiognosis spinosa*, 17. Holotype male, 18. Paratype female, 19. Male apex of abdomen, lateral view, 20. Male apex of abdomen, ventral view, 21. Female apex of abdomen, lateral view, 22. Female apex of abdomen, ventral view, 23. Egg, dorsal view, 24. Egg, lateral view. Figs 17, 18, scale bar = 10 mm; Figs 19 to 24, scale bar = 1 mm.

Paratype males.— MR35 with minute tubercles at back of head. MR35 with only one spine and a small granule instead of a second spine on pronotum. MR 34 with only 3 strong conical spines on mesonotum; these spines disposed rather alternately, not in pairs, on each side of median line for the two paratypes. Both paratypes with no anterior spines on metanotum, but with stronger granulations instead. Granulations on abdomen stronger for two paratypes. MR 35 with

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Table 3. Measurements of *Monoiognosis spinosa* sp. n. (in mm).

	male holotype	male paratypes	female paratypes
Body	53	53-54.5	59.5-62.5
Head	2.5	2.5	3-3.5
Antennae	16.5	15-17	15-16
Pronotum	3	3	4-4.5
Mesonotum	9.5	9-10	11-11.5
Metanotum and median segment	8.5	8-9	10-10.5
Median segment	3	3	?
Fore femora	22.5	21-24	21.5-22.5
Mid femora	12.5	12-12.5	12-13.5
Hind femora	17.5	17-18	16-18
Fore tibiae	24.5	24-25.5	25-25.5
Mid tibiae	12	11-12	11.5-12.5
Hind tibiae	19	18-19.5	18-19
Cerci	1	1	1

a protuberance more marked on the tergite VII, lacking for MR 34. Both paratypes with central carina on the subgenital plate.

Female: small wingless stick insect, sturdier than male, with some spines on thorax; deep green as young adult, becoming progressively brown.

Paratype females.— (Figs 18, 21, 22)
Head: Longer than wide, with parallel lateral margins, flattened dorsally, with a few minute granules, with longitudinal median fissure and usually with 2 small tubercles posteriorly on each part of fissure. Gula with very minute granules. Eyes small, ovoid, protruding, brown. Antennae short, not reaching apex of fore femora, with 24 to 25 articles, the first lamellate and carinated, the second cylindrical, shorter and thinner than the first, the third as long as the second, thinner, cylindrical.
Thorax: Pronotum longer than head, slightly longer than wide, usually with a longitudinal median fissure and sometimes with a transverse median one, pronotum with minute granules, armed with 2 strong central conical spines. Mesonotum more than 2.5× longer than pronotum, with sparse small and minute granules and 3 to 4 strong conical spines along median line on anterior part. Metanotum and median segment combined only a little shorter than mesonotum; metanotum with sparse minute granulations and 1 to 2 small conical spines or at least few stronger granules anteriorly. Median segment indistinct. Meso- and metasternum finely granulated.
Abdomen: Nearly smooth for 2 female paratypes, with some longitudinal wrinkles, with only sparse small granules; the third female (MR43) with a posterior protuberance on tergites V, VI and VII, the largest on tergite VI. Sternites 2 to 7 very finely granulated. Tergite II nearly square. Tergites III-VII usually widened laterally and dorsally (feature more distinct on living specimens). Tergites II-VII of approximately same length, tergite VIII slightly shorter, tergites IX-X combined as long as tergite VIII, anal segment slightly longer than tergite IX. Apex of anal segment rounded. Cerci short, visible from above, lamellate, narrow, with rounded apex. Operculum flattened, barely reaching hind margin of tergite IX, narrowed posteriorly, apex truncate. Valvulae slightly exceeding operculum.
Legs: Elongate. All femora with a pair of apical spines and 2 to 3 subapical spines on the medioventral carina. Fore femora triangular in cross-section, mid and hind femora quadrate in cross-section. Base of fore femora strongly incurved. Dorsoanterior carina of fore femora finely serrulate proximally. Ventroposterior carina of fore femora with minute teeth all along. Dorsal carinae of mid and hind femora with minute teeth, more numerous on the proximal part, stronger on the posterior carina; ventrolateral carinae with few distal teeth; ventromedian carina with small teeth all along. All tibiae unarmed. First tarsomere of fore tarsi slightly longer than the remaining tarsomeres combined, first tarsomere of mid tarsi shorter than the remaining tarsomeres combined, first tarsomere of hind tarsi a little shorter than the remaining tarsomeres combined.
Egg: (Figs 23, 24) Capsule ovoid, flattened laterally, smooth, light green after laying, then becoming progressively light brown or reddish, circled nearly entirely by a white strip on the dorsal and ventral surfaces, broadened at the posterior pole at level with the micropylar plate, with 2 whitish circles more or less distinct on the lateral surfaces. Capsule length 3.5 to 4 mm, height 3 mm, width 2.2 to 2.5 mm. Micropylar plate whitish, in the shape of a small elongate ellipse, placed near the posterior pole. Operculum oval, greyish; pseudocapitulum short and cylindrical, whitish, covered by a beige short pedicel, cork-like, ending in a narrow and elongate plate glued to a support.

Etymology.— The species name refers to the thoracic spines present in both sexes.

Distribution.— Mauritius. Known only from the fenced protected plot at Mare Longue. This species appears to be uncommon.

Foodplants.— This species has only been seen eating *Leea guineensis* (Leeaceae). It accepted no other plant in captivity.

Phasmatidae: Xeroderinae

***Epicharmus* Stål 1875: 60**

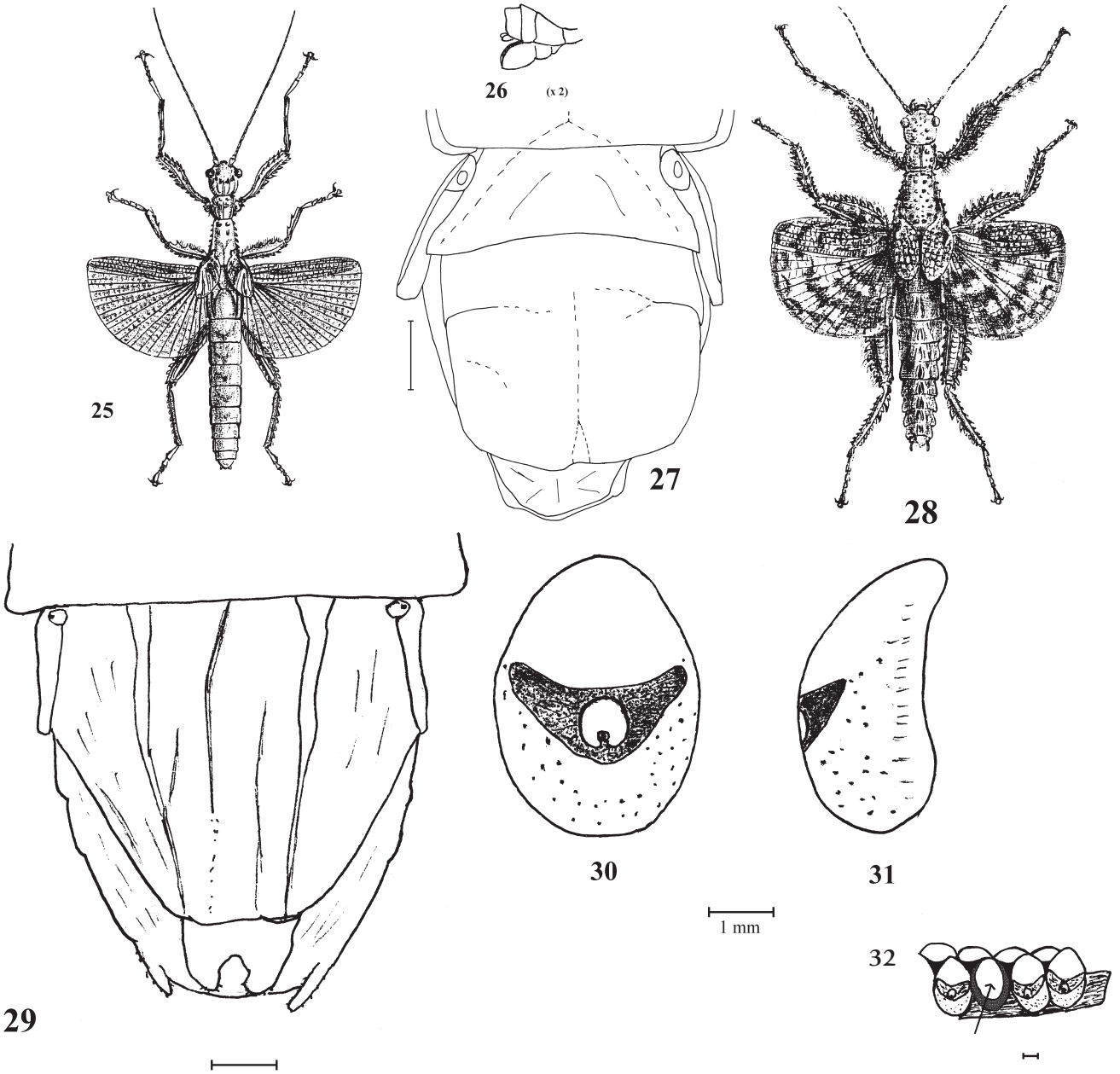
Type species: *Prisopus marchali* Audinet-Serville 1838 by subsequent designation (Kirby 1904b: 404).

***Epicharmus marchali* (Audinet-Serville 1838)**
(Figs 25-32, 36)

Prisopus marchali Audinet-Serville, 1838: 284. Holotype ♂, Ile-de-France [Mauritius], leg. Marchal (OXUM).
— , de Haan, 1842 : 112, 116.
Xeroderus ? marchali, Westwood, 1859 : 103, pl. 36: 4.
Xeroderus marchali, Stål, 1875: 60, 102.
Epicharmus marchali, Kirby, 1904b: 404; Redtenbacher, 1908: 362; Orian, 1957: 517; Vinson, 1968: 113.
Prisopus guerinii Westwood, 1859 : 170, pl. 21:1. Syntype ♂ and ♀, île Maurice, coll. Guérin-Méneville (not traced) **syn. n.**
— , Stål, 1875: 60.
Epicharmus guerinii Kirby 1904b: 404; Redtenbacher 1908: 361; Orian, 1957: 517; Vinson, 1968: 113.

Non-type material examined.—
1 ♀ (NCMR7), Maurice, Brise Fer, 10.iii.2001, leg. N. Cliquennois; 1 ♂ and 2 ♀♀ (NCMR14 and 15, 39), Maurice, Plaine Lièvre (Brise Fer), 15.iii.2001, leg. N. Cliquennois ; 2 ♂ and 1 ♀ (NCMR60, 73 and 74), Maurice, Henrietta, Le Mondrain, 16.v.2002, leg. N. Cliquennois ;

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Figs 25-32. *Epicharmus marchali*, 25. Holotype male (after Westwood 1859), 26. Holotype male apex of abdomen, lateral view (after Westwood, 1859), 27. Male apex of abdomen, ventral view, 28. Female: *E. guerini* syn. n. syntype "male" (after Westwood, 1859), 29. Female apex of abdomen, ventral view, 30. Egg, dorsal view, 31. Egg (without operculum), lateral view, 32. Bunch of eggs; the arrow shows internal surface of the operculum. Figs 27, 29-32, scale bar = 1 mm.

1♂, Maurice, Brise Fer, leg. and coll. S. Motala ; 1 ♂, Maurice, Bel Ombre, leg. MWF (coll. S. Motala) ; 1♀, Ile Maurice, Chute Nouvelle Moka, leg. Carié, janv. [19]07 (MNHN) ; 1 ♀, Mauritius, Ray[mond] Mamet (MNHN). Three batches of eggs (26 eggs in all).

Material leg. Cliquennois deposited thus: MNHN: NCMR14, 15 and 60; MHNR: NCMR73 and 74; coll. Brock: NCMR7; coll. Seow-Choen (Singapore): NCMR39. One batch of eggs is deposit in MNHN, MHNR and in the collection of John Sellick.

Epicharmus superficially resembles the South American Prisopodini but lacks the *area apicalis* on mid and hind tibiae. The genus is very close to the much longer representatives of *Nisyrus*, Stål 1877 and *Cotylosoma* Wood-Mason 1878 (both Xeroderinae).

The description, measurements and figure of the "male" *Prisopus guerinii* by Westwood (Fig. 28) perfectly match the female *P. marchali*; same for the description and measurements of the "female" *P. guerinii* which match the male *P. marchali*. Actually, the male subgenital plate (Figs 26,27) is rather unusual and may have been mistaken for a female operculum.

Egg: (Figs 30-32) Capsule remarkably large for size of species, untypical of phasmids, rounded dorsally with micropylar plate placed at opposite side of operculum which is glued directly to a branch; it is therefore difficult to regard a surface as ventral. 6 to 9 eggs in 2 rows, inserted the one in the other, are glued side by side to a branch. The micropylar plate in one row of eggs is at the opposite end re the next row. Length 4.2 mm, height 2.2 mm, width 3.2 mm.

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The upper part of the capsule adjoining the anterior pole is uniformly cream, smooth to the naked eye, slightly imprinted with a reticular net of wrinkles under high magnification. Micropylar plate placed in center of raised transverse rugose brown crescent-shaped band, not quite extending across width of capsule. Micropylar plate circular, indented posteriorly, cream, surrounded by elevated black ridge, wrinkled; micropylar cup black. Median line short. Posteriorly ventral surface cream, pitted with minute black holes. Capsule surface around opercular collar wrinkled. Collar finely milled. Operculum unusually large, semi-ovoid, internal rim finely milled. Note: In eggs of other phasmids, the operculum (or lid) is situated at the top of the egg, not underneath it, as in *Epicharmus*.

Distribution.— Known from relics of natural forests in South-Western Mauritius: Montagne du Brise Fer, Plateau de Mare Longue, Bois du Bon Courage (Bel Ombre) and Le Mondrain.

Foodplants.— This species appears to be a specialised feeder on *Labourdonnaisia calophylloides, Labourdonnaisia glauca, Sideroxylon cinereum, Sideroxylon puberulum, Mimusops erythroxylon* (all Sapotaceae). No other plants from other families were accepted in captivity.

Discussion on the eggs of Mauritian phasmids

The 4 species dealt with in this paper, belonging to 3 genera, and to at least 2 different subfamilies, feature eggs that are fundamentally atypical in Phasmatodea.

They all share the fact that they are glued to a surface by the operculum, a remarkable feature unreported in the order.

Eggs of *Mauritiophasma* and of *Monoiognosis* are superficially similar and their shared characters may suggest a homology on which one could base the erection of a monophyletic taxon including the 2 genera. The monophyly of this taxon is not, however, supported by a morphological comparison:

Mauritiophasma	*Monoiognosis*
Male genital forceps formed by 2 inner extensions of tergite X in the dorsal posterior angles (Fig. 33)	Male genital forceps formed by inner spines on the swollen ventral posterior angles of tergite X (Figs 34-35)
Brachypterous	Apterous. Median segment, when distinct, much shorter than metanotum
Mesonotum elongate, about 5× longer than pronotum, 2× longer than metanotum and median segment combined	Mesonotum not very elongate, about 3× longer than pronotum, about as long as metanotum and median segment combined
Head rounded laterally, not elongated. In ♀: dorsally rounded. Longitudinal median fissure short, superficial or lacking	Head with lateral parallel margins, elongated.In ♀: dorsally flattened. Longitudinal median fissure very distinctive
Legs stocky, strongly lobed (♀)	Legs slender, without lobes

Those differences, of which some may appear of poor phyletic value, have to be weighed with consideration of the young age of Mauritius Island (about 7 or 8 My). To our knowledge, such a divergence of characters has never been reported for closely related genera of a volcanic island or archipelago. Only the difference in the male genitalia is strong enough to dismiss the hypothesis of a close affinity.

Comparison of the eggs of these 2 Mauritian genera also highlights some important differences:

Mauritiophasma	*Monoiognosis*
Pseudocapitulum without a pedicel, egg glued directly by the flattened tip of the pseudocapitulum	Pseudocapitulum with a pedicel, egg glued by the flattened extension of the pedicel
Operculum tilted with a negative angle of 45°	Operculum at right angle
Capsule without a white strip	Capsule surrounded by a white strip on dorsal and ventral surfaces
Capsule pitted, with stick-like projections	Capsule absolutely smooth

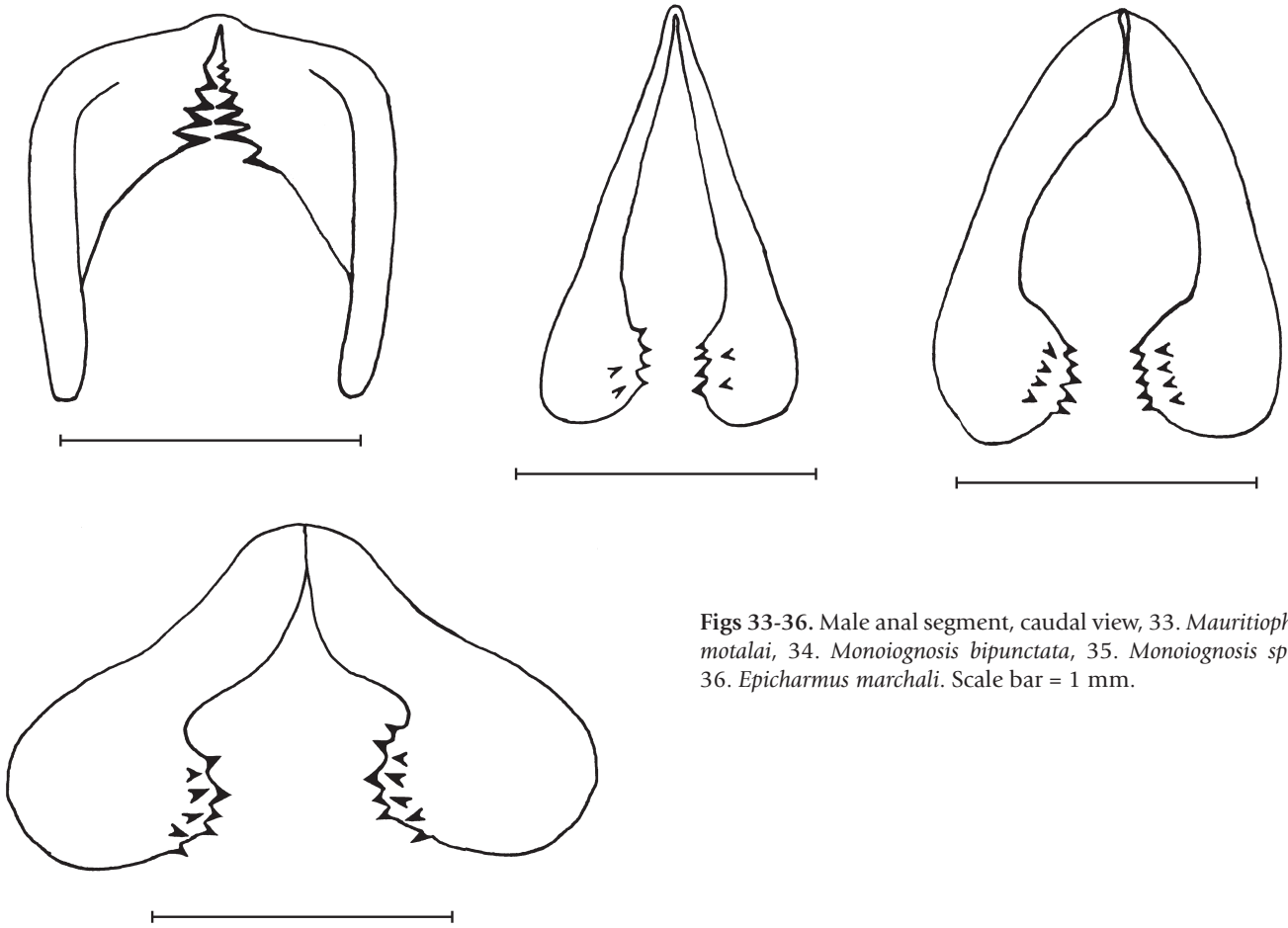
The eggs of the third genus featuring unusual eggs (*Epicharmus*), are distinct from those of *Mauritiophasma* and *Monoiognosis*, but are alike in the fact that the eggs are glued by the operculum. The taxonomic placement of *Epicharmus* in Xeroderinae is, in our view, appropriate. It is therefore difficult to consider the character "egg glued by the operculum" as a autapomorphy of an endemic Mauritian monophyletic taxon comprising *Mauritiophasma*, *Monoiognosis* and *Epicharmus*. So this character has to be considered as a homoplasy and therefore with no phyletic value.

Attaching eggs to plants may have advantages, at least for monophagous species, as the newly hatched nymphs should soon locate a suitable foodplant, and are protected from ground dwelling predators (unlike most phasmids, whose eggs are simply dropped or flicked to the ground). Until now only eggs attached by the ventral surface or by the posterior pole, have been recorded in phasmids; for both kinds of attachment the operculum falls to the ground during hatching and the nymph emerges from the capsule, which remains on the plant. This advantage of gluing eggs is apparently defeated when gluing by the operculum as eggs are fixed in such a position that the hatching nymph falls to the ground with the egg capsule. This applies wherever eggs are laid, *i.e.*, on a branch in a batch (*Epicharmus*), at the junction of 2 small branches, between a branch and the petiole of a leaf (*Mauritiophasma*), or on the ventral or dorsal surface of a leaf (*Monoiognosis*): phasmid nymphs emerge by their "back" first which pushes the operculum off, the legs emerge last. No hatching has yet been observed for these 4 Mauritian species, but after hatching, the operculum has always been totally detached from the capsule, leading to the conclusion that the capsule falls to the ground with the nymph.

We have therefore to suppose a strong selection pressure that greatly counterbalancing the apparent disadvantage described above. Selection for an advantage yet to be determined has resulted in a convergent evolution in 3 non-related taxa. This is newly reported in phasmid eggs, which have been studied in detail, particularly since the 1970s. In conclusion, it is likely that this selection pressure exists only in Mauritius or is counterbalanced elsewhere.

Sylvain Hugel (pers. com.) suggested this phenomenon could be explained as a protection against a parasitoid, which will be tested by field studies in Mauritius by Hugel and Cliquennois. Another possibility is protection against other specific predator(s) yet to be determined.

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Figs 33-36. Male anal segment, caudal view, 33. *Mauritiophasma motalai*, 34. *Monoiognosis bipunctata*, 35. *Monoiognosis spinosa*, 36. *Epicharmus marchali*. Scale bar = 1 mm.

Another area in need of further investigation is determination of the ancestral state of each species, initially by investigating *Nisyrus* for *Epicharmus* and *Anophelepis* for *Mauritiophasma*. It is likely that primitive eggs were also glued, as the evolutionary distance between eggs dropped or flicked to the ground and the Mauritian eggs fixed by the operculum, appears too important to be a realistic scenario in so short a period. *Epicharmus* is the only Mauritian genus with a related genus, *Cotylosoma*, for which the egg is known. But the egg of *Cotylosoma* sp. is very different: non-adhesive, almost spherical, covered in matted hairs with an almost elliptical micropylar plate (Sellick 1997, and pers. com.). Brock has eggs of a probable *Anophelepis* species from north Queensland, Australia (Brock, in progress, part of detailed study on Australian phasmids); they are fairly typical oval phasmid eggs, dropped to the ground, with the operculum on top of the capsule. Unlike *A. telesphorus*, the male only has full-sized hindwings.

The 2 Mauritian species with a Malagasy origin (*Monandroptera acanthomera* and *Rhaphiderus scabrosus* (both Monandropterini) do not glue their eggs: females of those species flick their eggs to the ground. Another Mauritian species, *Apterograeffea marshallae* (Platycraninae *sensu* Günther), which also has an Australasian origin, glues eggs by the ventral surface.

Chopard (1938: 174-175) studied the eggs of an undetermined Mauritian species (probably *Monoiognosis bipunctata*) with its eggs attached by the operculum: he wondered how they were laid, putting forward the hypothesis that the egg was either turned around after being laid, using an unknown process, or very unlikely, that it goes out with its anterior pole first, instead of the posterior one as observed in all species for which egg laying is known. Both theories appear to be incorrect, if the egg laying process is the same for *Monoiognosis* and *Mauritiophasma motalai*. A female *motalai* was observed laying an egg normally with the posterior pole first; the egg is then glued thanks to a twisting movement of the abdomen ensuring it is fixed to a suitable surface.

This process probably differs in *Epicharmus*. Rows of phasmid eggs glued to leaves or branches are known in other species, such as *Marmessoidea rosea* (Fabricius 1793) from Peninsular Malaysia. It seems an arduous task for *Epicharmus* to manoeuvre the eggs in strict rows to create a beautiful, complex structure. It is hoped that observations will reveal exactly how this process is undertaken.

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