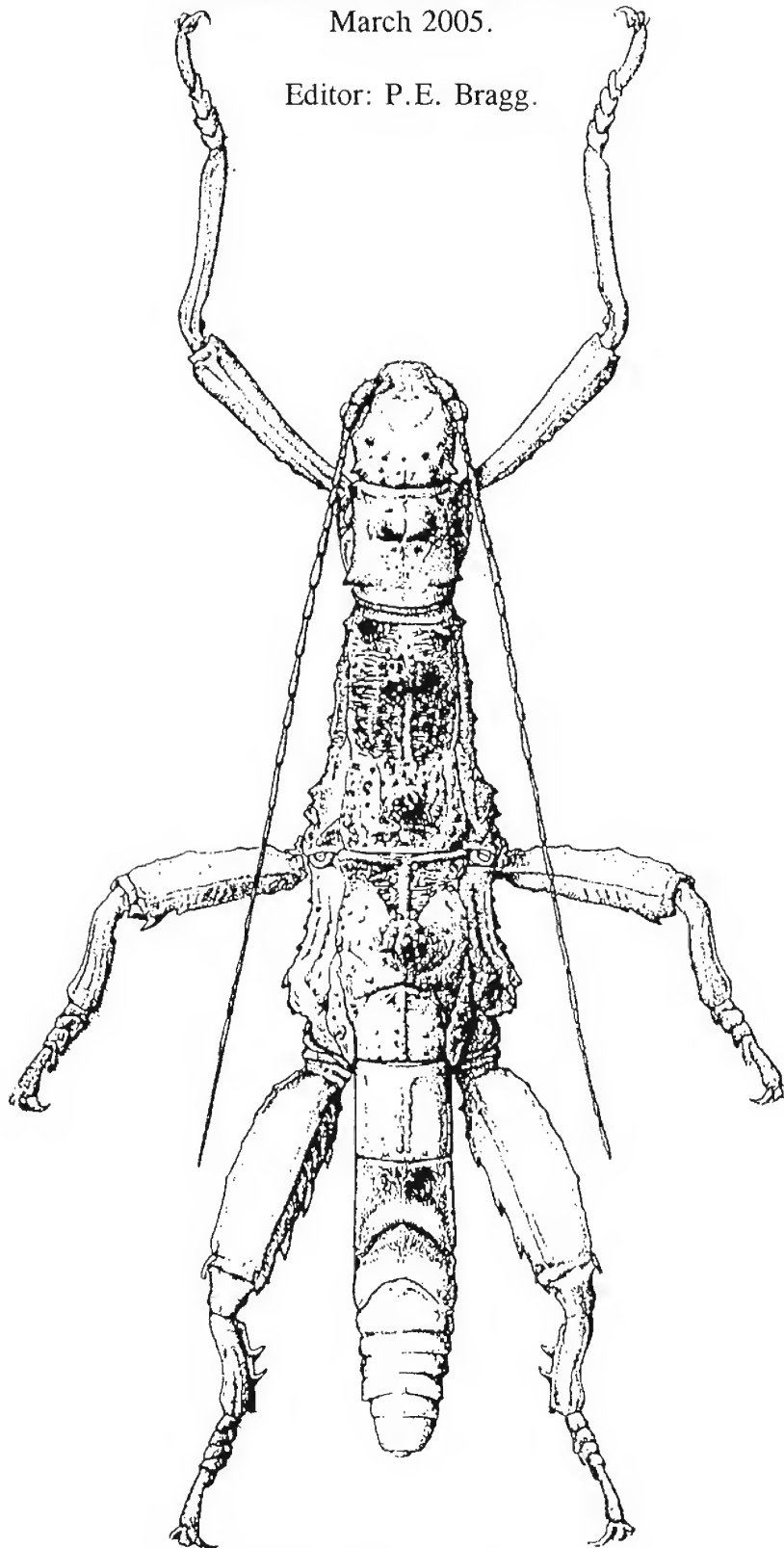


# PHASMID STUDIES.

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# Peruvian Phasmids in the Manu National Park

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## Abstract

The article describes a five night trip to the Manu National Park in South Eastern Peru in September of 2000. Phasmids were found at three different sites within the reserve between 500 and 1000 m in primary and secondary (disturbed) rainforest. The most common stick insects encountered were similar in appearance to the genera *Ocnophiloidea* and *Pseudophasma*, with a few other larger species also found. No collections were made and therefore no formal identifications have been possible.

## Key words

Phasmida, Peru, Manu, South America.

I travelled to Peru in September 2000 with a group of six other friends. As part of this trip we had booked a six-day trip with Manu Expeditions (of Michael Palin's "Full Circle" and "Andes to Amazon" fame) to explore the world heritage zone of the Manu Biosphere Reserve. There are two "easily" accessible parts of the Peruvian Rainforest open to tourists. Trips depart onto the Amazon basin itself from Iquitos in the North of the country (Figure 1) and also from around the Puerto Maldonado area into the Manu reserve further south. I had been told that the flora and fauna in the Manu area were more distinctive than around Iquitos and, as it is less visited, were less disturbed.

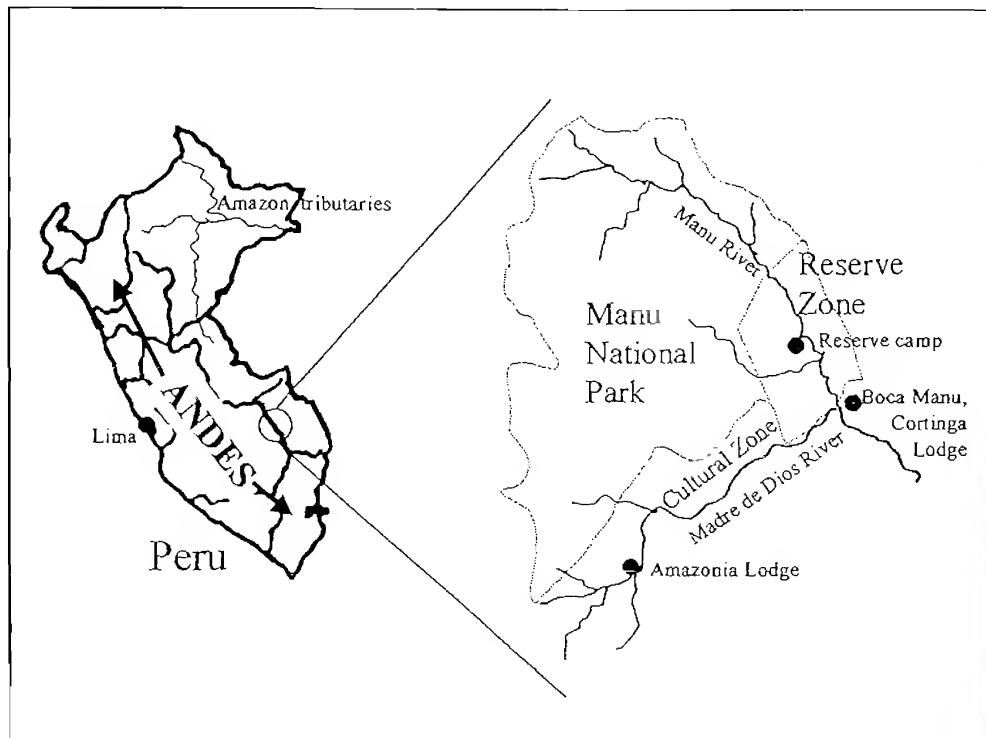


Figure 1. Map of Peru and the Manu National Park.

We travelled by minibus from the ancient Inca capital of Cusco over the Andes and down into the Manu National Park. This park covers an area the size of Wales and includes an enormous range of habitats as it spans over 3500 meters in altitude. Humans are allowed in the "Cultural Zone" of the park to help make it financially viable, but our ultimate destination was the reserved zone, accessible only by boat and free from all humans except the native tribesmen (Figure 1). We entered the park at around 3800 meters where the vegetation changes from the Puna, or high Andean grassland, to elfin forest, which is quite an open forest full of moss-covered, trees, dwarfed by the harsh mountain conditions. We were here at mid morning, so there was little chance of phasmid spotting, but I did find a

stick-mimicking grasshopper in the long "grass".

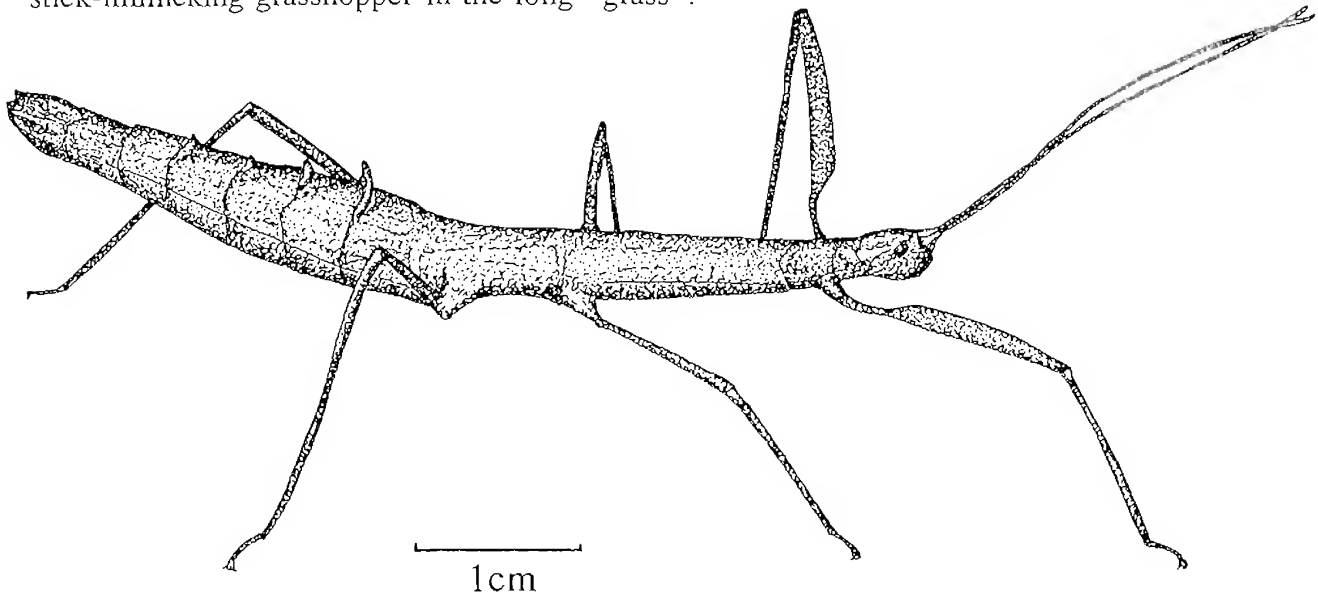


Figure 2. "*Ocnophiloidea sp.*", female found at Amazonia Lodge.

Six hours of bumpy descent through the cloud forest into the highland rainforest brought us to La Atalaya, a little settlement at about 1000m above sea level. Just across the upper Madre de Dios river from here was the Amazonia Lodge, an old tea hacienda which was to be our first night's lodgings.

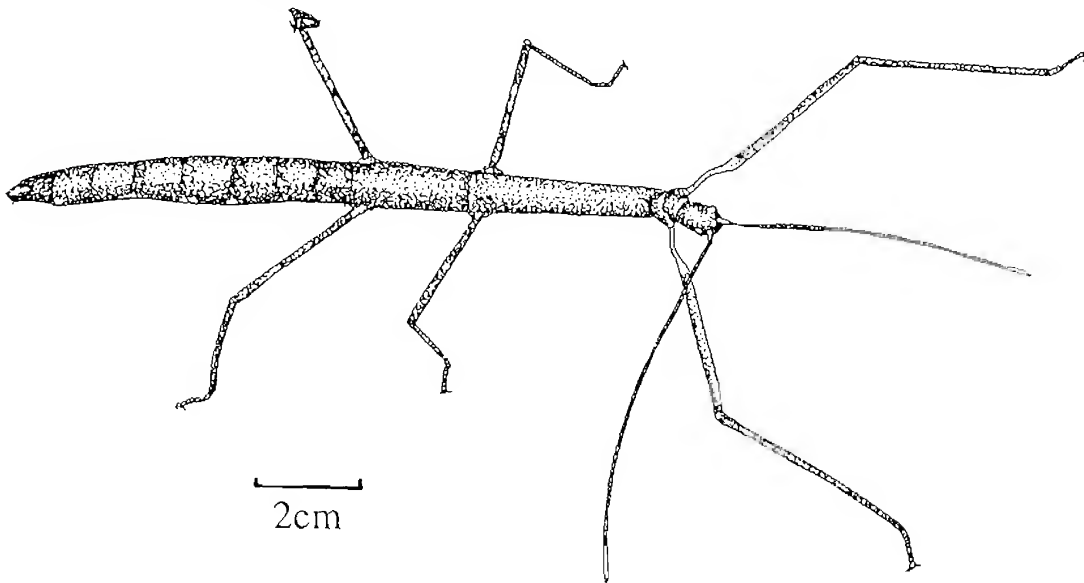


Figure 3. "*Dyme sp.*" Female found at Amazonia Lodge. The inside of the fore legs near the head was turquoise in colour, and the mouth parts were red.

Amazonia Lodge is in the Cultural Zone of the park, and consequently there were a lot of citrus trees interspersed with the young rainforest trees that were slowly reclaiming the area. Many of the plants were heavily insect-damaged, and it was only ten minutes into our first night walk that my wife spotted the first stick insect of the trip, a rather uninspiring small green nymph. However, several more sticks were soon found. The most common was

a species which looked very like a *Ocnophiloidea* sp. (Figure 2). These appeared either to be quite variable in colour, or to be of several closely related species, with some specimens being almost black with red legs and others a much lighter brown.

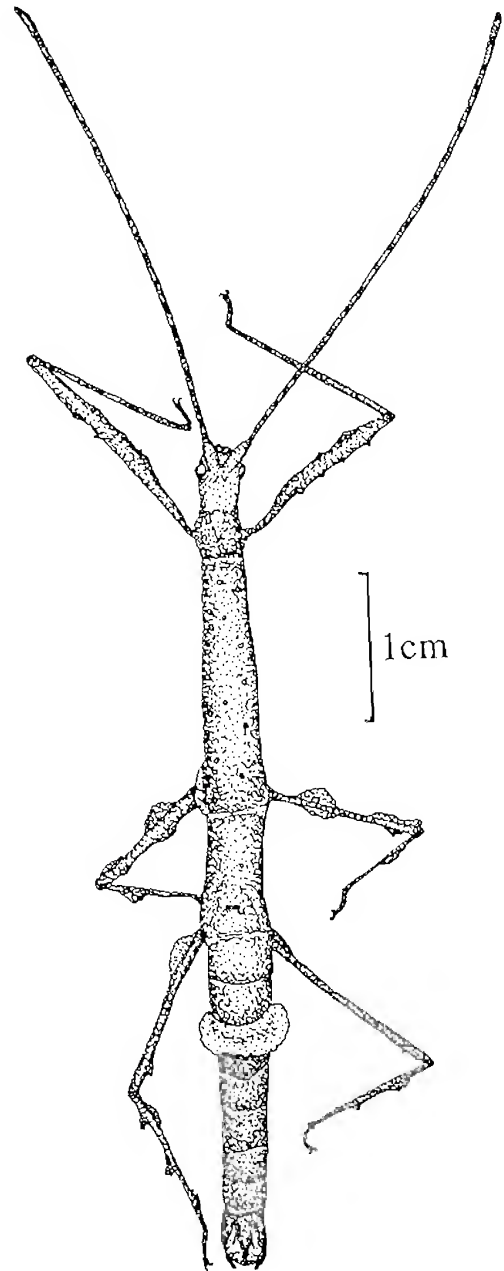
The largest insect we found was an adult female of what looked like a *Dyme* species. She was evenly brown, around 15cm long, with bright turquoise patches at the base of her forelegs, and a bright red mouth (Figure 3). Also we found a couple of flying species, quite *Paraphasma*- or *Pseudophasma*-like, one with brown wings and the other with bright yellow ones. We found a mating pair of the latter (?*Otyciphides* sp.?) flying around the lodge (still coupled) the following morning (Fig. 13).

The following day we descended by river to where the upper Madre de Dios river joins the river Manu at a small settlement called Boca Manu (at around 500m altitude) and our next night's accommodation in Cortinga Lodge. Here we were subjected to a violent thunderstorm which lasted most of the night and made us all very glad that we were not camping by the river!

The sudden drop in temperature caused by the storm brought the caiman out onto the sandbanks as we made our way by boat into the Reserved Zone of the park up the Manu River the following day. However, it also meant that that night we saw no phasmids at all around our camp that evening, and very few other insects.

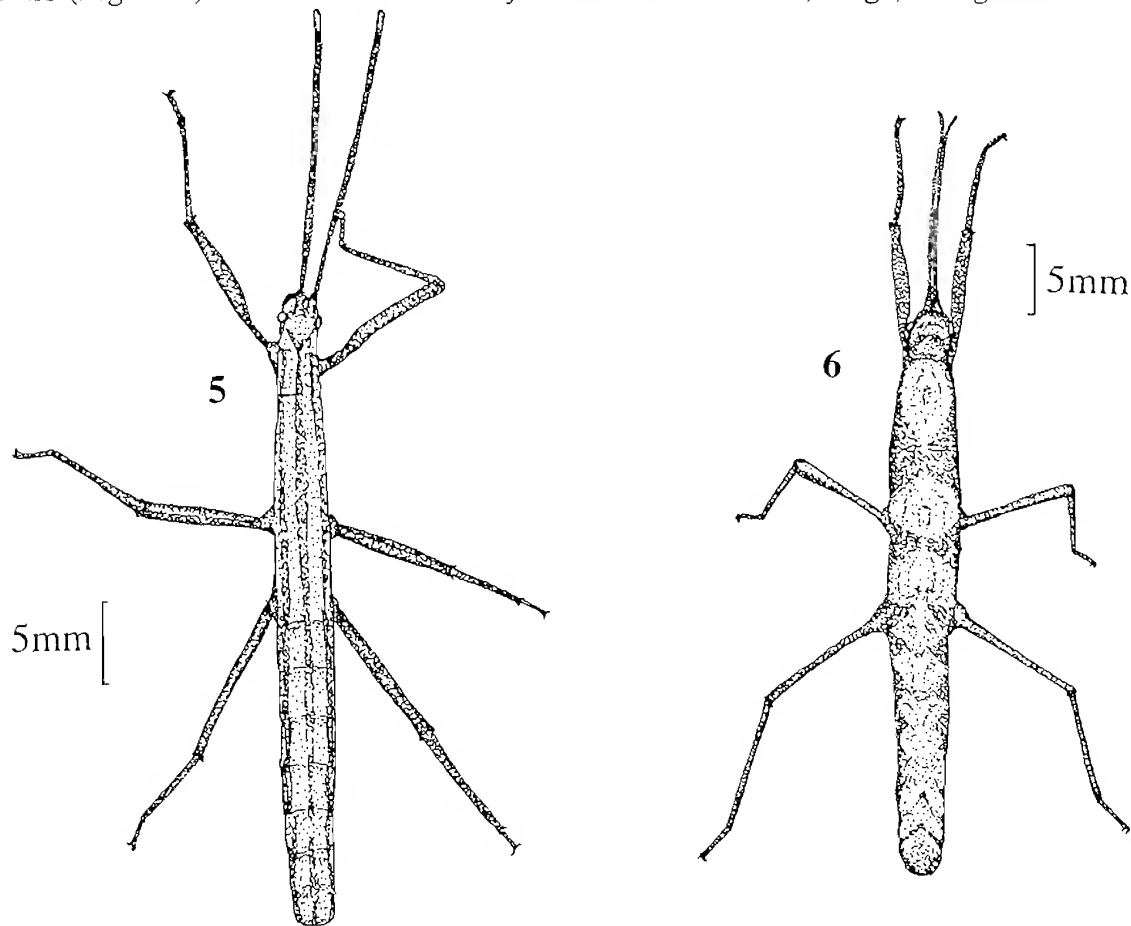
We were staying in tents pitched in a small clearing under the forest canopy in an area of floodplain forest, which is submerged by several metres of water in the wet season. After the first night's failure, I was pessimistic about finding any phasmids at all as I assumed that their eggs would get drowned or washed away in the floods. However, the following night, the temperature had increased to around 25°C and in two hours we found a variety of stick insects.

The first was a slender male, around 10cm long, dark brown with little yellow tubercles all over his thorax. The "*Ocnophiloidea*" were the most common again, however, and ranged from very smooth to having quite extensive foliose expansions on all their legs (Figure 4); the foliose expansions on the legs and abdomen in these insects were quite variable. Again, among the nymphs we found, there was a large variation in colour and patterning. Figures 5 and 6 show two colour forms found in the Reserve Zone: dull orange and black or brown stripes with black legs (Figure 5) and pale brown with white "bird dropping" markings



**Figure 4.** "*Ocnophiloidea ignavus* (Westwood)", female found within the Reserve Zone.

(Figure 6). We saw several "*Pseudophasma*" nymphs and a long brown female *Dyme*-like stick with her hind two pairs of legs bright green and sharp spines along the top of her thorax in pairs (Figure 7). We also found many varied bush crickets, frogs, and geckos.

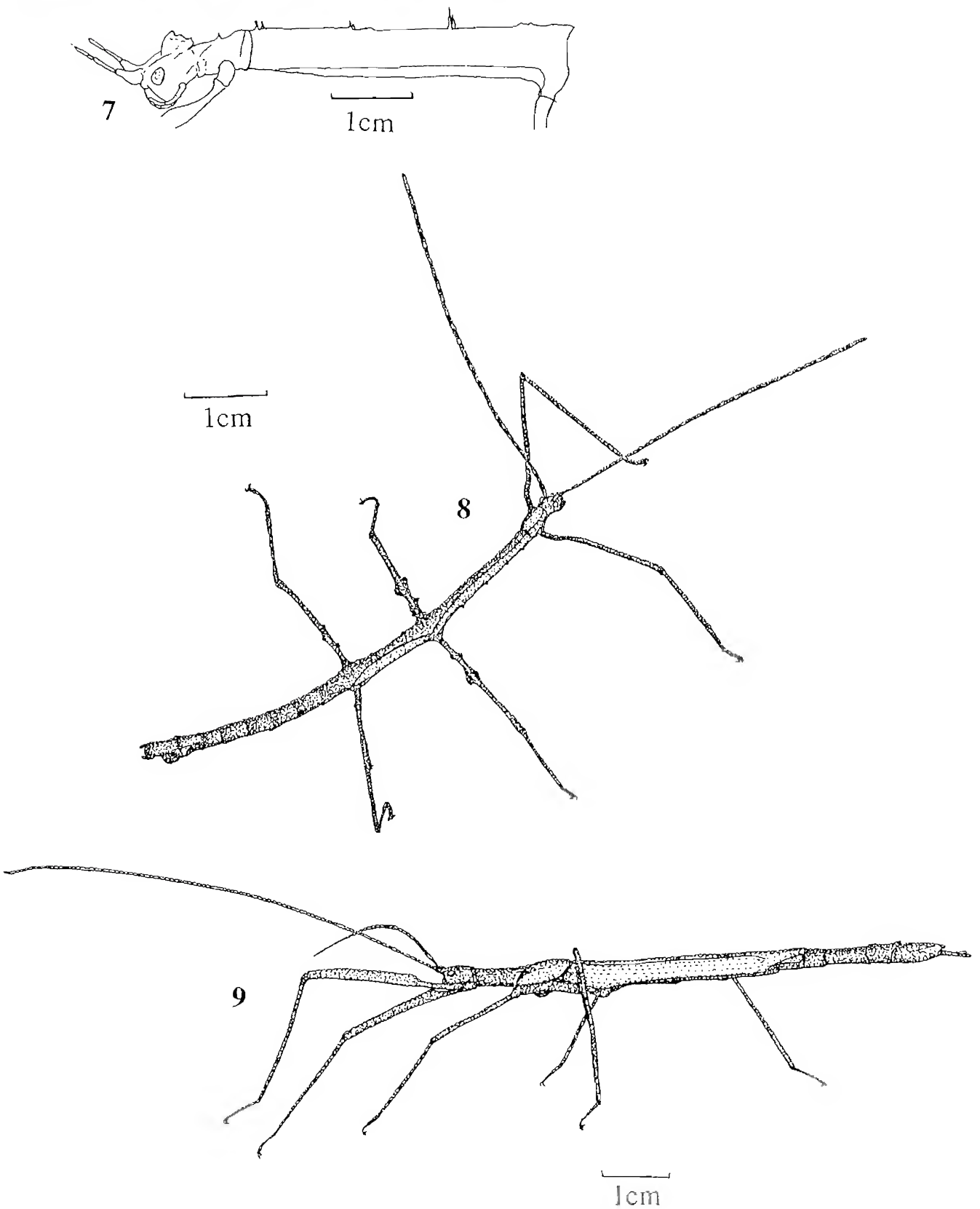


Figures 5 & 6. "*Ocnophiloidea* sp." Nymphs, showing the variability in colour form.

After spending the next day hunting for the giant otters of the region, we headed back down the Manu river to Cortinga Lodge for our last night in the forest. Having not been able to explore around the lodge on the first night, I was keen to go out one more time. Unfortunately there were no marked trails around the lodge, so we simply followed a logging path for a few hundred metres into the forest.

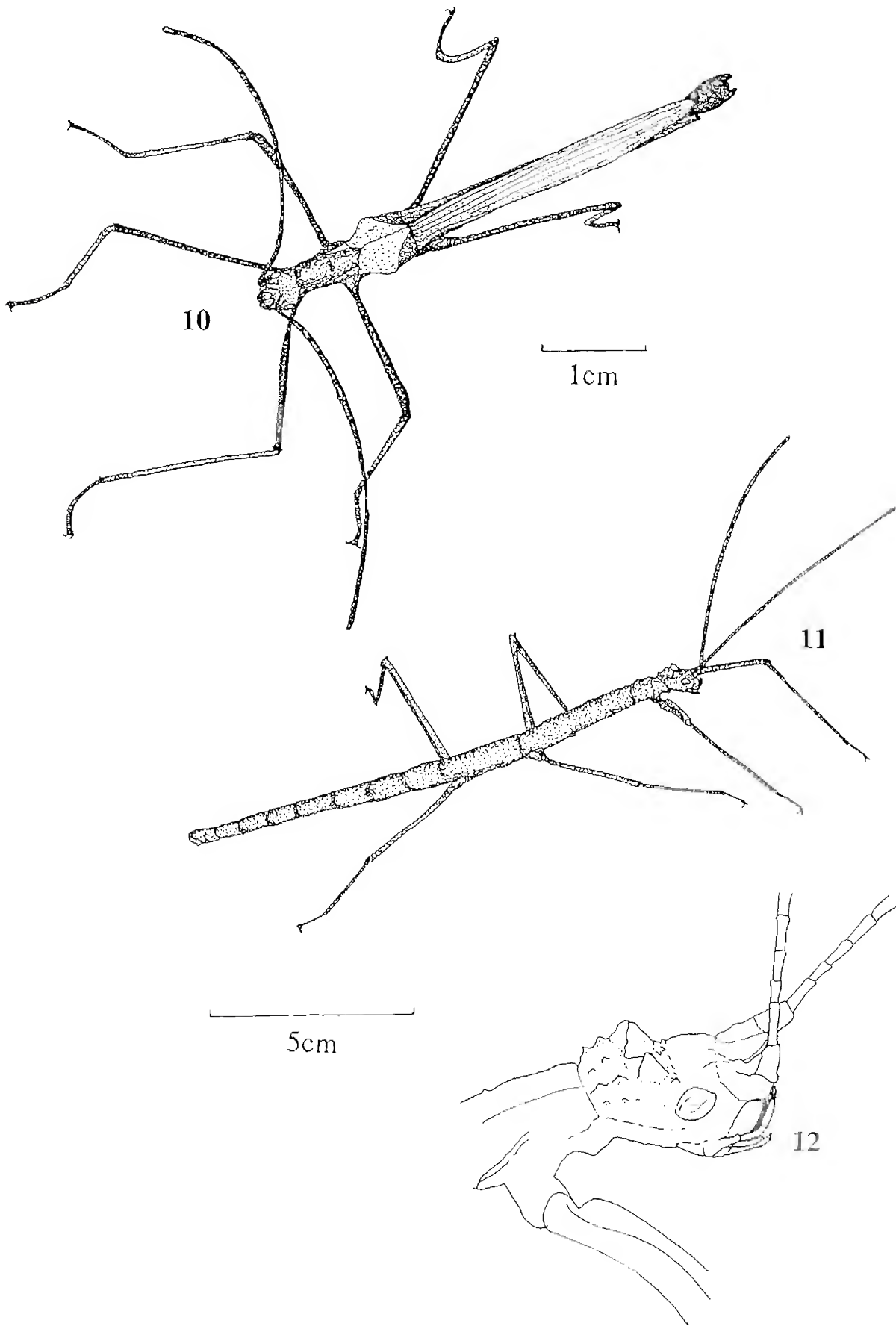
The "*Ocnophiloidea*" were the most common species again, and here they showed the greatest variety of foliose expansions on their legs and bodies. Even the males that we found (if indeed they were the same species) had little leafy expansions on their legs (Figure 8). There were a couple of "*Pseudophasma*", one with brown wings and one with bright orange wings and cream elytra (Figure 10), as well as another uniformly mid-brown flying species which looked rather like a large brown *Sipyloidea* species (?*Metriophasma* sp?, Figure 9). In addition, we found a large green female which looked rather like the brown and green one from the Manu campsite, but had two little yellow "horns" on her head and only small tubercles on her thorax (Figures 11 and 12). I found a nymph of the same species dying on a path the following day with the same coloration and the characteristic yellow horns.

Being on a guided tour in a World Heritage Zone did mean I couldn't collect any sticks or eggs to bring home. In addition, we spent the following week trudging through the snow around the shore of Lake Titicaca high in the Andes, so I doubt any livestock would have survived. The Manu National Park is certainly an excellent place to go insect hunting and



Figures 7-9.

- 7. "*Dyme* sp." Female found within the Reserve Zone.
- 8. "*Ocnophiloidea* sp." Male found at Cortinga Lodge.
- 9. "*Metriophasma* sp." Female found at Cortinga Lodge.

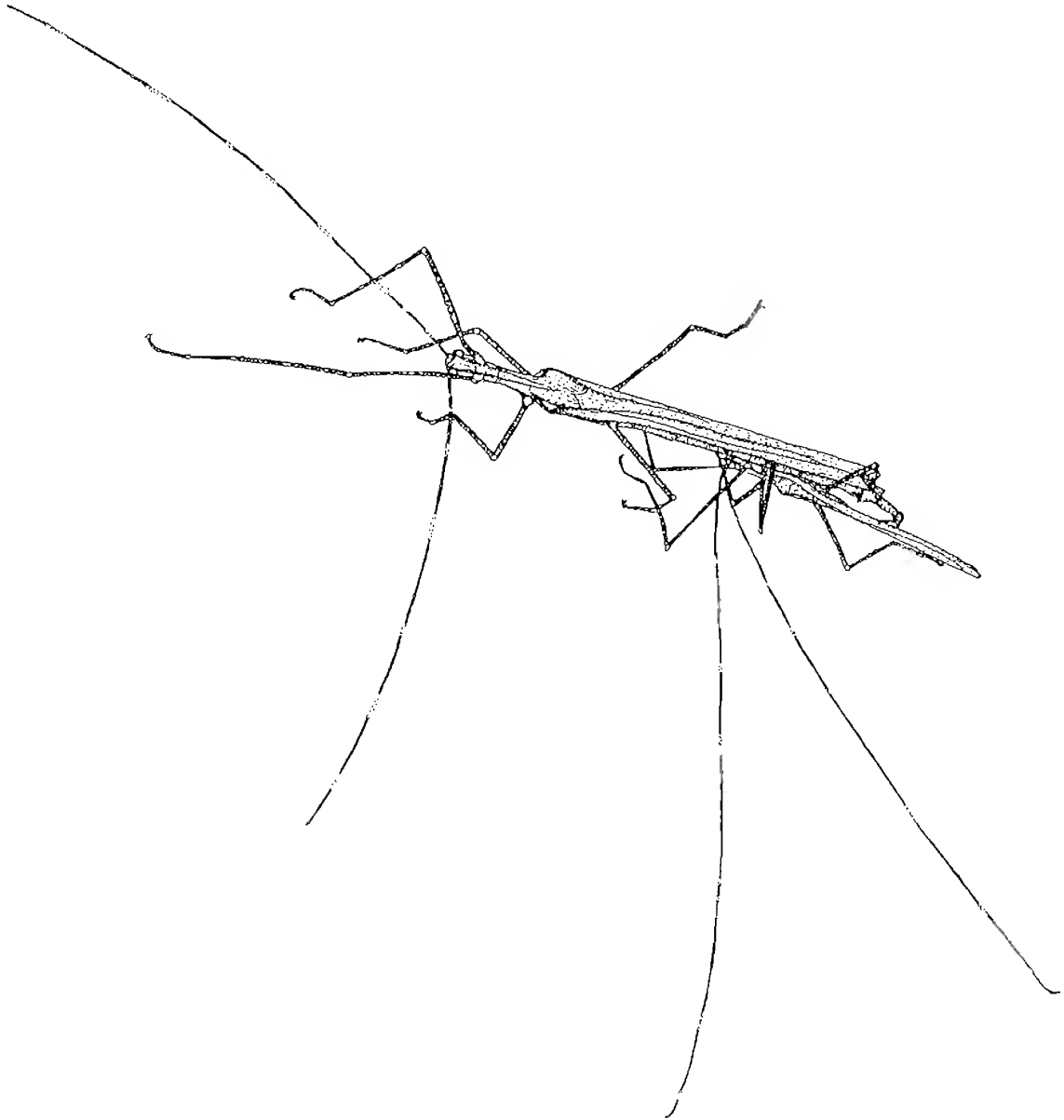


**Figures 10-12.**

10. "*Pseudophasma* sp." Found at Cortinga Lodge.  
11 & 12. Large green species found at Cortinga Lodge.



I expect there are many more attractive and interesting phasmids yet to be discovered in the area.



**Figure 13.** '*Olyciphides* sp.' Mating pair flying in the daytime around Amazonia Lodge.

I would like to thank Judith Marshall and Allan Harman for helping me to look through the collections in The Natural History Museum, London (BMNH) to try to identify some of the species from the trip. I would also like to thank our tour guide, Jessica, and my fellow travellers for being such excellent insect spotters. Please note that all names given in this article are "best guesses", given for descriptive purposes, but not necessarily taxonomically accurate. Similarly all sizes were approximated, not measured.

# Notes on *Lonchodes geniculosus* (Westwood, 1848) (Diapheromeridae: Lonchodinae)

Paul D. Brock & Francis Seow-Choen,

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## Abstract

*Phasma (Bacteria) geniculosum* Westwood, 1848 [*Lonchodes geniculosus* (Westwood)] is confirmed as a synonym of *Lonchodes geniculatus* Gray, 1835, contrary to a report in Hennemann (2003), which is based on another *Lonchodes* species, possibly originating from Myanmar.

## Key words

Phasmida, *Lonchodes geniculosus*, Myanmar, Peninsular Malaysia.

## Introduction

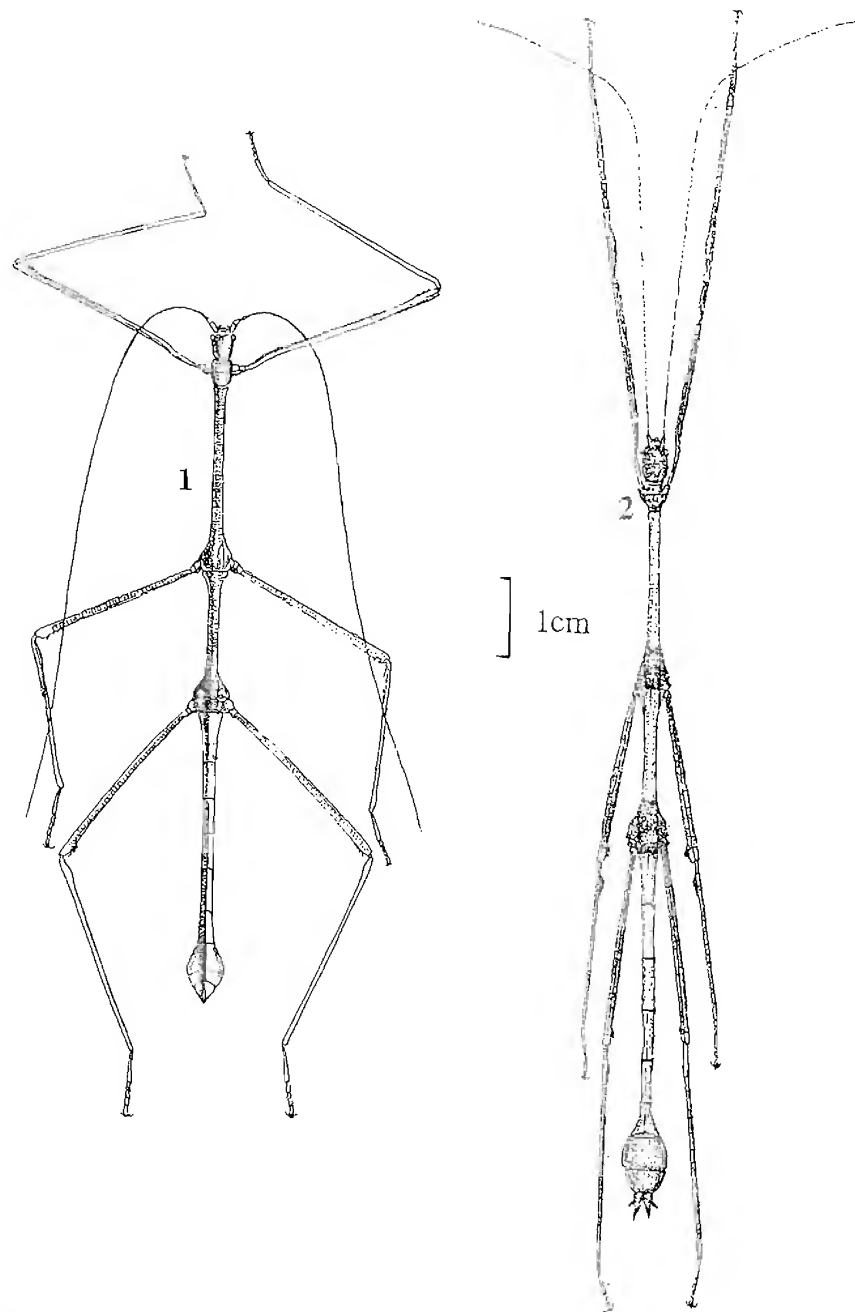
Hennemann (2003) removed *Phasma (Bacteria) geniculosum* Westwood, 1848 [*Lonchodes geniculosus* (Westwood)] from synonymy with *Lonchodes geniculatus* Gray, 1835. He also described and figured both sexes from Tenasserim, Myanmar, a locality regarded as doubtful due to probable errors in localities recorded by the supplier or collector (confirmed as doubtful by Hennemann, pers. com.).

## Remarks

The genus *Lonchodes* Gray, 1835 can be confusing, but comparison with Westwood's accurate drawing of the male of *L. geniculosus* from Prince of Wales Island (= Penang in Peninsular Malaysia) (fig 1) shows this differs from Hennemann's male *L. geniculosus* "from Myanmar" (fig. 2) in more than one respect. Whilst there are general similarities, both sexes clearly differ. The male in the Naturhistorisches Museum Wien (Vienna), which Hennemann attributed to *L. geniculosus* (which Brunner listed in the collection as *Lonchodes* sp., Penang) has been examined, and found to be typical of *L. geniculatus*. It is probable that Hennemann has not taken into account variability within males of *L. geniculatus* across its range in Peninsular Malaysia and Singapore. Hennemann described the *L. geniculosus* based on his specimens and not Westwood's holotype male in the Hope Entomological Collection, Oxford University Museum (OXUM), thus resulting in the present confusion.

Westwood's holotype male of *Phasma (Bacteria) geniculosum* has been examined in detail by both authors and it differs from Hennemann's species significantly. Westwood's brief description of his specimen is important and showed marked differences between his specimen and Hennemann's species. Westwood's description is reproduced here. "Phasma elongated, cylindrical, wingless, obscure brown, unarmed, the extremity of the meso- and metathorax suddenly and equally dilated and green; the head and prothorax simple, green, the thorax rather longer than the entire abdomen, the extremity of which is dilated and cleft, legs slender and green, the tips of all femora with a broad ring of red and internally armed with several minute spines, middle legs rather shorter but scarcely thicker than the rest, tarsi simple with the basal joint elongated." Westwood's *L. geniculatus* has a thorax which is longer than the abdomen and it is true of all our specimens from Peninsular Malaysia and Singapore but not Hennemann's species. Simple mathematics from Hennemann's table of measurement of his species showed that the longest possible abdomen is 53.4mm whilst the longest possible thorax is only 44.5mm. The extremity of the mesothorax and the metathorax are equally dilated in Westwood's specimen and our specimens of *L. geniculatus* but not in Hennemann's species which has a metathorax extremity which is broader than the extremity of the mesothorax. A further point to add is that the head of Westwood's specimen is thin with almost parallel sides and not broader than the prothorax as are all specimens of *L. geniculatus* unlike Hennemann's species which has a globular head. Hennemann has also not

taken into account intraspecific variations in his description of the differences in the mid femora of *L. geniculatus*. Not all our specimens of the male of *L. geniculatus* have a prominent spine on the superior carina of the mid femora. We have several specimens in our collection where the mid femora of *L. geniculatus* does not possess any spine on its superior aspect.



Figures 1 & 2.

1. *L. geniculatus* (Westwood) - male (from Westwood, 1848)
2. *L. geniculatus* Hennemann, not Westwood - male (from Hennemann, 2003)

Penang is the type locality of Westwood's phasmid. The second author travels extensively in Penang looking for phasmids and is well acquainted with museum and private collections of Penang phasmids. Whilst *L. geniculatus* is plentiful both in the wild in Penang and in these collections, he had never come across a specimen that looks remotely like Hennemann's species.

As part of research on the phasmid fauna of Peninsular Malaysia, Brock's catalogue of species (1995) details confirmed records of type material. The holotype of *L. geniculatus* is in the Museum of Victoria, although Hennemann stated 'not traced', after Bragg (2001). The holotype male clearly matching Gray's description is in the Curtis collection, an unlabelled male to the right of a male type *Ctenomorpha tessulata*. It is hoped that confirmed details of the type localities (Otte & Brock, 2003) should assist researchers to trace and examine type specimens. In view of our comments above, *Phasma (Bacteria) geniculosum* Westwood (not Hennemann) is confirmed as a synonym of *L. geniculatus* Gray.

The first author's research in archive material at the Hope Entomological Museum, Oxford University Museum, confirms that Westwood was familiar with Curtis' type material, indeed the archives include beautiful, but only partly coloured, unpublished paintings of some phasmids in the Curtis collection.

We have to reject therefore Hennemann's account of *Lonchodes geniculosus* (Westwood, 1848) as being different from *Lonchodes geniculatus* Gray, 1835.

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# A key to the genera of the Phasmatodea: Areolatae (Insecta)

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## Abstract

Following the systematic arrangement established by Zompro (2004), a key is presented to all genera of the Phasmatodea: Areolatae (Insecta). For the first time, it allows a determination of eggs down to the generic level.

## Key words

Phasmida, Phasmatodea, systematics, phylogeny, key, genera, eggs.

## Introduction

The systematic arrangement of and the phylogenetic relationships within the insect order Phasmatodea have not been sufficiently researched. The phylogeny of the Areolatae was clarified and discussed by Zompro (2004). As a result, the Phasmatodea is subdivided into the suborders Agathemerodea with the single genus *Agathemera* Stål, 1875 and the Verophasmatodea, which contain all other Recent phasmids and the extinct Archipseudophasmatidae, which are only known from Eocene Baltic amber. Within Verophasmatodea, the Phyllioidea with the single family Phylliidae is the sister group to all other Recent phasmids of the Areolatae and the Anareolatae. In all probability, the Anareolatae are simply derived Areolatae and all of their subgroups can be attached to subtaxa of Areolatae. The attachment of the families of Areolatae is as follows:

Phasmatodea	= Verophasmatodea + Agathemerodea.
Verophasmatodea	= (Areolatae + Anareolatae) + Phyllioidea.
Areolatae	= (Aschiphasmatoidea + (Pseudophasmatoidea + Bacilloidea)).
Aschiphasmatoidea	= Damasippoididae + Prisopodidae + Aschiphasmatidae.
Pseudophasmatoidea	= Pseudophasmatidae + Heteronemiidae.
Bacilloidea	= Heteropterygidae + Anisacanthidae + Bacillidae.

Four generic synonyms have been traced in that work: *Brachyelena* Hebard, 1933 is a synonym of *Decidia* Stål, 1875, *Harpuna* Redtenbacher, 1906 of *Xerosoma* Audinet-Serville, 1831, *Phaeophasma* Redtenbacher, 1906 of *Dajaca* Brunner von Wattenwyl, 1893 and *Pinnispinus* Brock, 1995, of *Ommatopseudes* Günther, 1942.

## Keys to genera of Phasmatodea: Areolatae

### Key to Families: Adults

1. Abdominal segment I not fused with metanotum; tarsi pseudotrimeric (Timematodea)  
- Abdominal segment I fused with metanotum . . . . . 2. Phasmatodea
2. Meso- and metatibiae with area apicalis . . . . . 3.  
- Meso- and metatibiae without area apicalis . . . . . Anareolatae
3. Area apicalis membranous, with a sclerotized area apically . . . . . Agathemeridae  
- Area apicalis completely sclerotized . . . . . 4.
4. Tergites and sternites of abdomen foliaceously dilated; leaf like . . . . . Phylliidae  
- If abdomen dilated, tergites folded laterally; sternites weakly dilated . . . . . 5.
5. Area apicalis with a spine or prosternum with three sensory areas . . . . . 6.  
- Area apicalis not spinose, prosternum with one sensory area at best . . . . . 7.
6. Profemora straight or prosternum with at least two sensory areas . . Heteropterygidae  
- Profemora curved and compressed basally, without sensory areas . . Anisacanthidae
7. Antennae at best as long as profemora . . . . . Bacillidae  
- Antennae considerably longer than profemora . . . . . 8.
8. ♂ metasternum with a segmented appendix in an excavation, ♀ metabasitarsus serrate

- ventrolaterally . . . . . Damasippoididae: *Damasippoides*
- Different . . . . . 9.
- 9. Meso- and metafemora not carinate ventromedially and profemora distinctly shorter than head, pronotum and mesonotum combined . . . . . 10.
- Different; if meso- and metafemora not carinate ventromedially, then profemora longer than head, pronotum and mesonotum combined . . . . . 11.
- 10. Tegmina present, scale-shaped or longer . . . . . Prisopodidae
- Tegmina spiniform, filiform or absent . . . . . Aschiphasmataidae
- 11. Profemora with three edges, edges lamellate . . . . . Heteronemiidae
- Profemora with four edges . . . . . Pseudophasmataidae

**Key to Families: Eggs**

- (1. Micropylar plate small, micropyle placed near anterior margin of capsule . . . . . Timematodea)
- If micropylar plate small, then micropyle not near anterior margin of capsule . . . . . Phasmata: Areolatae: 2.
- 2. Capsule cork-like, internal micropylar plate surrounded by fringes . . . . . Phylliidae
- Capsule and internal micropylar plate different . . . . . 3.
- 3. Capitulum present . . . . . 4.
- Capitulum absent . . . . . 5.
- 4. Micropylar plate elongate oval, half as long as capsule, capsule strongly shiny . . . . . Damasippoididae: *Damasippoides*
- Micropylar plate lanceolate, more than half as long as capsule, median line present . . . . . Bacillidae: Macyniinae: *Macynia*
- 5. Operculum inserted at an angle of 45°; micropylar plate projecting anteriorly . . . . . *Pseudodatames*
- Egg different, micropylar plate not projecting anteriorly . . . . . 6.
- 6. Internal micropylar plate open . . . . . 7.
- Internal micropylar plate closed . . . . . 11.
- 7. Micropylar plate expanded at least posterolaterally . . . . . Heteropterygidae
- Micropylar plate different . . . . . 8.
- 8. Capsule long, cylindrical, micropylar plate almost as long as capsule Agathemeridae
- If capsule cylindrical, micropylar plate shorter . . . . . 9.
- 9. Capsule with a smooth, longitudinal area ventrally . . . . . Prisopodidae
- Capsule not differentiated ventrally . . . . . 10.
- 10. Micropylar plate small, micropyle inserted close to polar area . . . . . Heteronemiidae
- Micropyle inserted closer to the middle of capsule . . . . . Pseudophasmataidae
- 11. Micropylar plate surrounding capsule completely . . . . . Aschiphasmataidae
- Micropylar plate distinctly shorter . . . . . 12.
- 12. Capsule not distinctly marginated anteriorly . . . . . Anisacanthidae
- Capsule with an elevated margin anteriorly; if margin indistinct, then capsule with irregular ridges . . . . . Bacillidae

## Aschiphasmatoidea

### Prisopodidae

#### Key to Genera: Adults

1. Tegmina long, radial vein of alae branched . . . . . 2. Prisopodinae
- Tegmina scale-shaped, radial vein of alae not branched . . . . . 6. Korinninae
2. Tegmina projecting beyond abdominal segment II . . . . . 3. Prisopodini
- Tegmina distinctly shorter . . . . . 5. Paraprisopodini
3. Profemora serrate ventrally . . . . . *Prisopus*
- Profemora smooth ventrally . . . . . 4.
4. Head flat, body and tegmina greyish. Anal fan of alae at best weakly marginated . . . . . *Dinelytron*
- Head globose, body and tegmina often colourful. Anal fan marginated posteriorly . . . . . *Damasippus*
5. Profemora serrate ventrally, head and thorax spinose . . . . . *Paraprisopus*
- Profemora smooth ventrally, abdomen strongly elongated . . . . . *Melophasma*
6. Profemora curved basally, alae at best tinted . . . . . *Korinnis*
- Profemora straight basally, alae strongly coloured . . . . . *Kalocorinnis*

#### Key to genera: Eggs

1. Egg capsule circled by a sharp ridge laterally . . . . . *Kalocorinnis*
- Egg capsule not circled by a sharp ridge laterally . . . . . 2.
2. Operculum inserted in anterior end of capsule . . . . . *Paraprisopus*
- Operculum inserted at a distinct angle . . . . . 3.
3. Capsule cylindrical, operculum inserted in anterior half of dorsal surface . . . . . *Prisopus*
- Operculum inserted at an angle of about 45° . . . . . *Damasippus*

### Aschiphasmatidae

#### Key to Genera: Adults

1. Profemora undulate ventrally . . . . . Xylobistinae: *Xylobistus*
- Profemora smooth ventrally . . . . . 2. Aschiphasmatinae
2. Ungues not serrate . . . . . Dajacini: *Dajaca*
- Ungues serrate . . . . . 3. Aschiphasmatini
3. Profemora curved and compressed basally, if not, mesonotum with a spine . . . . . 4.
- Profemora straight, mesonotum without posteromedial spine . . . . . 14. *Aschiphasma*-group
4. Pronotum with a spine medioposteriorly . . . . . 5.
- Pronotum without spine medioposteriorly . . . . . 6.
5. Pronotum flat, not strikingly armed . . . . . *Dinophasma*
- Pronotum with two large tubercles anteriorly . . . . . *Ommatopseudes*
6. Pronotum armed with two horns anteriorly . . . . . *Parabrosoma*
- Pronotum not armed . . . . . 7.
7. In alae anal fan of uniform colour . . . . . 8. *Abrosoma*-group
- In alae anal fan with broad margin posteriorly . . . . . 11. *Eurybistus*-group
8. Tegmina absent . . . . . *Abrosoma*
- Tegmina present . . . . . 9.

- 9. Femora and tibiae unarmed . . . . . *Anoplobistus*
- Ventral carinae of femora at least with some small spines . . . . . 10.
- 10. Tegmina elongate triangular . . . . . *Presbistus*
- Tegmina long and filiform . . . . . *Yongtsuius*
- 11. Body green . . . . . *Chlorobistus*
- Body brownish . . . . . 12.
- 12. Cerci of male dorsoventrally flattened . . . . . *Eurybistus*
- Cerci of male not dorsoventrally flattened . . . . . 13. *Kerabistus*
- 13. Subgenital plate of ♀ without apical notch . . . . . *K. (Kerabistus)*
- Subgenital plate of ♀ with apical notch . . . . . *K. (Rhadinobistus)*
- 14. Pronotum longer than wide . . . . . 15.
- Pronotum transverse . . . . . *Aschiphasma*
- 15. At least alae present . . . . . 16.
- Apterous . . . . . *Leurophasma*
- 16. Tegmina present . . . . . *Orthomeria*
- Tegmina absent . . . . . *Coloratobistus*

**Key to Genera: Eggs**

- 1. Capsule round in lateral aspect, slightly depressed, strongly shiny, not setose . . . . . *Xylobistus*
- Capsule mostly longer than high, if round, then more strongly depressed . . . . . 2.
- 2. Capsule rounded trapezoidal in lateral aspect . . . . . 8.
- Capsule oval or round in lateral aspect . . . . . 3.
- 3. Capsule slightly depressed, round in lateral aspect and lateral surfaces convex . . . . . *Aschiphasma*
- Capsule more strongly depressed, more oval, or lateral surfaces not convex . . . . . 4.
- 4. Capsule oval in lateral aspect . . . . . 5.
- Capsule at best slightly longer than high . . . . . *Orthomeria*
- 5. Capsule strikingly smooth and shining . . . . . *Coloratobistus*
- Capsule not shining, often setose . . . . . 6.
- 6. Operculum inserted at a distinct angle . . . . . *Ommatopseudes*
- Capsule oval in lateral aspect, operculum inserted roundly, without angle . . . . . 7.
- 7. Capsule strongly setose . . . . . *Dinophasma*
- Capsule weakly setose . . . . . *Dajaca*
- 8. Capsule at best slightly longer than high . . . . . *Presbistus* group
- Capsule distinctly longer than high . . . . . *Chlorobistus* group

**Pseudophasmatoidea**

**Pseudophasmatidae**

**Key to Subfamilies: Adults**

- 1. Meso- and metafemora without ventromedian carina; often colourful . . . . . Stratocleinae
- Meso- and metafemora with a distinct ventromedian carina, if this is indistinct, then profemora broader, at best as long as head, pro- and mesonotum combined . . . . . 2.
- 2. Femora and tibiae lamellate and / or serrate dorsally and ventrally . . . . . Xerosomatinae
- Femora and tibiae not serrate, sometimes broadened in apical one-third . . . . . Pseudophasmatinae



**Key to Subfamilies: Eggs**

1. Capsule distinctly flattened laterally, surface without ridges . . . . . Stratocleinae
- Capsule more oval or round in cross-section, not distinctly flattened laterally . . . . . 2.
2. Micropylar plate, at least anteriorly, projecting over capsule . . . . . 3. Xerosomatinae
- Micropylar plate inserted in dorsal surface of capsule . . . . . 4. Pseudophasmatinae

**Xerosomatinae****Key to Genera: Adults**

1. Exterodorsal and -ventral edges of profemora strikingly lamellate or with lobes dorsally . . . . . 3. *Prexaspini*
- Exterodorsal and -ventral edges of profemora not lamellate, without lobes dorsally . . . . . 2.
2. Femora and tibiae with striking groups of bristles . . . . . Setosini: *Setosa*
- Femora and tibiae without striking groups of bristles . . . . . 12. Xerosomatini
3. Alae of uniform colour or margined, not tessellate . . . . . 10.
- Alae tessellate, or apterous . . . . . 4.
4. In ♀ profemora strongly serrate, in ♂ mesonotum slender and elongated, not wider than head . . . . . 9.
- Profemora at best bearing few, small teeth, in ♂ mesonotum as wide as head . . . . . 5.
5. Mesonotum round in cross-section, not flattened dorsally . . . . . 7.
- Mesonotum strikingly flattened dorsally, margined by distinct carinae . . . . . 6. *Metriophasma*
6. Tegmina elongated oval in shape; body slenderer . . . . . *M. (Metriophasma)*
- Tegmina rounded rhombic in shape; body broader . . . . . *M. (Acanthometriotes)*
7. Mesonotum about three times as long as pronotum . . . . . *Planudes*
- Mesonotum distinctly shorter . . . . . 8.
8. Mesonotum not spinose. Tegmina without large spine . . . . . *Periodes*
- Mesonotum with spines. Tegmina with a large spine . . . . . *Olinta*
9. Meso- and metafemora with distinct carina ventromedially . . . . . *Isagoras*
- Ventromedian carinae of meso- and metafemora indistinct . . . . . *Periphloea*
10. Anal fan of alae uniformly coloured . . . . . 11. *Prexaspes*
- Anal fan of alae with broad, darker margin . . . . . *Oestrophora*
11. Anterolateral edges of tegmina produced as large teeth . . . . . *P. (Prexaspes)*
- Anterolateral edges of tegmina produced as acute spines . . . . . *P. (Elasia)*
12. Occiput at best with some tubercles . . . . . 13.
- Occiput with diverging spines or lobes (if indistinct, habitus cricket-like) . . . . . 14.
13. Pronotum bearing prominent spines or horns posteriorly; winged . . . . . *Xerosoma*
- Pronotum at best granulate or tuberculate; apterous . . . . . *Xera*
14. Less than 35mm; abdomen with raised median line; habitus cricket-like . . . . . 19. *Grylloclonia*-group
- At least 35mm; dorsomedial line on abdomen interrupted or absent . . . . . 15. *Acanthoclonia*-group
15. Profemora distinctly curved and compressed basally . . . . . 16.
- Profemora straight, at best slightly compressed basally . . . . . 18.
16. Scapus strikingly armed or carinate dorsomedially . . . . . 17.
- Scapus not armed or carinate dorsomedially . . . . . *Xylospinodes*
17. Scapus with raised carina dorsomedially . . . . . *Creoxylus*
- Scapus with definite spines . . . . . *Acanthoclonia*

- 18. Scapus not armed . . . . . *Parobrimus*
- Scapus armed, in females genital valves strongly elongated . . . . . *Mirophasma*
- 19. Mesonotum trapezoidal, wider anteriorly than posteriorly . . . . . 20.
- Lateral margins of mesonotum parallel, prosternum with sensory area . . . . . *Pachyphloea*
- 20. Abdominal segments transverse, more than 4 times as wide as long . . . . . *Grylloclonia*
- Mesonotal median carina elevated, projecting and furcate anteriorly . . . . . *Dicranoclonia*

**Key to Genera: Eggs**

- 1. Micropylar plate slightly projecting, at least inserted in capsule posteriorly . . . . . 2. Prexaspiini
- Micropylar plate and area around it strongly projecting . . . . . 4. Xerosomatini
- 2. Micropylar plate stronger projecting anteriorly than posteriorly . . . . . *Metriophasma*
- Micropylar plate evenly projecting . . . . . 3.
- 3. Micropylar plate surrounded by a complete margin . . . . . *Isagoras*
- Margin of micropylar plate indistinct median line . . . . . *Planudes*
- 4. Capsule only slightly depressed laterally, with prominent, irregular ridges . . . . . *Xerosoma*
- Capsule distinctly depressed laterally . . . . . 5.
- 5. Capsule very small, grey, operculum with deep hole in its centre . . . . . *Xera*
- Operculum without deep hole in its centre . . . . . 6.
- 6. Operculum with a long ridge medially . . . . . *Xylospinodes*
- Operculum without ridge medially . . . . . 7.
- 7. Surface of capsule punctured, operculum with a broad ring exteriorly . . . . . *Creoxylus*
- Surface of capsule with tubercles or operculum with a broad ring and a cone . . . . . 8.
- 8. Capsule tuberculate . . . . . *Acanthoclonia*
- Operculum with a broad ring exteriorly and a cone centrally . . . . . *Grylloclonia*

**Pseudophasmatinae**

**Key to Genera: Adults**

- 1. Profemora of both sexes distinctly longer than head, prothorax and mesothorax combined . . . . . 2. Pseudophasmatini
- Profemora at best as long as head, prothorax and mesothorax combined . . . . . 10. Anisomorhini
- 2. Meso- and metafemora broadened apically; antennomeres club shaped . . . . . 3.
- Meso- and metafemora and antennomeres built normally . . . . . 5.
- 3. Winged, profemora curved basally . . . . . 4.
- Apterous, profemora straight basally . . . . . *Paranisomorpha*
- 4. Posterolateral edges of abdominal segments not projecting . . . . . *Reticulonigrum*
- Posterolateral edges of abdominal segments projecting . . . . . *Ignacia*
- 5. Colourful, with yellow wings, body smooth, slightly shining . . . . . *Tithonophasma*
- Wings brown . . . . . 6.
- 6. Profemora straight basally . . . . . 7.
- Profemora curved and compressed basally . . . . . 8.
- 7. Alae fully developed, projecting beyond abdominal segment VIII . . . . . *Pseudolcypoides*
- Alae abbreviated, distinctly shorter; body robust . . . . . *Decidia*
- 8. In ♂ abdominal sternite IX on the right with long appendix dorsolaterally; in ♀ tegmina short, only slightly covering bases of alae . . . . . 9.
- In ♂ abdominal sternite IX on the right without long appendix dorsolaterally; in ♀

- tegmina scale shaped, covering bases of alae . . . . . *Alloeophasma*
9. Alae fully developed, mesonotum with a median line . . . . . *Pseudophasma*  
 - Mesonotum lacking median line; alae scale shaped and covered by tegmina . . . . .  
 . . . . . *Neophasma*
10. Body strikingly smooth, often colourful and shining . . . . . 14. *Anisomorpha* group  
 - Body not shining, greyish or brownish, rarely partially spinulose . . . . .  
 . . . . . 11. *Urucumania* group
11. Profemora more or less straight . . . . . 13.  
 - Profemora distinctly curved and compressed basally . . . . . 12.
12. Tegmina present, with striking, often colourful, net-like venation; in ♂ sternite IX on  
 the right with long appendix dorsolaterally . . . . . *Urucumania*  
 - Tegmina present, rudimentary or totally lacking, greyish or brownish, not colourful,  
 with simple venation; in ♂ abdominal sternite IX on the right without long appendix  
 dorsolaterally . . . . . *Malacomorpha*
13. Antennomeres simple; in ♂ abdominal sternite IX on the right with long appendix  
 dorsolaterally . . . . . *Peruphasma*  
 - Antennomeres slightly club-shaped; in ♂ lateral edges of abdominal segment X  
 elongated and projecting . . . . . *Columbiophasma*
14. Mesonotum distinctly more than twice as long as pronotum; winged *Pteranisomorpha*  
 - Mesonotum at best twice as long as pronotum; wings reduced . . . . . 15.
15. Profemora slightly curved and compressed basally; third antennomere at best as long  
 as pedicellus; body shining; meso- and metafemora not carinate medioventrally . . .  
 . . . . . *Anisomorpha*  
 - Profemora straight; third antennomere longer than pedicellus . . . . . 16.
16. In ♂ lateral edges of abdominal tergite IX elongated and projecting; body of ♀ more  
 elongated . . . . . *Autolyca*  
 - In ♂ lateral edges of abdominal tergite IX not projecting; ♀ strikingly cricket-like 17.
17. Abdominal tergites II-VII smooth . . . . . *Monticomorpha*  
 - Abdominal tergites II-VII with a small hump posteromedially . . . . . *Atratomorpha*

**Key to Genera: Eggs**

1. Micropylar plate circular, about as high as wide . . . . . 2. Pseudophasmatini  
 - Micropylar plate distinctly higher than wide, cordiform or oval . . . . . 6. Anisomorphini
2. Capsule with prominent, irregular ridges . . . . . 3.  
 - Capsule with less prominent, slenderer ridges, rectangular or oval . . . . . 5.
3. Ridges narrower than areas surrounded by them . . . . . 4.  
 - Ridges broader than areas surrounded by them . . . . . *Neophasma*
4. Ridges connected . . . . . *Reticulonigrum*  
 - Ridges often interrupted . . . . . *Pseudophasma*
5. Capsule oval in shape . . . . . *Tithonophasma*  
 - Dorsal and ventral surface of capsule parallel . . . . . *Pseudolcyphides*
6. Micropylar plate with broad, angled margin, anterior part impressed *Malacomorpha*  
 - Capsule at best with round, less prominent margin . . . . . 7.
7. Micropylar plate without high ridges . . . . . 8.  
 - Micropylar plate with prominent, irregular ridges . . . . . 10.
8. Micropylar plate more lanceolate in shape . . . . . 9.  
 - Micropylar plate more oval in shape . . . . . *Monticomorpha*
9. Egg capsule slightly granulose . . . . . *Autolyca*  
 - Egg capsule almost smooth . . . . . *Peruphasma*

- 10. Micropylar plate narrowed and more or less acute anteriorly . . . . . 11.
- Micropylar plate semicircular anteriorly . . . . . *Urucumania*
- 11. Operculum with a closed, circular ridge . . . . . *Pteranisomorpha*
- Operculum with a cone in the middle . . . . . *Anisomorpha*

### Stratocleinae

#### Key to Genera: Adults

- 1. Profemora almost straight exteriorly, at best slightly curved inwards . . . . . 2.
- Profemora distinctly curved and compressed basally . . . . . 5.
- 2. In alae, anal fan of uniform colour . . . . . 3.
- Anal fan with a whitish, translucent area basally, broadly margined . . . . . 4.
- 3. Mesonotum spinose . . . . . *Euphasma*
- Mesonotum lacking spines . . . . . *Eucles*
- 4. Mesonotum as long as pronotum, head round, slightly globose . . . . . *Stratocles*
- Mesonotum distinctly longer than pronotum . . . . . *Parastratocles*
- 5. Body strikingly shining, alae of ♀ abbreviated . . . . . *Anisa*
- Body at best slightly shining, alae of ♀ fully developed . . . . . 6.
- 6. Dorsal carinae of profemora of same size, indistinct or absent . . . . . 8.
- Interodorsal carina of profemora, especially in ♀, strongly raised . . . . . 7.
- 7. Tegmina flat, comparatively long . . . . . *Chlorophasma*
- Tegmina short, shouldered, shoulders sometimes pointed . . . . . *Paraphasma*
- 8. Mesonotum only slightly longer than pronotum . . . . . 9.
- Mesonotum more than 1.5 times as long as pronotum . . . . . 10.
- 9. Head longer than wide, mesonotum slightly longer than pronotum . . . *Anthericonia*
- Head about as long as wide, mesonotum longer than pronotum . . . . . *Brizoides*
- 10. Mesonotal median line produced as impression or two parallel ridges . . . . . 11.
- Mesonotal median line not impressed, profemora elongate, slender . . . . *Olcyphides*
- 11. Edges of all femora rounded dorsally and ventrally . . . . . *Holcooides*
- Profemora with distinct edges or median longitudinal impression . . . . . 12.
- 12. Dorsal carinae of meso- and metafemora indistinct or rounded . . . . . 13.
- Meso- and metafemora with carinae or median impression dorsally . . . . . 14.
- 13. Meso- and metatibiae with indistinct carinae dorsally, not round . . . . . *Holca*
- Meso- and metatibiae round dorsally . . . . . *Tenerella*
- 14. Meso- and metatibiae round dorsally . . . . . *Antherice*
- Meso- and metatibiae at least indistinctly carinate dorsally, not round . . . . . 15.
- 15. Posterior margin of tegmina round . . . . . *Agrostia*
- Tegmina pointed roundly posteriorly . . . . . *Citrina*

#### Key to Genera: Eggs

- 1. Capsule strongly setose . . . . . *Paraphasma*
- Surface of capsule not setose . . . . . 2.
- 2. Lateral surfaces of capsule impressed . . . . . *Holca*
- Capsule not impressed laterally . . . . . 3.
- 3. Capsule strikingly elongate, more than 3 times as long as high . . . . . *Citrina*
- Capsule distinctly shorter and more compact . . . . . 4.
- 4. Capsule light brown, strongly depressed laterally . . . . . *Parastratocles*
- Capsule medium brown, only slightly depressed laterally . . . . . *Stratocles*

## Heteronemiidae

### Key to Genera: Adults

1. Median segment at least as long as metanotum . . . . . 2. *Canuleius* group
- Median segment distinctly shorter than metanotum . . . . . 5. *Heteronemia* group
2. Mesonotum more than 4 times as long as pronotum . . . . . *Canuleius*
- Mesonotum less than 3 times as long as pronotum . . . . . 3.
3. Mesonotum lacking definite spines . . . . . *Pygirhynchus*
- Mesonotum spinose . . . . . 4. *Ceroys*
4. Mesonotum at least 5 times as long as pronotum . . . . . *C. (Ceroys)*
- Mesonotum about or slightly less than 4 times as long as pronotum . . . . . *C. (Miroceroys)*
5. Head with two tubercles, vertex slightly raised . . . . . *Spinonemia*
- Head flat, not armed . . . . . 6.
6. Probasitarsus distinctly shorter than following four tarsomeres combined . . . . .
- . . . . . *Splendidonemia*
- Probasitarsus at least as long as following four tarsomeres combined . . . . . 7.
7. Head about as long as pronotum . . . . . *Heteronemia*
- Head distinctly longer than pronotum . . . . . 8.
8. In ♂ abdominal segment IX as long as VIII; in ♀ thorax granulose . . . . . *Xeropsis*
- Abdominal segment IX longer than VIII . . . . . *Minteronemia*

### Key to Genera: Eggs

1. Capsule almost symmetrically oval in lateral aspect . . . . . 2.
- Capsule distinctly swollen and projecting dorsally . . . . . 3.
2. Micropylar plate with broad, structured margin . . . . . *Canuleius*
- Micropylar plate with simple margin . . . . . *Heteronemia*
3. Capsule with strikingly deep, round impressions . . . . . *Ceroys*
- Capsule different . . . . . 4.
4. Micropylar plate with strikingly structured raised, broad margin . . . . . *Spinonemia*
- Micropylar plate with simple margin . . . . . *Xeropsis*

## Bacilloidea

### Heteropterygidae

#### Key to Subfamilies: Adults

1. Area apicalis with a spine medio-apically . . . . . 2.
- Area apicalis without spine medio-apically . . . . . Dataminae
2. Prosternum without rough sensory areas . . . . . Heteropteryginae
- Prosternum with two rough sensory areas . . . . . Obriminae

#### Key to Subfamilies: Eggs

1. Capsule more or less spherical, not distinctly bullet-shaped. Operculum flat, not conical medially. If capsule strongly depressed laterally, then bearing setae that end in hooks . . . . . Dataminae
- Capsule different; not round, if setose, then not strongly depressed laterally . . . . . 2.
2. Capsule large, broad, not round; completely setose, if not, then operculum conical

- medially . . . . . Heteropteryginae
- Capsule more slender; if setose, then operculum not conical medially . . . . . Obriminae

### Heteropteryginae

#### Key to Genera: Adult Males

- 1. Abdominal sternites II to VI with distinct, cingulate excavations laterally *Miniopteryx*
- Abdominal sternites II to VI without excavations . . . . . 2.
- 2. Alae completely covered by tegmina . . . . . *Haaniella*
- Alae fully developed . . . . . *Heteropteryx*

#### Key to Genera: Adult Females

- 1. Green or yellow, abdomen strikingly dilated, segment V widest . . . . . *Heteropteryx*
- Brown, abdomen from segment IV on increasingly narrower . . . . . *Haaniella*

#### Key to Genera: Eggs

- 1. Capsule with small, dark spots, or short bristled . . . . . *Haaniella*
- Capsule uniformly grey, with irregular small, flat impressions . . . . . *Heteropteryx*

### Obriminae

#### Key to Genera: Adults

- 1. Mesonotum transverse to quadrate, not longer than wide . . . . . 2. Miroceramiini
- Mesonotum distinctly longer than wide . . . . . 3.
- 2. Profemora almost straight, only slightly curved basally . . . . . *Mirocearamia*
- Profemora curved and compressed basally, shorter than pro- and mesonotum . . . . .  
*Mearnsiana*
- 3. Meso- and metanotum without composite posterior meso- and metanotals . . . . .  
. . . . . 4. Eubulidini
- Meso- and metanotum with composite posterior meso- and metanotals 10. Obrimini
- 4. Median mesonotals produced as distinct spines; body elongate . . . . . *Stenobrimus*
- Median mesonotals absent or tuberculate; body more stout . . . . . 5.
- 5. Mesonotum without raised triangular area anteriorly . . . . . *Heterocopus*
- Mesonotum with raised triangular area anteriorly . . . . . 8.
- 6. Pronotum with two large spines directed anteriorly . . . . . *Pterobrimus*
- Pronotum without two prominent spines . . . . . 7.
- 7. Mesonotum only slightly dilating posteriorly . . . . . *Eubulides*
- Mesonotum trapezoidal, posteriorly nearly twice as wide as anteriorly . *Theramenes*
- 8. Pronotum without large spines . . . . . *Ilocano*
- Pronotum bearing large spines . . . . . 9.
- 9. Mesonotum flat dorsally, with a distinct median carina . . . . . *Tisamenus*
- Mesonotum oval in cross-section, median carina absent . . . . . *Hoploclonia*
- 10. Anterior mesonotals indistinct . . . . . *Trachyaretaon*
- Anterior mesonotals prominent . . . . . 11
- 11. Metasternal pseudo-foramina absent . . . . . *Aretaon*
- Metasternal pseudo-foramina present . . . . . 12.
- 12. Metasternal pseudo-foramina produced as narrow slits . . . . . *Obrimus*

- Metasternal pseudo-foramina large, open pits near lateral margin . . . . . 13.
- 13. Metasternal pseudo-foramina semi-cingulate . . . . . *Brasidas*
- Metasternal pseudo-foramina completely cingulate . . . . . *Euobrimus*

**Key to Genera: Eggs**

- 1. Operculum oval, convex, inserted at an angle of about 45° . . . . . *Stenobrimus*
- Operculum more or less round, convex or flat . . . . . 2.
- 2. Capsule around operculum narrowed, posterior pole pointed . . . . . *Sungaya*
- Capsule bullet-shaped . . . . . 3.
- 3. Capsule considerably longer than wide, not bristled . . . . . 5.
- Capsule only slightly longer than wide, bristled . . . . . 4.
- 4. Operculum inserted horizontally . . . . . *Tisamenus*
- Operculum inserted in capsule at an angle . . . . . *Hoploclonia*
- 5. Capsule convex also ventrally or about parallel dorsally and ventrally . . . . . 6.
- Capsule convex dorsally and concave ventrally . . . . . *Miroceramia*
- 6. Dorsal and ventral part of capsule parallel . . . . . 7.
- Capsule slightly convex at least dorsally . . . . . *Brasidas* and *Euobrimus*
- 7. Posterolateral arms of micropylar plate long, dilated laterad . . . . . *Trachyaretaon*
- Posterolateral arms of micropylar plate short, not dilated laterad . . . . . 8.
- 8. Micropylar plate rectangular anteriorly . . . . . 9.
- Micropylar plate round anteriorly . . . . . 10.
- 9. Micropylar plate rectangular, with a notch posteriorly . . . . . *Aretaon*
- Posterior edges of micropylar plate diverging, elongate . . . . . *Eubulides*
- 10. Operculum with round impression medially . . . . . *Theramenes*
- Operculum without round impression medially . . . . . *Heterocopus*

**Dataminae****Key to Genera: Adults**

- 1. Antennae distinctly longer than profemora, almost as long as forelegs . . . . . 2.
- Antennae at best slightly longer than profemora . . . . . *Planispectrum*
- 2. Mesonotum less than twice as long as pronotum . . . . . *Dares*
- Mesonotum longer . . . . . 3.
- 3. Mesonotum and metanotum with large spines, scapus not armed . . . . . *Epidares*
- Mesonotum and metanotum without large spines . . . . . 4.
- 4. Mesonotum with prominent median carina . . . . . 5.
- Mesonotum not carinate medially . . . . . *Orestes*
- 5. Mesonotum without long spines anteriorly . . . . . *Pylaemenes*
- Mesonotum armed with two large, anteriorly projecting spines anteriorly . . . . . *Spinodares*

**Key to Genera: Eggs**

- 1. Capsule with large impressions laterally . . . . . *Spinodares*
- Capsule roundly, without impressions laterally . . . . . 2.
- 2. Micropylar plate projecting, capsule strikingly punctured . . . . . *Planispectrum*
- Micropylar plate flat, not projecting . . . . . 3.
- 3. Capsule almost round, posterior arms of micropylar plate at best slightly projecting above half height of capsule . . . . . *Dares*
- Capsule more elongate, if round, posterior arms of micropylar plate reaching far above

- half height of capsule . . . . . 4.
- 4. Posterior arms of micropylar plate almost surrounding capsule . . . . . *Pylaemenes*
- End of posterior arms visible from lateral aspect . . . . . 5.
- 5. Posterior arms of micropylar plate dilating ventrad; setae very long . . . . . *Orestes*
- Posterior arms of micropylar plate not dilating ventrad; setae short . . . . . *Epidares*

**Anisacanthidae**

**Key to Genera: Adults**

- 1. Mesonotum at best two times as long as mesonotum . . . . . 2.
- Mesonotum distinctly more than 2 times as long as pronotum . . . . . 3.
- 2. Vertex flat . . . . . *Pseudoleosthenes*
- Vertex raised conically, spinose . . . . . *Parectatosoma*
- 3. Profemora short, slightly longer than head and pronotum, strongly lamellate . . . . .
- . . . . . *Xerantherix*
- Profemora much longer than head and pronotum, moderately lamellate . . . . . 4.
- 4. Head tuberculate or spinose; in ♀ abdominal tergite X elongated . . . . . *Anisacantha*
- Head not armed; in ♀ abdominal tergite X not elongated . . . . . 5.
- 5. Scapus subcylindrical, abdominal tergite VI without lobe dorsally . . . . . *Leiophasma*
- Scapus very flat; abdominal tergite VI with a lobe dorsally . . . . . *Parorobia*

**Key to Genera: Eggs**

- 1. Capsule with raised ridge or pseudo-plate posteriorly . . . . . 2.
- Capsule at best with a raised knob posteriorly . . . . . 3.
- 2. Capsule with one raised ridge posteriorly . . . . . *Xerantherix*
- Capsule with two ridges (pseudo plate) posteriorly . . . . . *Leiophasma*
- 3. Capsule very finely punctured, with very short setae . . . . . *Anisacantha*
- Capsule slightly granulated . . . . . *Parectatosoma*

**Bacillidae**

**Key to Genera: Adults**

- 1. Gula present . . . . . 2. Bacillinae
- Gula absent . . . . . 4.
- 2. Protibiae without area apicalis . . . . . 3. Bacillini
- Protibiae with area apicalis . . . . . Phalcini: *Phalces*
- 3. Antennae of ♂ with more than 19, of ♀ with more than 18 segments . . . . . *Bacillus*
- Antennae of ♂ and ♀ with less than 18 segments . . . . . *Clonopsis*
- 4. Body smooth, shiny . . . . . Macyniinae: *Macynia*
- Body not shiny, rough . . . . . 5.
- 5. Third antennomere roundly in cross-section . . . . . 11. Xylicini
- Third antennomere with distinct edge interodorsally . . . . . 6. Antongiliinae
- 6. Scapus with a spine exteroventrally . . . . . 8. Pseudodatamini
- Scapus not armed exteroventrally . . . . . 9. Antongiliini
- 8. Vertex not raised. Body elongate, slender . . . . . *Cirsia*
- Vertex raised. Body stout, extremities short. . . . . *Pseudodatames*
- 9. Body, meso- and metafemora with definite spines . . . . . 10.



- Body not armed. Meso- and metafemora with lobes . . . . . *Leprodes*
- 10. Abdomen long, hindfemora much shorter than abdomen . . . . . *Antongilia*
- Abdomen short, hindfemora more or less reaching tip of abdomen . . . . . *Onogastris*
- 11. Head between eyes at best tuberculate . . . . . *Bathycharax*
- Head between eyes with two spines . . . . . 11.
- 12. Probasitarsus carinate dorsally, without large lobe . . . . . *Xylica*
- Probasitarsus with large lobe dorsally . . . . . *Ocnobius*

**Key to Genera: Eggs**

- 1. Operculum with capitulum . . . . . Macyniinae: *Macynia*
- Operculum without capitulum . . . . . 2.
- 2. Operculum inserted in capsule at an angle of 45° . . . . . Pseudodataminae  
*Pseudodatames*
- Operculum inserted in capsule without significant angle . . . . . 3. Bacillinae
- 3. Capsule rough or smooth, without irregular ridges . . . . . 4.
- Capsule with irregular ridges . . . . . 6. Antongiliinae
- 4. Capsule rough . . . . . 5. Bacillini
- Capsule smooth . . . . . Phalcini: *Phalces*
- 5. Operculum flat, without high and broad ridge . . . . . *Clonopsis*
- Operculum with high and broad ridge . . . . . *Bacillus*
- 6. Micropylar plate lanceolate, distinctly narrowed anteriad . . . . . 7. Antongilini
- Micropylar plate not distinctly narrowed anteriad . . . . . 8. Xylicini
- 7. Capsule with long setae . . . . . *Antongilia*
- Capsule at best with few very short setae . . . . . *Leprodes*
- 8. Micropylar plate broadest near micropylar cup . . . . . *Bathycharax*
- Micropylar plate not broader near micropylar cup, parallel sided . . . . . *Xylica*

**Phyllioidea****Phylliidae****Key to Genera: Adults**

- 1. Head with two tubercles posteromedially, wings iridescent, anal region of alae brown . . . . . Nanophylliini: *Nanophyllum*
- Head with only one tubercle or spine posteromedially, anal region of alae transparent . . . . . 2. Phylliini
- 2. Mesonotum before tegmina distinctly transverse . . . . . 3.
- Mesonotum before tegmina almost quadrate . . . . . 4.
- 3. Anterior half of prosternum without spine . . . . . *Microphyllum*
- Anterior half of prosternum with distinct spine . . . . . *Chitoniscus*
- 4. Protibiae with exterior lobes only . . . . . *P. (Phyllum)*
- Protibiae with interior and exterior lobes . . . . . *P. (Pulchriphyllum)*

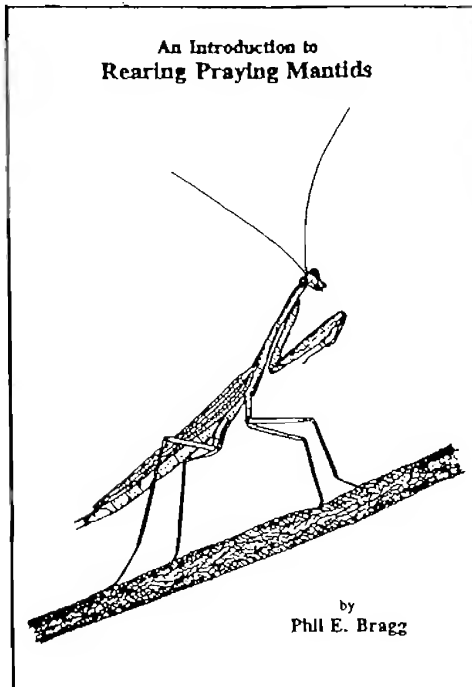
**Acknowledgements**

The author wants to thank everyone, who made this project possible, and especially Ms. Anke Teschke (Kiel, Germany), Mr. Andreas Zompro (Elmshorn, Germany), and Prof. Dr. Joachim Adis and Prof. Dr. Wolfgang Junk (both Tropical Ecology, Max-Planck-Institute,

Plön, Germany).

## References

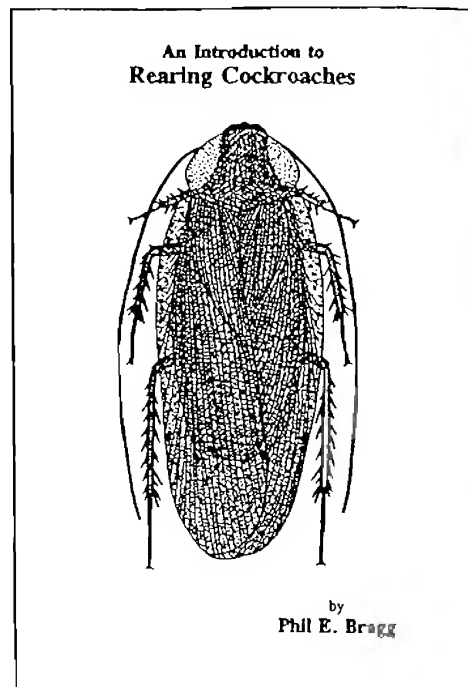
Zompro, O. (2004) Revision of the genera of the "Areolatae", including the status of *Timema* and *Agathemera* (Insecta: Phasmatodea). *Abhandlungen des Naturwissenschaftlichen Vereins in Hamburg*, (NF)37: 1-327.



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# A new genus and four new species of South African stick insects

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## Abstract

An interestingly shaped new species from the Eastern Cape is described in a new genus, *Gratidiinilobus* n.gen. The sole representative, *G. capensis* n.sp., is designated as type species for the genus, which belongs to the subfamily Pachymorphinae, tribe Gratidiini. Also described from the same tribe are *Clonaria capelongata* n.sp. (Northern Cape), *Maransis browni* n.sp. (Northern Cape). *Xylica tomsi* n.sp. (Eastern Cape and Northern Province) belongs to the subfamily Bacillinae, tribe Xylicini. Other minor taxonomic changes are made relating to *Clonaria* species found in South Africa.

## Key words

Phasmida, *Gratidiinilobus* new genus, *Clonaria*, *Maransis*, *Xylica*, new species, South Africa.

## Introduction

In a recent catalogue of the world Phasmida, Otte & Brock (2003) listed 31 species from South Africa. As with the giant stick insects of the genera *Bactrododema* Stål, 1858, *Palophus* Westwood, 1859 and *Bactricia* Kirby, 1896 (revised in Brock, 2004), a revision is necessary in order to evaluate the fauna, particularly as many synonyms of phasmid species have not yet been established in this understudied order (Brock 1999). As part of a detailed study on southern African phasmids (in progress), this paper describes four new species found in South African museum collections. All these species occur in the Eastern or Northern Cape, areas which have been rather neglected by collectors. The classification used follows Otte & Brock (2003), which is an updated version of Bradley & Galil (1977).

## Material and Methods

This study is based on the examination of South African material in several museum collections, also Afrotropical type material, where necessary. During a visit to Pretoria in May 2003, I found undescribed material of interesting species in the National Collection of Insects, Pretoria (SANC), and Transvaal Museum, Pretoria (TMSA) collections. After submitting this paper for publication, I also located specimens of the new genus in The Natural History Museum, London (BMNH).

## Abbreviations for Depositories

BMNH The Natural History Museum, London, U.K.

SAMC South African Museum, Cape Town, South Africa.

SANC National Collection of Insects, Pretoria, South Africa.

TMSA Transvaal Museum, Pretoria, South Africa.

## Bacillidae, subfamily Bacillinae, tribe Xylicini

### *Xylica* Karsch

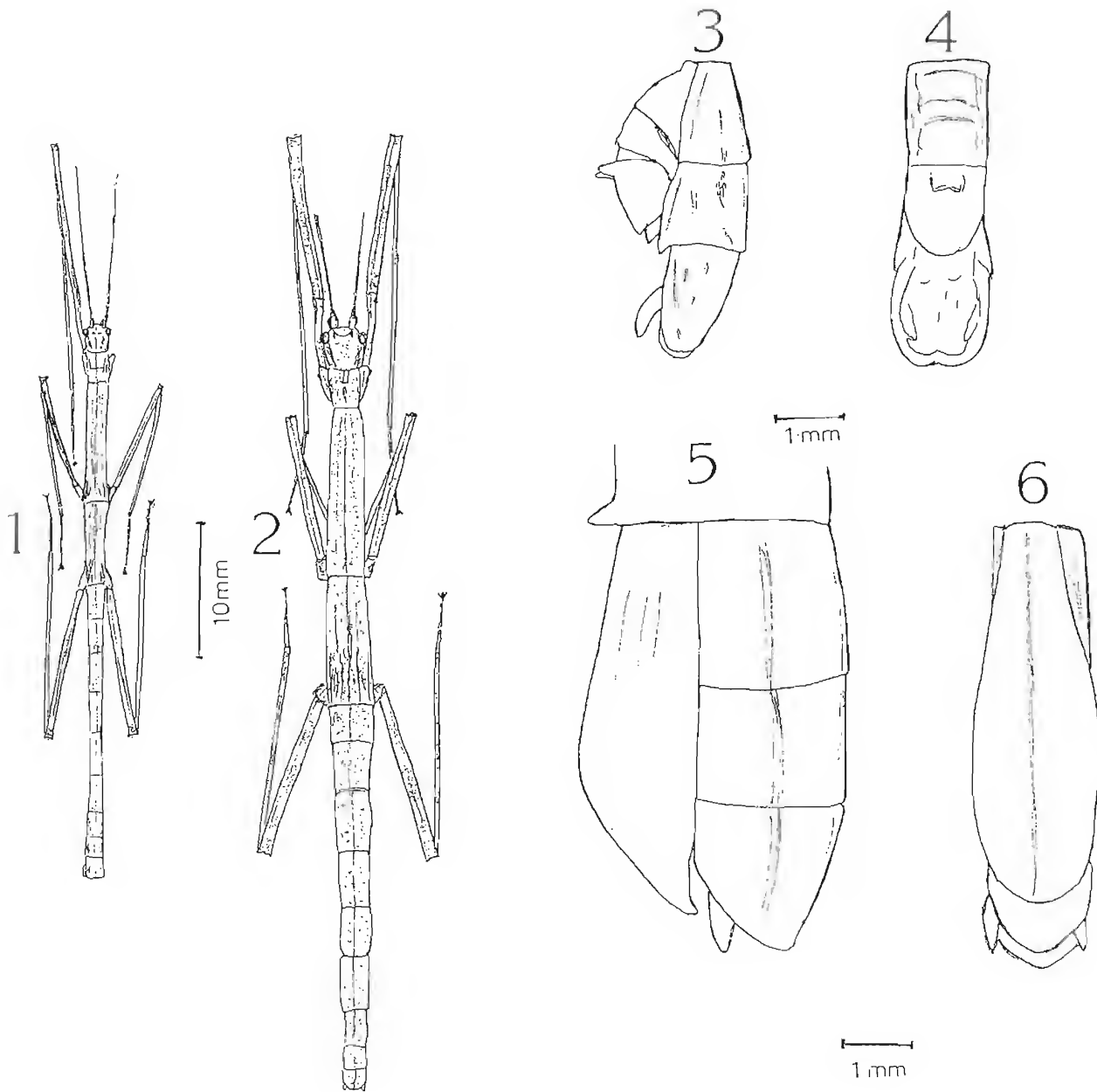
*Xylica* Karsch, 1898: 365, 381. Type species. – *Xylica oedematosa* Karsch, 1898, by monotypy.

*Xylica*; Kirby, 1904: 404; Redtenbacher, 1906: 29; Otte & Brock, 2003: 41.

### *Xylica tomsi* n.sp., Figs 1-6.

**Male** (Figs. 1, 3 & 4)

Holotype: Small mid brown insect with bold central carina, mottled with darker shades, including bandings on legs. Body length 41mm.



Figs 1-6 *Xylica tomsi*

1. Holotype male. 2. Female. 3-6: Ventral and lateral views of abdomen, 3-4. ♂, 5-6. ♀.

Head slightly longer than wide, fairly smooth. Pair of stout raised tubercles between eyes. Head with dark blackish-brown central carina; darker brown bands from eye to posterior, with further broader band beneath. Central dark blotches also present. Posterior with five swollen ridges. Antennae dark brown, short, not reaching end of fore femora. hairy; 22 segments. Basal segment depressed, broad; second segment reduced in length but broader than subsequent segments.

Thorax sparsely granulated, with bold central carina. Pronotum slightly longer than

head, slightly granulated and hairy. Posterior half of pronotum slightly raised, sharply ridged. Mesonotum fairly smooth, more than four times length of pronotum; mid-brown, with darker areas towards hind part of segment. Metanotum and indistinct median segment shorter than mesonotum.

Abdomen elongate, sparsely granulated, with a mixture of darker markings. Segments 1-7 of similar length; 8<sup>th</sup> segment swollen and shorter; 9<sup>th</sup> segment shorter than 8<sup>th</sup>; anal segment slightly longer than 9<sup>th</sup>, hind margin subtruncate. Cerci short, rounded at tip; hidden beneath anal segment. Subgenital plate broad and swollen, conspicuously double spined in centre; end rounded, reaching end of 9<sup>th</sup> abdominal segment (Figs 3-4).

Legs plain, slightly hairy, indistinctly mottled. All femora with short apical spines; apices rather darker. Right fore leg missing.

Paratype males (2 specimens, in copula with females). Same as holotype except shorter.

<i>Xylica tomsi</i> measurements (in mm)	Holotype ♂	Paratype ♂	Paratype ♀
Body length	41	36-37	55-60
Head	1.7	1.7	3
Antennae	12	11	9
Pronotum	2	1.5	2.5-2.8
Mesonotum	8.5	8	12-13
Metanotum & median segment	6	6	9.5
Femora: fore	15	13	17-18
Femora: mid	8.5	8.5	10-11
Femora: hind	11	10	12
Tibiae: fore	17	15	21
Tibiae: mid	9.5	8	11.5-12
Tibiae: hind	13	12.5	15
Cerci	0.8	0.8	0.6

Table 1. Measurements of *Xylica tomsi* n.sp.

#### Female (Figs. 2, 5 & 6)

Paratype females: three specimens, including two mounted in copula with males. These range from mid-brown, hardly mottled, to heavily mottled all over with darker blackish-brown spots and blotches and mottled legs. Robust looking, with bold double spined head. Central longitudinal carina and two others run whole length of insect. Body length of adults 55-60mm.

Head as in male except for pair of bold spines between eyes. Darker brown bands from eye to posterior, with further broader band beneath (lighter on pale insects). Antennae shorter than in male, with 21-22 segments.

Thorax granulated. Pronotum not quite as long as head, slightly granulated and ridged, with central indentation. Mesonotum conspicuously granulated, more than four times length of pronotum. Metanotum and indistinct median segment shorter than mesonotum.

Abdomen as in male except as follows: end of segment not quite rounded. Operculum boat shaped, end not quite rounded, not reaching end of anal segment (Figs 5-6). Opercular spine a broad, stout tubercle.

Legs as in male.

### Measurements

Measurements of both sexes (in mm) are given in table 1.

### Type material

Holotype ♂, South AFRICA: Bedford, Marlepekop, SE2430DB, 20-21.ii.1988 (R. Stals) (TMSA). Paratypes: All South Africa: ♀, Bedford, Marlepekop, SE2430DB, 20-21.ii.1988 (R. Stals); 2♂♂, 2♀♀ - collected [and mounted] in copula, Hanglip Forest, Louis Trichardt, 2229DD U344, 10.xii.1984 (R. Toms) (all TMSA).

### Distribution

So far only known from Bedford (Eastern Cape) and Louis Trichardt (Northern Province), suggesting that this species has been overlooked at other localities.

### Etymology

Named after Rob Toms, a specialist in Orthoptera (Transvaal Museum), who collected two pairs of this species. Dr Toms has obtained many interesting phasmids during his collecting trips in South Africa.

### Notes

*X. tomsi* is closest to *X. abbreviata* Redtenbacher, 1906, from Tanzania. Key differences are given in table 2.

Characteristic	<i>tomsi</i>	<i>abbreviata</i>
Body length	♂ 36-41mm, ♀ 55-60mm.	♂ 56mm, ♀ 75mm.
Antennae	Shorter than fore femora in both sexes; those of ♂ longer than ♀.	Longer than fore femora in ♂ Equal to fore femora in ♀.
Abdominal segments of ♀	Lacking central spine-like tubercle at end of abdominal segments.	With central spine-like tubercle at end of abdominal segments.
Genitalia	♂ subgenital plate with conspicuous pair of spines. ♀ opercular spine a broad tubercle.	♂ subgenital plate lacking spines. ♀ opercular spine absent.

Table 2. Differences between *X. tomsi* and *X. abbreviata*.

**Diapheromeridae, subfamily Pachymorphinae, tribe Gratidiini**

***Clonaria* Stål**

*Clonaria* Stål, 1875a: 5. Type species: *Bacillus natalis* Westwood, 1859: 6, pl. 23: 7-8, by subsequent designation of Kirby, 1904: 337.

*Clonaria*; Stål, 1875b: 14, 71; Kirby, 1904: 337; Brunner, 1907: 217 (synonym of *Gratidia*); Rehn, 1933: 61; Otte & Brock, 2003: 263 [which includes other references].

*Gratidia* Stål, 1875b: 14, 70. Type species: *Gratidia sansibara* Stål, 1875b: 14, 70, by original designation.

*Gratidia*; Kirby, 1904: 330; Brunner, 1907: 217; Rehn, 1933: 61; Otte & Brock, 2003: 262.

*Paraclonaria* Brunner, 1893: 89. Type species: *Paraclonaria hamuligera* Schulthess, 1898: 83, by subsequent designation of Rehn, 1904: 83.

*Paraclonaria*; Rehn, 1904: 83; Kirby, 1904: 335; Brunner, 1907: 217 (synonym of *Gratidia*); Otte & Brock, 2003: 262.

Many of the 130 or so species of *Gratidia* Stål, 1875 have been confused with other genera, and for many years were included in *Ramulus* Saussure, 1862 (Otte & Brock, 2003). All former *Gratidia* species should now be placed in *Clonaria* Stål, 1875, which pre-dates *Gratidia*. *Clonaria* appeared in Stål, 1875a: 5, whereas *Gratidia* first appeared in 1875b: 14, 70, as clarified by Rehn (1933) and Cliquennois (in press).

***Clonaria capelongata* n.sp., Figs 7-9.**

**Male (Figs. 7-9)**

**Holotype:** Smooth, brown, very elongate species with lateral longitudinal darker brown lines on head and thorax, less distinct on abdomen. Body length 55mm.

Head three times longer than wide, smooth. Eyes large, dark brown. Broad dark brown lateral band running from alongside eye to back of head; either side of band paler. Broad central spear-like indentation between eyes, then narrow central groove to back of head. Slightly darker brown band either side of median line and narrower darker line between this and lateral dark band mentioned above. Antennae short, just over half length of femora, with 17 segments. Basal segment slightly broader, second segment reduced in length.

Thorax elongate. Pronotum clearly shorter than head, with darker brown central cross-like indentation and narrow, darker brown longitudinal lines either side of central line on upper half of segment. Mesonotum eight times length of pronotum. Metanotum slightly shorter than mesonotum; median segment short. Both mesonotum and metanotum with central and almost lateral narrow dark brown and blackish longitudinal lines. Area beneath outer lines narrowly cream, only conspicuous on hind part of both segments.

Abdomen darker brown and blackish narrow central longitudinal line present, along with two lines either side, the latter indistinct at times, particularly towards hind part (7<sup>th</sup>-10<sup>th</sup> segments). Abdomen elongate, with segments 8-10 rather swollen towards a rounded anal (10<sup>th</sup>) segment; final segments reduced in length compared with segments 2-7. Subgenital plate small, reaching end of 9<sup>th</sup> abdominal segment, tip subtruncate (Figs 8-9). Cerci long, thin, clubbed tip.

Legs plain brown, very elongated. All femora with short pair of apical spines. Paratype male description same as holotype, except smaller (52mm).

**Measurements**

All measurements are in millimetres. Holotype ♂: Body length 55, Head 2.5, Antennae 12, Pronotum 1.5, Mesonotum 12, Metanotum 10.3 Median segment, 0.7. Femora: fore 24, mid 20, hind 22. Tibiae: fore 29, mid 23, hind 27. Cerci 1.5. Paratype ♂: Slightly shorter in all features when compared with holotype.

**Type material**

Holotype ♂, South Africa: Groblershoop, Northern Cape, 28°53'S, 21°59'E, 20-24.iii.1989 (C.M. Moolman) (SANC). Paratype ♂, South Africa: Groblershoop, Northern Cape, 28°53'S, 21°59'E, 20-24.iii.1989 (C.M. Moolman) (SANC).

**Distribution**

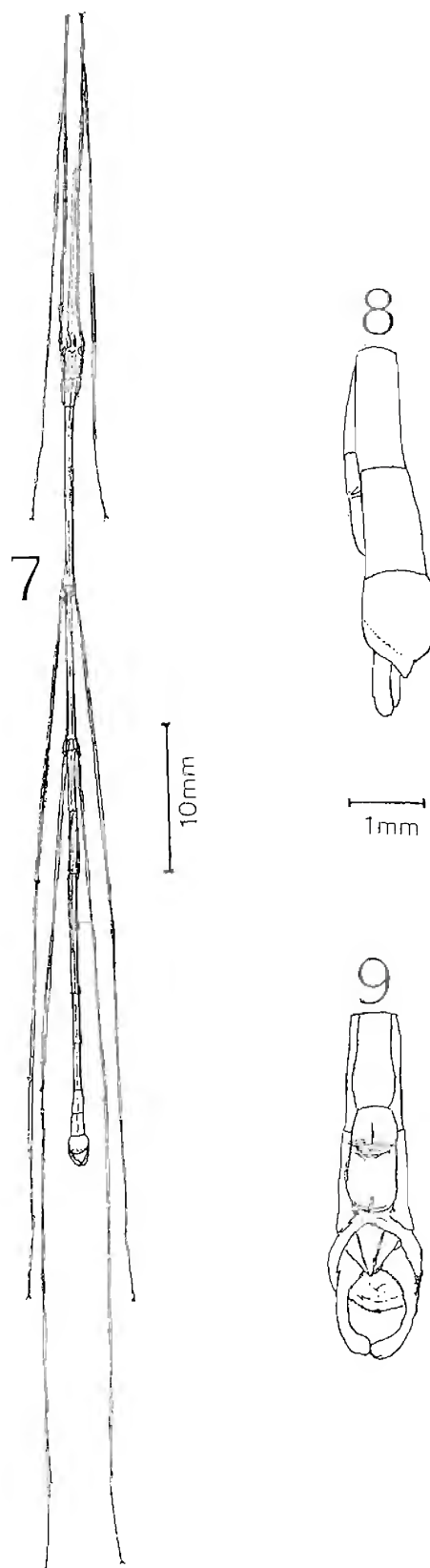
So far only known from the type locality Groblershoop in Northern Cape.

**Etymology**

Cape from [Northern] Cape, and elongate from the appearance of this species.

**Notes**

Closely related to the widespread South African species *Clonaria natalis* (Westwood, 1859) which is likewise remarkably elongate, rather than less slender, South African species (see Table 3 below). *Clonaria* species with broader males include: *C. guenzii* (Bates, 1865) (male sex only known so far) which is not a synonym of *natalis*, as recorded by Brunner, 1907. *C. pulchrepecta* (Carl, 1913) is a new synonym of *guenzii* n.syn., based on examination of the types. *Clonaria longithorax* Brunner, 1907, is known from a male from Transvaal. *Clonaria annulata* (Westwood, 1859) n.comb. [here transferred from the genus *Leptynia*] occurs in Western Cape. I am aware of a *Clonaria* sp. female from Table Mountain, Cape Town (SAMC), but am hesitant to describe it without matching opposite sexes. Having reviewed *Clonaria* species from southern Africa as well as other Afrotropical *Clonaria*, I am confident that *capelongata* has not already been described.



Figs 7-9. *Clonaria capelongata* n.sp  
 7. Holotype male.  
 8-9. End of abdomen of male.



Characteristic	<i>capelongata</i>	<i>natalis</i>
Colour	Brown with lateral darker brown longitudinal lines on head and thorax, less distinct on abdomen	Black with pale lateral longitudinal lines and brown legs
Body	Elongate	Even more slender than <i>capelongata</i>
Antennae	17 segments	18-19 segments

**Table 3.** Differences between males of *Clonaria capelongata* and *Clonaria natalis*.

### **Gratidiinilobus new genus**

Rather more robust than many representatives of the tribe Gratidiini, the new genus and species described below readily key to the tribe, but have unique characteristics, rarely seen in phasmids (bold lobes on the head, thorax and abdomen). The egg has a close affinity with *Clonaria*, *Leptynia* and others.

Type species: *Gratidiinilobus capensis* n.sp., here designated.

#### **Characteristics of the genus**

Apterous. Females small and fairly stout, with body rugose and granulated; male more slender. Head with pair of slightly separated tubercles and lobes between eyes in female (in male swollen elevation). Antennae very short, with nine segments in female, ten in male; basal segment depressed, lamellate. Series of robust lateral lobes on abdominal segments 2-7 (paired lobes at hind part of mesonotum and metanotum). Abdomen elongate, narrowing towards tip in female. Female operculum short, reaching about end of 8<sup>th</sup> abdominal segment, with valvulae extending beyond that; subgenital plate in male reaching end of 9<sup>th</sup> abdominal segment. Cerci of moderate length, in female, longer and incurved in male with subbasal spur. All femora with pair of short apical spines.

#### **Etymology**

Lobed Gratidiini

#### ***Gratidiinilobus capensis* n.sp.** Figs 10-17.

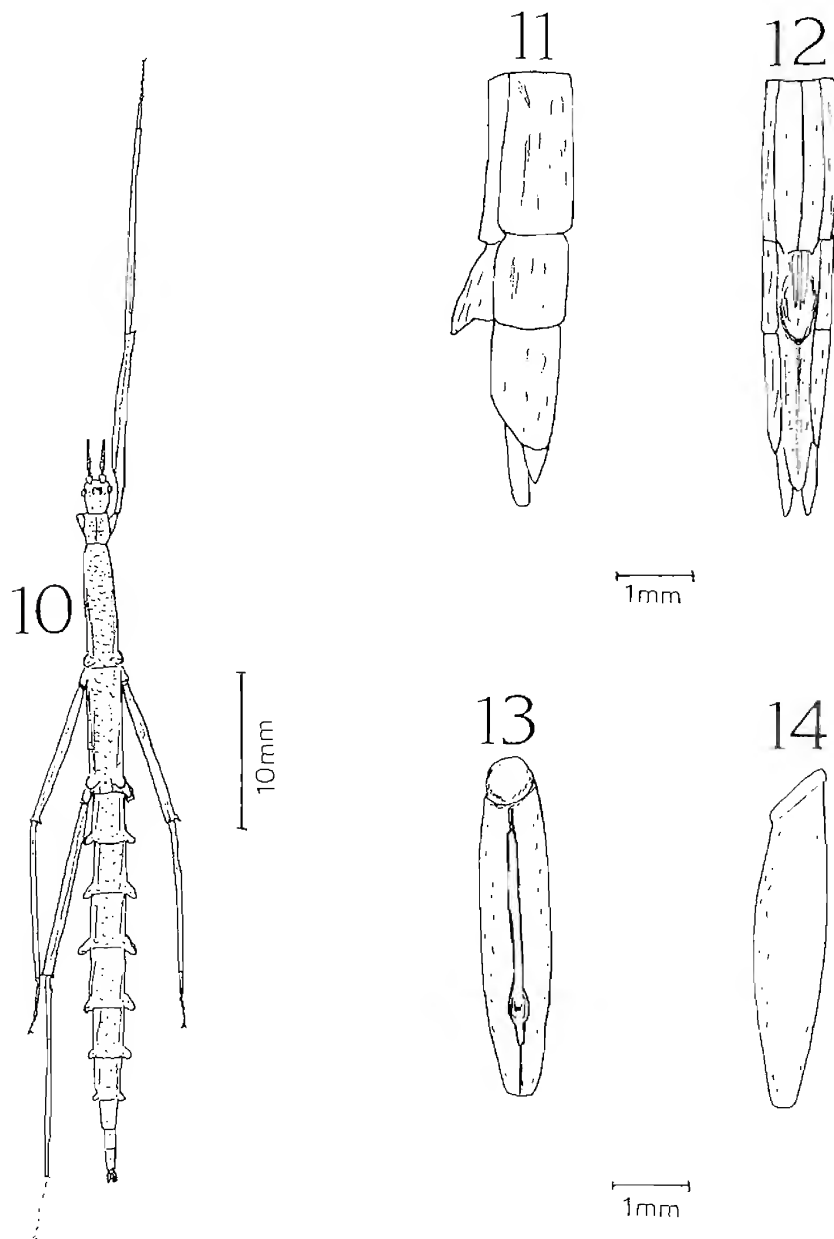
##### **Female** (Figs. 10-12)

Holotype: small, robust-looking apterous species, with very short antennae. Whole body dark brown, rugose and conspicuously granulated. Body length 46mm.

Head slightly longer than wide, with pair of slightly separated tubercles and lobes between eyes. Antennae very short, with nine segments; second segment greatly reduced in length and third segment much longer than others.

Pronotum shorter than head, with central indentation. Mesonotum four times length of pronotum. Metanotum slightly shorter than mesonotum; median segment short. Conspicuous, well spaced paired lobes at hind part of mesonotum and metanotum.

Abdomen with series of robust lateral lobes on abdominal segments 2-7. Abdomen



Figs 10-14. *Gratidiinilobus capensis* n.sp.

10. Holotype ♀. 11-12. Female abdomen: 11. lateral, 12. ventral.

13-14. Egg: 13. dorsal, 14. lateral.

elongate, narrowing towards tip (8<sup>th</sup>-10<sup>th</sup> segments). End of anal segment truncate. Supra-anal plate visible beneath. Operculum short, reaching end of 8<sup>th</sup> abdominal segment, with valvulae extending beyond that (Figs 11-12). Cerci of moderate length, rounded at tip.

Legs plain, indistinct darker mottling. All femora with short pair of apical spines. Left fore leg and right hind leg missing.

Paratype females (3 specimens). Same as holotype except slightly shorter. One is more slender with slightly less pronounced lobes; whole body also with whitish markings or dusting, and legs clearly mottled.

#### Male (Figs. 15-17)

Paratype: small, slender apterous insect, with short antennae. Body brown, with greyish mottling on abdomen and slightly mottled banding on mid femora and tibiae. Abdomen rugose

and sparsely granulated. Body length 33.5mm.

Head longer than wide, with swollen area between eyes. Antennae short, reaching half length of fore femora; ten segments; basal segment broadened; second segment greatly reduced in length and third segment much longer than others.

Pronotum slightly shorter than head, with central indentation. Mesonotum slightly granulated, less than four times length of pronotum. Metanotum slightly granulated; equal in length with mesonotum if median segment included. Conspicuous, well spaced paired lobes at hind part of mesonotum and metanotum.

Abdomen with series of robust lateral lobes on abdominal segments 2-8. Abdomen elongate. End of anal segment subtruncate. Subgenital plate narrowing to almost pointed tip, reaching end of 9<sup>th</sup> abdominal segment (Figs 16-17). Cerci reasonably long, incurved, with subbasal lobe.

Legs as in female.

#### Egg (Figs 13-14).

Operculum missing (nymph has obviously emerged). Capsule elongate, whitish brown with black and darker flecks marked with a reticulate pattern. Operculum slanting. Micropylar plate elongate, rather narrow, black-rimmed; plate starting from near rim of operculum and reaching about three quarters length of capsule. Median line continuing to opercular rim and end of posterior pole. Capsule length 3.8mm, height 0.8mm, width 0.8mm.

As with other related genera, it appears that eggs are glued to suitable surfaces, such as branches, leaves or in crevices.

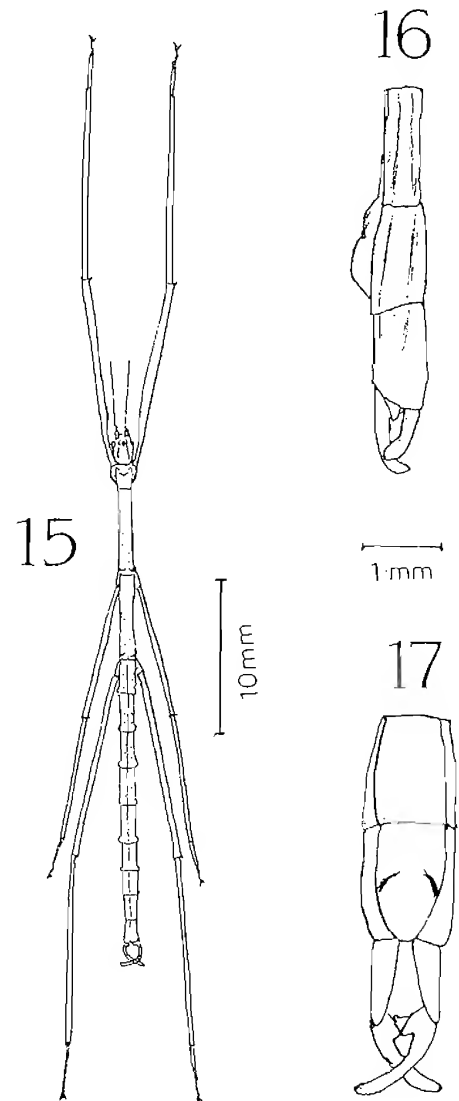
#### Measurements

Holotype ♀ (in mm): Body length 46, Head 2.5, Antennae 4, Pronotum 2, Mesonotum 8, Metanotum 7, Median segment 1, Femora: fore 12, mid 9, hind 11. Tibiae: fore 13, mid 10, hind 13. Cerci 1. Two of the ♀ paratypes are 44mm, with only slightly reduced head, thorax and abdomen. The other damaged ♀ in BMNH is 52mm. ♂ Body length 33.5, Head 1.7, Antennae 4.5, Pronotum 1.5, Mesonotum 5.5, Metanotum 4.5, Median segment 1, Femora: fore 12, mid 8.5, hind 12. Tibiae: fore 12, mid 8, hind 12. Cerci 1.6.

#### Type material

Holotype ♀, South Africa: 14m[iles]. E. Middelburg, C. Prov[ince], 8-14.xii.1969 (Furst) (SANC).

Paratypes: ♀, South Africa: 14m[iles]. E. Middelburg, C. Prov[ince], 8-14.xii.1969 (Furst) ♀, SOUTH AFRICA: Bethesdaweg, nr. Nieu-Bethesda, 31.54S, 24.45E, 8.ii.1990 (M.



Figs 15-17. *Gratidiinilobus capensis* Male. 15. dorsal view. 16-17. End of abdomen: 16. lateral, 17. ventral.

Jonsson) [with egg attached to end of abdomen] (both SANC); ♂, South Africa: Cape Province, between Aberdeen and Somerset East, 18.x.1955, B.P. Uvarov (BMNH reg. no. B.M. 1955-751); ♀, South Africa: Longhope [Cape Province], xii.1926, Mrs. Ethel Gough (BMNH reg. no. B.M. 1927-280).

### Distribution

So far only known from a small part of Eastern Cape.

### Etymology

From [Eastern] Cape Province.

## *Maransis* Karsch

*Maransis* Karsch, 1898: 365, 381. Type species. – *Bacillus mozambicus* Westwood, 1859, by monotypy.

*Maransis*; Kirby, 1904: 336; Rehn, 1911: 332; Otte & Brock, 2003: 275.

*Maransis* Karsch, 1898 is considered to be a valid genus, quite distinct from *Leptynia* Pantel, 1890, although Rehn (1911) synonymised them. Females of the African genus *Maransis* have conspicuous lateral tubercles on the thorax, unlike the European *Leptynia* species. Genitalia also differ (Brock, revision of South African species, including detailed differentiation between European species, in progress).

### *Maransis browni* n.sp., Figs 18-23.

**Male** (Figs. 18, 20 & 21)

Holotype: medium sized uniform yellowish brown elongate insect with bold longitudinal central black stripe from head to front of mesonotum. Body length 70mm.

Head elongate, longer than wide, smooth. Eyes dark blackish-brown. Black central stripe and two lateral lines present. Antennae short, less than half length of femora, with 19 segments. Basal segment broader, second segment reduced in length.

Thorax elongate, smooth. Pronotum slightly shorter than head, with bold black central stripe. Clear central indentation. Mesonotum more than 5.5 times length of pronotum towards end; also with shorter lateral black lines. These lines also present at hind part of segment. Metanotum longer than mesonotum, again with black central and lateral lines present at start and hind part of segment. Median segment short.

Abdomen elongate, smooth. Segments of similar length until shorter, swollen 8<sup>th</sup> segment. Ninth segment longer than 8<sup>th</sup> and very swollen, narrowing towards anal segment. The anal segment sharply broadened towards tip, hind margin double lobed. Cerci long, incurved, rounded at tip. Subgenital plate broad and swollen, end not quite rounded, almost reaching end of 9<sup>th</sup> abdominal segment (Figs 20-21).

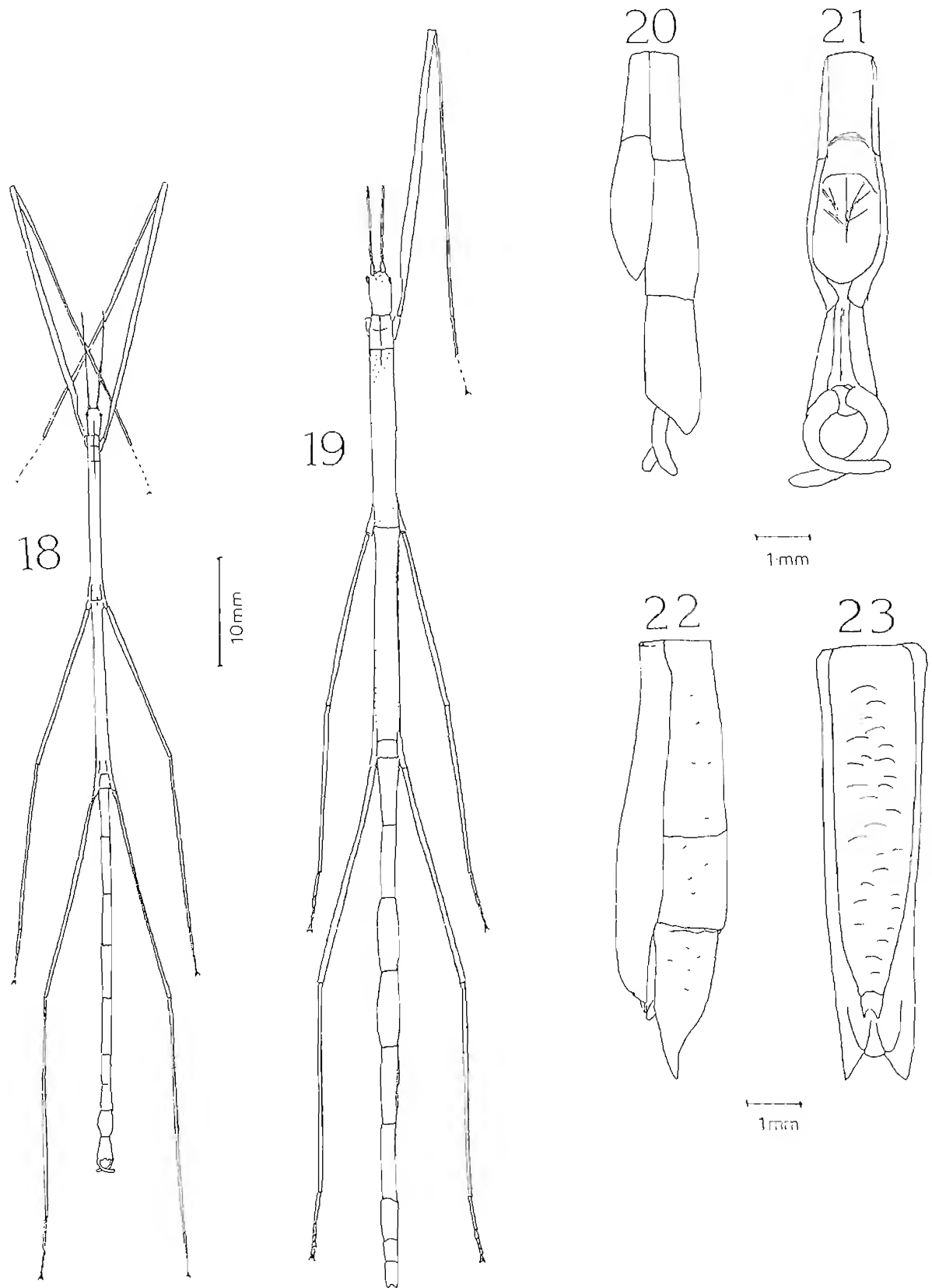
Legs plain, elongate.

**Female** (Figs. 19, 22 & 23)

Paratype female: medium sized uniform yellowish-brown elongate insect with bold black stripe from pronotum to front of mesonotum. Numerous small tubercles laterally on mesonotum, rather smaller on metanotum. Body length 93mm.

Head as in male, but lacks black central stripe.

Thorax as in male except mesonotum five times length of pronotum. Black central line continuing for 1.5mm. Mesonotum with numerous tubercles laterally, typical for the genus; otherwise dorsal surface sparsely granulated, particularly on upper part. Metanotum also with



Figs 18-23. *Maransis browni* n.sp.  
18. Holotype male. 19. Female. 20-23. End of abdomen: 20-21. ♂, 22-23. ♀.

series of granulations laterally; longer than mesonotum.

Abdomen with segments of similar length until shorter 8<sup>th</sup> segment, slightly swollen, then tapering to much shorter 9<sup>th</sup> segment. Anal segment slightly longer than 9<sup>th</sup>, almost triangular incised, giving the appearance of a double pointed tip. Operculum elongate, end subtruncate, not reaching half the length of anal segment. Cerci of moderate length, concealed beneath anal segment (Figs 22-23).

Legs as in male. Left fore leg missing.

### Measurements

All measurements in millimetres. Holotype ♂: Body length 70, Head 2.5, Antennae 9, Pronotum 2.2, Mesonotum 12.5, Metanotum 15.8, Median segment 1.2; Femora: fore 24, mid 15, hind 19; Tibiae: fore 25, mid 15, hind 20. Cerci 2.5. Paratype ♀: Body length 93, Head 4, Antennae 8, Pronotum 3, Mesonotum 16, Metanotum 19.5, Median segment 1.5; Femora: fore 26, mid 16, hind 20; Tibiae: fore 26, mid 15, hind 19. Cerci 0.8.

### Type material

Holotype ♂, South Africa: 21m[iles] NW of Kuruman, N. Cape, 7.ii.[19]61 (H. Dick Brown) (SANC). Paratype ♀, South Africa: 21m[iles] NW of Kuruman, N. Cape, 7.ii.[19]61 (H. Dick Brown) (SANC).

### Distribution

So far only known from the type locality near Kuruman in Northern Cape Province.

### Notes

Closely related to other South African *Maransis* species, including the type species *M. mozambicus* (Westwood, 1859). The plain coloration and length of the dorsal black median line in the new species, readily distinguishes it from other taxa.

### Etymology

Named after the collector Dick Brown, a noted South African entomologist who has made contributions in several fields of orthopterology, including many new South African species.

### Acknowledgements

I thank the following individuals for assistance and (in the case of the SANC and TMSA) the loan of material: B. Dombrowsky (TMSA), G. Beccaloni, J. Marshall, D. Vane-Wright (BMNH), H. Robertson (SAMC), R. Urban (SANC). N. Cliquennois (Réunion) alerted me to problems with the validity of *Gratidia*. Mrs Dombrowsky kindly arranged accommodation. In addition to the above, many other museum collections in Europe, South Africa and elsewhere have been checked for African species, with thanks to the curators.

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## Description of the female of *Diesbachia chani* Bragg, 2001

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### Abstract

The female and egg of *Diesbachia chani* Bragg, 2001 are described for the first time. Another male is recorded and an ambiguity in the original description is clarified.

### Key words

Phasmida, *Diesbachia chani*, Mt. Kinabalu, Borneo.

### Introduction

When *Diesbachia chani* Bragg, 2001 was described only the adult male and nymphs of both sexes were available. Shortly after publication of *Phasmids of Borneo* (Bragg, 2001) I visited Kinabalu National Park, accompanied by Mark Bushell and Bettina Bläsing, and collected another adult male. Two years later an adult female was collected just outside the Park by Mark Bushell. The general appearance of the female is similar to *Diesbachia hellotis* (Westwood, 1859), but with smaller wings and a less spinose thorax. This paper describes the female and egg of *D. chani*, and gives data on the most recently collected male.

### *Diesbachia chani* Bragg, 2001

*Diesbachia chani* Bragg, 2001: 552, fig. 220, map 32D. Sabah, Kinabalu NP, near Park HQ, 1580m. ♂ Holotype (PEB-1064) P.E. Bragg, 30.vii.1990; ♂ nymph Paratype (PEB-1707) P.E. Bragg, 30.viii.1992; ♂ nymph Paratype (C.L. Chan) C.L. Chan & M.Y. Chan 01.v.1986. Sabah, Kinabalu NP, Silau Silau trail. ♂ Paratype (C.L. Chan) C.L. Chan, 21.ix.1991; ♂ nymph Paratype (C.L. Chan) 19.iv.1993; 2♂♂ nymphs Paratypes (C.L. Chan) P.E. Bragg, C.L. Chan & P. Jennings, 27.vii.1990. Sabah, Mt Silam, 2000ft, Lahat Datu. ♀ nymph Paratype (C.L. Chan) W. Mrazek, iv.1982.

### New material

Sabah, Kinabalu National Park, HQ area, Bundu Tuhan View trail, ♂ (PEB-3149) P.E. Bragg, 24.viii.2001.

Sabah, Mt Kinabalu, Sonny's, ♀ and one egg (M. Bushell) Mark Bushell, 16.ix.2003.

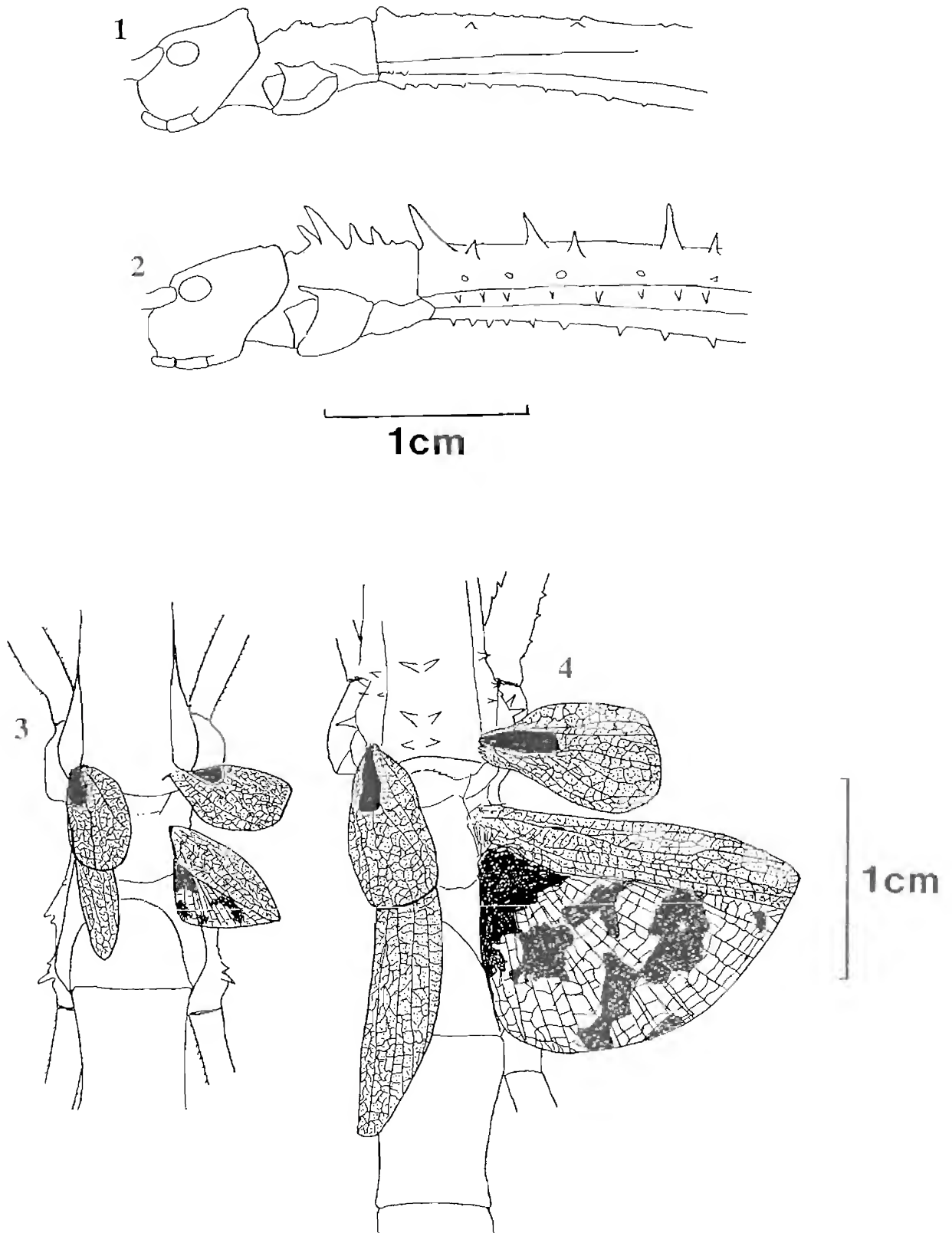
### Description of female (figs 1 & 3)

Head and body almost uniformly dark brown. Legs mottled mid and lighter brown. Elytra very dark brown. Costal region of wing very dark brown, anal region pink with dark brown tessellations. The specimen seems to have darkened as a result of preservation, in life the coloration may have been lighter. Measurements of the female are given in the table below.

Antennae long and slender, light brown with joints darkened; basal segment flattened, second segment with a small tubercle at the base near the outer margin. Head broad, flat, rugulose; posterior margin with two central, distinct, and two very indistinct rounded tubercles, as in the male (see below), there are a third minute pair. Pronotum with a pair of rounded tubercles slightly anterior of the mid point. Mesonotum long, slender, widening slightly towards the posterior; with a pair of small, blunt spines on the anterior margin, and small spine-like tubercles scattered on the dorsal surface (fig. 1). Mesosternum and mesopleurae with numerous small spines. Metanotum slightly wider than long. Metasternum and metapleurae with small spines.

Median segment wider than long. Abdominal segments rugose, dorsally sparingly setose, lateral margins and ventrally distinctly setose. Segments 2-7 of similar length, slightly longer than wide and of almost uniform width; 8th slightly narrower than 7<sup>th</sup> and clearly wider than long; 9th short, more than twice as wide as long; 10<sup>th</sup> very short with serrated posterior margin and a longitudinal carina; lamina supraanalis extremely short (almost





Figures 1-4.

1-2. Side view of head and thorax, 1. *Diesbachia chani*, 2. *Diesbachia hellotis*.  
3-4. Dorsal view showing wings, 3. *Diesbachia chani*, 4. *Diesbachia hellotis*.

completely hidden when viewed dorsally). Abdominal sternites rugose, and with stout setae which give an almost spinose appearance. Operculum long, slender, rugose, and setose, apex with a very deep notch. Appendicular ovipositor very pronounced.

Legs long and slender. All carinae of femora and tibiae with strong setae and femora with distinct serrations on all ventral carinae, and indistinct serrations on dorsal carinae. Fore tarsi both missing from this specimen. First tarsomere slightly longer than the combined length of tarsomeres 2-4 on hind legs, as long on mid leg; 4th tarsomere very short on both mid and hind legs. Medio-ventral carina of middle and hind tibiae with an almost triangular lobe near the base. All coxae with a stout spine projecting over the coxal-trochantal joint. Elytra almost as wide as long, just covering the base of the hind wing. Wings short, reaching only slightly more than half way along the median segment (fig. 3).

<i>Diesbachia chani</i> Bragg, 2001			
Measurements of female (mm)			
Total length	94	Fore femora	31
Antennae	59+	Fore tibiae	39
Head	5.5	Fore tarsi	missing
Pronotum	6.0	Mid femora	22
Mesonotum	21	Mid tibiae	23
Metanotum	4.5	Mid tarsi	7
Median segment	4.5	Hind femora	33
Elytra	5.0	Hind tibiae	39
Hind wing	6.5	Hind tarsi	9

### Description of the egg

Capsule roughly cylindrical, polar end conical, opercular end truncated. Capsule dark brown, rugose with a series of strong ridges. Operculum flat, rugose; surrounded by a collar of thick setae; opercular angle clearly positive. Capsule length 6.8mm, height 2.7mm, width 2.6mm.

The egg is similar to that of *hellotis* (see Bragg, 2001: fig. 221B), but the micropylar plate is more central (although this is variable in *hellotis*, it is usually clearly towards the polar end), and the operculum lacks the spine which is present in some (but not all) eggs of *hellotis*.

### Distinguishing *Diesbachia chani* and *D. hellotis*

My key to species of *Diesbachia* (Bragg, 2001: 552) indicates two tubercles on the back of the head of *D. chani* while the description mentions four. There are two reasonably obvious, and two rather indistinct tubercles. More laterally there are irregularities, which could perhaps be considered a third minute, pair. The male found in 2001 has a body length of 74mm, within the range of the type material.

The general appearance shows this species is closely related to *Diesbachia hellotis* (Westwood, 1859). However, the female is easily distinguished by the absence of large spines on the body (see figs. 1 & 2) and by the shorter wings (figs. 3 & 4). Similarly, the male of *chani* lacks strong spines and has wings comparable to the female; the male of *hellotis* is strongly spinose, has full length wings, and flies readily.

### Acknowledgements

My thanks to Mark Bushell for the loan of the female, to Mark Bushell and Bettina Bläsing for assistance during our 2001 collecting trip, and to staff at Kinabalu Park for permission to collect phasmids in the National Park.

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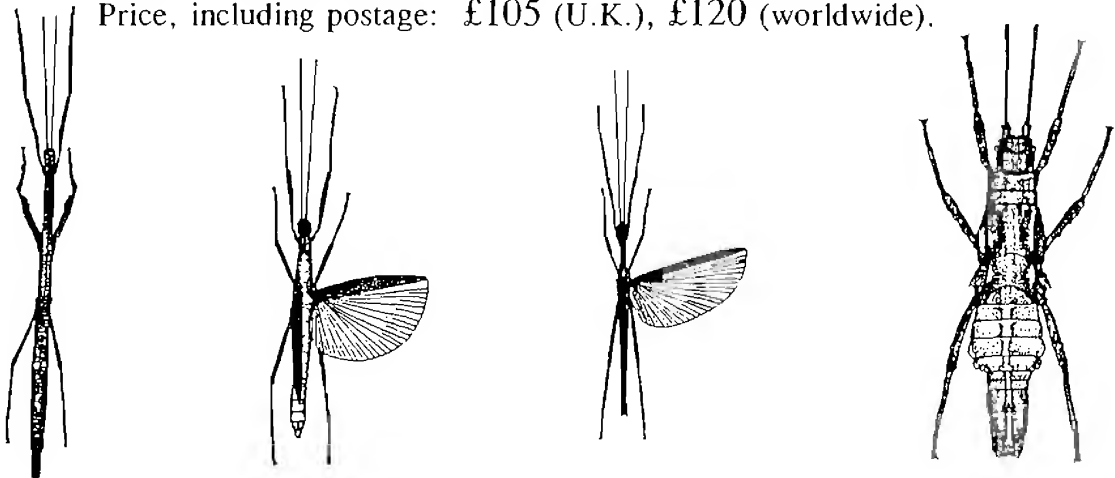
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# Reviews and Abstracts.

## Book Review

*Revision of the genera of the Areolatae, including the status of Timema and Agathemera (Insecta, Phasmatodea) by Oliver Zompro.* Published by Naturwissenschaftlichen Vereins in Hamburg. Hardback, 25cm x 18cm; 327 pages, 161 figs. ISBN 3-931374-39-4. Price 90 Euros. — Reviewed by P.E. Bragg.

In recent years several authors have dabbled with the systematics of stick insects. That no major changes have been widely accepted is a reflection of the piecemeal approach which has been adopted by workers, with little or no experience of phasmid taxonomy, selecting a few "representative species". In contrast, Dr Zompro has many years experience with phasmid taxonomy and is therefore well qualified to work on the systematics of the group. This is the first time a comprehensive phylogenetic revision of a phasmid suborder has been carried out. Dr Zompro has revised all the taxa down to generic level by consideration of the fossil records, egg structure, and geographical distribution, in addition to adult insect morphology. While the higher systematics will undoubtedly be disputed by some, the rearrangement of genera and keys will be welcome by every taxonomist.

It is an outstanding book, lavishly illustrated with 232 black and white photographs and numerous drawings. There are ten excellent SEM photographs comparing different tibiae; the bulk of the photographs show preserved males and females, type specimens in many cases. With photographs of whole phasmids, the limited depth of field and poor contrast inevitably means some are of limited value. The drawings depict 87 eggs (lateral, dorsal and opercular views), and the remaining 50 drawings show internal micropylar plates of eggs (15), diagnostic details of species of *Planispectrum* (29), and some whole insects.

The book is written in a very readable style which will be accessible to most readers, although some may wish a glossary had been included. The first 20 pages include an introduction and review of previous studies, and discussion of the arrangement of the higher taxa. The subsequent few pages consider the Phasmatodea and summarise the arrangement of genera of the Areolatae. This is followed by ten pages on fossil phasmids, including two new species. The bulk of the book deals with the detailed arrangement of the families, subfamilies, tribes, and genera of the Areolatae. The later sections include a general discussion, checklist of type species, reference section and an index to the genera.

The section on each taxon includes a diagnosis, distribution summary, a key to the lower taxa, and relevant comments; keys go as far as genera. The book includes a photograph or, in a few cases, a drawing of a representative of each genus (with the exception of *Parorobia* Chopard, 1952 for which material was unavailable); in many cases both sexes are illustrated. Information on the genera comprises a full synonymy, details on the type species, distribution, a diagnosis, a list of species included (with synonyms), a list of material examined and some general comments.

There are a number of significant changes to the systematics. Timematodea are removed from Phasmatodea. The genus *Agathemera* Stål, 1875 is deemed to warrant its own suborder, distinct from the new suborder Verophasmatodea which contains the Areolatae and Anareolatae. The Anareolatae are not considered, but within the Areolatae there are changes to the status of many taxa, and new taxa ranging from family to species are described.

There is a three page summary in German, but unfortunately not duplicated in English, which contains a checklist of new taxa and synonyms. Fourteen new genera and 13 new species are described; three species are given replacement names; a lectotype is designated for *Agrostia bipunctata* Redtenbacher, 1906; the previously unknown male of *Spinodares*

*jenningsi* Bragg, 1998 is described; four species are synonymised, as are four genera; *Acanthometriotes* Hebard, 1924 is reduced to a subgenus of *Metriophasma* Uvarov, 1940; *Parobrimus* Scudder, 1895 is reinstated as a valid genus.

This book represents an indispensable tool for anyone interested in identification or systematics of phasmids.

## Phasmid Abstracts

The following abstracts briefly summarise articles which have recently appeared in other publications. Some of these may be available from local libraries. Others will be available in university or college libraries, many of these libraries allow non-members to use their facilities for reference purposes free of charge.

The editor of *Phasmid Studies* would welcome recent abstracts from authors so that they may be included in forthcoming issues. In the case of publications specialising in phasmids, such as *Phasma*, only the longer papers are summarised.

**Akay, T., Haehn, S., Schmitz, J. & Bueschges, A. (2004)** Signals from load sensors underlie interjoint coordination during stepping movements of the stick insect leg. *Journal of Neurophysiology (Bethesda)*, **92**(1): 42-51.

During stance and swing phase of a walking stick insect, the retractor coxae (RetCx) and protractor coxae (ProCx) motoneurons and muscles supplying the thorax-coxa (TC)-joint generate backward and forward movements of the leg. Their activity is tightly coupled to the movement of the more distal leg segments, i.e., femur, tibia, and tarsus. We used the single middle leg preparation to study how this coupling is generated. With only the distal leg segments of the middle leg being free to move, motoneuronal activity of the de-afferented and -afferented TC-joint is similarly coupled to leg stepping. RetCx motoneurons are active during stance and ProCx motoneurons during swing. We studied whether sensory signals are involved in this coordination of TC-joint motoneuronal activity. Ablation of the load measuring campaniform sensilla (CS) revealed that they substantially contribute to the coupling of TC-joint motoneuronal activity to leg stepping. Individually ablating trochanteral and femoral CS revealed the trochanteral CS to be necessary for establishing the coupling between leg stepping and coxal motoneuron activity. When the locomotor system was active and generated alternating bursts of activity in ProCx and RetCx motoneurons, stimulation of the CS by rearward bending of the femur in otherwise de-afferented mesothoracic ganglion terminated ongoing ProCx motoneuronal activity and initiated RetCx motoneuronal activity. We show that cuticular strain signals from the trochanteral CS play a major role in shaping TC-joint motoneuronal activity during walking and contribute to their coordination with the stepping pattern of the distal leg joints. We present a model for the sensory control of timing of motoneuronal activity in walking movements of the single middle leg.

**Baert, D. (2004)** *Pistacia lentiscus*. *Phasma*, **14**(55): 13. [in Dutch]

This article describes the food plant *Pistacia lentiscus* with a lot of information about the history, other uses than just food plant, how to keep the plant, other members of the family and a lot more.

**Baessler, U., Sauer, A.E. & Bueschges, A. (2003)** Vibration signals from the FT joint can induce phase transitions in both directions in motoneuron pools of the stick insect walking system. *Journal of Neurobiology*, **56**(2): 125-138.

The influence of vibratory signals from the femoral chordotonal organ fCO on the activities of muscles and motoneurons in the three main leg joints of the stick insect leg, i.e., the thoraco-coxal (TC) joint, the coxa-trochanteral (CT) joint, and the femurtibia (FT) joint, was investigated when the animal was in the active behavioral state. Vibration stimuli induced a switch in motor activity (phase transition), for example, in the FT joint motor activity switched from flexor tibiae to extensor tibiae or vice versa. Similarly, fCO vibration induced phase transitions in both directions between the motoneuron pools of the TC joint and the CT joint. There was no correlation between the directions of phase transition in different joints. Vibration stimuli presented during simultaneous fCO elongation terminated the reflex reversal motor pattern in the FT joint prematurely by activating extensor and inactivating flexor tibiae motoneurons. In legs with freely moving tibia, fCO vibration promoted phase transitions in tibial movement. Furthermore, ground vibration promoted stance-swing transitions as long as the leg was not close to its anterior extreme position during stepping. Our results provide evidence that, in the active behavioral state of the stick insect, vibration signals can access the rhythm generating or bistable networks of the three main leg joints and can promote phase transitions in motor activity in both directions. The results substantiate earlier findings on the modular structure of the single-leg walking pattern generator and indicate a new mechanism of how sensory influence can contribute to the synchronization of phase transitions in adjacent leg joints independent of the walking direction.

**Blaesing, B. & Cruse, H. (2004)** Stick insect locomotion in a complex environment: climbing over large gaps. *Journal of Experimental Biology*, **207**(8): 1273-1286.

In a complex environment, animals are challenged by various types of obstacles. This requires the controller of their walking system to be highly flexible. In this study, stick insects were presented with large gaps to cross in order to observe how locomotion can be adapted to challenging environmental situations. Different approaches were used to investigate the sequence of gap-crossing behaviour. A detailed video analysis revealed that gap-crossing behaviour resembles modified walking behaviour with additional step types. The walking sequence is interrupted by an interval of exploration, in which the insect probes the gap space with its antennae and front legs. When reaching the gap, loss of contact of an antenna with the ground does not elicit any observable reactions. In contrast, an initial front leg step into the gap that often follows antennal 'non-contact' evokes slowing down of stance velocity. An ablation experiment showed that the far edge of the gap is detected by tactile antennal stimulation rather than by vision. Initial contact of an antenna or front leg with the far edge of the gap represents a 'point of no return', after which gap crossing is always successfully completed. Finally, flow chart diagrams of the gap-crossing sequence were constructed based on an ethogram of single elements of behaviour. Comparing flow charts for two gap sizes revealed differences in the frequency and succession of these elements, especially during the first part of the sequence.

**Bresseel, J. (2004)** Kweekbeschrijving *Pharnacia ponderosa* (Stål, 1877). *Phasma*, **14**(51-52): 15-16. [in Dutch]

*Pharnacia ponderosa* is a large species that occurs in the Philippines and has a wide distribution among these islands. It is a difficult species to rear in captivity as nymphs die for no apparent reason and it is difficult to find a suitable foodplant all year round.

**Bresseel, J.** (2004) Soortbeschrijving van *Canachus alligator* (Redtenbacher, 1908). *Phasma*, **14**(54): 5-6. [in Dutch]

*Canachus alligator* a species from New Caledonia, has been reared in captivity for the first time by Oliver Coiffier. It is a member of the Eurycanthinae and can be reared on bramble.

**Brock, P.D.** (2002) Malaysian Stick Insect rarities. *Malaysian Naturalist*, **56**(1): 42-43.

Rarer species are discussed. *Marmessoidea rubescens* is confirmed as a Malayan species. *Nearchus grubaueri* is also discussed in detail and illustrated in colour.

**Brock, P.D.** (2004) Taxonomic notes on giant southern African stick insects (Phasmida), including the description of a new *Bactrododema* species. *Annals of the Transvaal Museum*, **41**: 61-77.

The southern African species of *Bactrododema* Stål, 1858, *Palophus* Westwood, 1859 (both Diapheromeridae: Palophinae) and *Bactricia* Kirby, 1896 (Diapheromeridae: Diapheromerinae), are reviewed. *Bactrododema krugeri* spec. nov. is described, while *Bactrododema hecticum* (Lichtenstein, 1796) comb. nov. is redescribed and discussed. *Bactrododema brevitarsis* Stål, 1876, *Bactrododema aculiferum* Kirby, 1902, *Bactrododema lugardi* Kirby, 1902, *Palophus brevicornis* Redtenbacher, 1908, *Palophus holubi* Redtenbacher, 1908, and *Palophus transvaalensis* Redtenbacher, 1908, are synonymized with *Bactrododema tiaratum* Stål, 1858. *Phibalosoma calametum* Bates, 1865, *Hyrtacus carinatus* Kirby, 1902, and *Bactricia irregularis* Brunner, 1907, are synonymized with *Bactricia bituberculata* (Schaum, 1857) stat. rev., which takes priority over *Bactricia trophinus* (Westwood, 1859). The genus *Palophus* is regarded as a synonym of the genus *Bactrododema*. *Palophus titan* Sjöstedt, 1913 is synonymized with *Bactrododema hippotaureum* (Karsch, 1896) comb. nov. *Palophus rothschildi* Bolivar, 1922 is synonymized with *Bactrododema phillipsi* (Kirby, 1896) comb. nov., and *Palophus brongniarti* Redtenbacher, 1908 is synonymized with *Bactrododema episcopalis* (Kirby, 1896) comb. nov. Keys to the adults of South African species are provided, eggs of two *Bactrododema* species are described, and the distribution of all southern African *Bactrododema* species mapped.

**Brock, P.D. & Hasenpusch, J.** (2003) Studies on the leaf insects (Phylliidae) of Australia. *Journal of Orthoptera Research*, **11**(2): 199-205.

Studies on the rarely reported Australian leaf insects have revealed that the previously reported *Phyllium* species from northern Queensland, Australia – *P. frondosum* Redtenbacher 1906 and *P. siccifolium* (L.) are misidentifications. Consequently, a new species *Phyllium (Phyllium) monteithi* is described and figured, including the egg. *Nanophyllium pygmaeum* Redtenbacher, 1906 is confirmed as Australian although it may be a different species, possibly even similar in appearance, or related to *Phyllium (Phyllium) frondosum* Redtenbacher, although females are needed to clarify the position. A third Australian species is also reported: *Chitoniscus lobiventris* (Blanchard 1853), based on a single museum record from 1903. Keys are provided to distinguish Australian leaf insects.

**Bucher, D., Akay, T., DiCaprio, R.A. & Bueschges, A.** (2003) Interjoint coordination in the stick insect leg-control system: The role of positional signalling. *Journal of Neurophysiology (Bethesda)*, **89**(3): 1245-1255.

Interjoint coordination is essential for proper walking behaviour in multi-jointed insect legs. We have shown previously that movement signals from the femur-tibia (FT) joint can shape motor activity of the adjacent coxa-trochanter (CT) joint in the stick insect, *Carausius*

*morosus*. Here, we present data on the role of position signals from the FT-joint on activity generated in motoneurons (MNs) of the CT-joint. We show that the probability of occurrence of stance (with depression in the CT-joint) or swing movements (with levation in the CT-joint) at the start of walking sequences is influenced by the angle of the FT-joint in the resting animal. We tested the influence of FT-joint angle on pharmacologically induced rhythmic activity of CT-joint depressor (DprTr) and levator (LevTr) MNs. The burst duration, mean spike rate within bursts, and duty cycle for each MN pool were found to depend on FT position. For LevTr MNs, these parameters progressively increased as the FT-joint was moved from extension to flexion, and the opposite was true for DprTr MNs. The cycle period of CT-MN rhythmicity also depended on FT position. In addition, we sometimes observed that the motor output shifted completely to one MN pool at extreme positions, suggesting that the central rhythm-generating network for the CT-joint became locked in one phase. These results indicate that position signals from the FT-joint modulate rhythmic activity in CT-joint MNs partly by having access to central rhythm generating networks of the CT-joint.

**Bueschges, A., Ludwar, B.C., Bucher, D., Schmidt, J. & DiCaprio, R.A.** (2004) Synaptic drive contributing to rhythmic activation of motoneurons in the deafferented stick insect walking system. *European Journal of Neuroscience*, **19**(7): 1856-1862.

A general feature of motor patterns for locomotion is their cyclic and alternating organization. In walking, for example, rhythmic activity in leg motoneurons innervating antagonistic muscles of a joint is primarily antiphasic within each cycle. We investigate which role central pattern generating networks play in the generation of leg motoneuron activity in the absence of sensory feedback. We elicited activity in antagonistic flexor and extensor tibiae motoneurons in the deafferented mesothoracic ganglion of the stick insect by mechanically stimulating the head or abdomen, while recording intracellularly from their neuropilar processes. In most cases, tactile stimulation induced coactivation of tibial motoneurons. However, in approx 25% of the trials, tibial motoneurons generated alternating cycles consisting of bursts of action potentials that were terminated by strong inhibitory synaptic inputs. Injection of depolarizing current increased the amplitude of the inhibitory phase of the oscillation, while hyperpolarizing current decreased it and revealed a tonic depolarization of the motor neurons during the bout of rhythmic motor activity. The same results were gathered from recording tibial leg motoneurons during 'twitching' motor activity in decerebrated animals. Our results indicate that alternating rhythmic motoneuron activity in the deafferented stick insect walking system results from phasic inhibitory drive provided by central pattern generating networks. This inhibitory input patterns the firing of the motoneurons that results from a tonic depolarizing drive. This tonic depolarizing drive was also observed in tibial motoneurons of the deafferented mesothoracic ganglion during walking movements of the intact ipsilateral front leg.

**Burrows, M. & Morris, O.** (2002) Jumping in a winged stick insect. *Journal of Experimental Biology*, **205**(16): 2399-2412.

The Thailand winged stick insect (*Sipyloidea* sp.) flees rapidly from a disturbance by jumping forwards when stimulated on the abdomen and backwards when stimulated on the head. The mechanisms underlying these fast movements were analyzed by measuring movements of the body and legs from images captured at 250Hz. A forward jump of both adults and nymphs involves movements of the abdomen and the middle and hind pairs of legs. The abdomen is raised and swung forwards by flexion at the joint with the metathorax and at the joint between the meso- and metathorax. At the same time, the tibiae of the hind and middle legs are extended and their femora depressed. The femora-tibial joints of the legs are



not fully flexed before a jump, and no structures in these joints appear to store muscular energy. The whole jumping sequence takes approximately 100 ms and results in take-off angles of 10-35° at velocities of 0.6-0.8ms<sup>-1</sup> and with an acceleration of 10ms<sup>-2</sup>. The abdominal angular velocity was 2000°s<sup>-1</sup> and the tip of the abdomen moved at linear velocities of some 1ms<sup>-1</sup>, while the maximum rate of tibial extension was 4000°s<sup>-1</sup>. Rapid backward movements result either in the collapse of the body onto the ground, with a displacement away from the stimulus of approximately half a body length, or in the propulsion of the insect off its perch. Neither movement involves curling of the abdomen. From a horizontal posture, the forward jumps result in a displacement of a few body lengths. More lift can be generated in adults by elevating the hind wings as the abdomen is swung forwards and depressing them as the legs lose contact with the ground. In this way, jumps can lead directly to flapping flight. Take-off into flight can, however, be achieved without the abdominal movements seen during jumping. From a vertical posture, a forward jump propels the insect upwards and backwards before it falls to the ground horizontally displaced from its perch. Backward movements result in the insect falling with little horizontal displacement from its perch.

**Camousseight, A.** (2003) Biology of *Heteronemia mexicana* Gray, 1835 (Phasmatodea, Diapheromeridae), an species with explosive reproduction, associated to pine forest. *Biología de Heteronemia mexicana* Gray, 1835 (Phasmatodea, Diapheromeridae), una especie con reproducción explosiva, asociada a bosque de pino. *Boletín del Museo Nacional de Historia Natural, Chile*, **52**: 7-15. [in Spanish]

The rearing of *Heteronemia mexicana* Gray in laboratory conditions has provided the following results: a) females produced an average of 480 eggs each (N=10), b) only 31.4% of these eggs has succeeded in being born. c) the nymphs raised reached the first moulting on an average of 1.7%, but then only a 1.3% of them arrived to the imago state. Males height reached 8.7cm on average, while females reached 10.6cm, though all of the individuals measured 10mm at birth, after the first moulting they double their height; this is the largest growing in the whole postembryonic cycle. The largest mortality rate (about 98%) has occurred at the state just before the first moulting, the following postembryonic states having an average of 0.4%. d) sexual rate got to be 19 males to seven females (1:2). e) the whole development period has taken 114 days, divided in seven moultings in the case of males and almost all the females. Yet, several females has shown a longer development, 144.2 days on average, and an eighth moulting. f) males adult life is 59.1% shorter than females. It lasted an average of 47.3 days while females live 80 days. g) the egg-laying period (65.1 days) lasts more than twice the time than the previous state (17.6 days). h) life cycle lasted 171.1 days in males case, and 215 in females.

**Cecchetti, A., Locci, M.T., Masetti, M., Fausto, A.M., Gambellini, G., Mazzini, M. & Giorgi, F.** (2003) Vitellin cleavage products are proteolytically degraded by ubiquitination in stick insect embryos. *Micron*, **34**(1): 39-48.

Vitellin polypeptides are proteolytically processed in ovarian follicles and embryos of the stick insect *Carausius morosus*. Data show that vitellin polypeptide A3 of 54 kDa is processed to yield polypeptide A3\* of about 48 kDa upon completion of ovarian development, whereas vitellin polypeptide A2 of 90 kDa yields polypeptide E9 during embryonic development. As vitellin polypeptides are processed, polypeptides A3\* and E9 are transferred from the yolk granules to the cytosolic space of the vitellophages and start to express a ubiquitin reactivity. At the confocal microscope, anti-ubiquitin antibodies label specifically numerous small yolk granules and the cytosolic space of vitellophages. During embryonic development, ubiquitin carrying granules undergo acidification in much the same way as

larger yolk granules. However, only these latter organelles are capable of converting a latent cysteine pro-protease into an active yolk protease upon acidification of their luminal space. These data are interpreted as indicating that ubiquitin-like polypeptides are restricted to small granules throughout ovarian and embryonic development, and that vitellin cleavage products are ubiquitinated following acidification of large yolk granules and transfer to the cytosolic space of the vitellophages.

**Cesari, M., Luchetti, A., Passamonti, M., Scali, V. & Mantovani, B.** (2003) Polymerase chain reaction amplification of the Bag320 satellite family reveals the ancestral library and past gene conversion events in *Bacillus rossius* (Insecta Phasmatodea). *Gene (Amsterdam)*, **312**: 289-295.

Polymerase chain reaction amplifications of genomic DNA in 17 individuals of bisexual and parthenogenetic populations of three subspecies of *Bacillus rossius* (Insecta Phasmatodea) revealed that the species still harbours the whole variability of the ancestral Bag320 satellite family, since monomers of all non-hybrid *Bacillus* taxa plus private sequences occur in it. Bag320 monomers had not been rescued as a major satellite component in *B. rossius*, but possibly represent the remnant of a set of diverging sequences present in the *Bacillus* ancestor. Following the library hypothesis, these monomer variants have been differently amplified along the evolutionary pathways leading to present taxa in agreement with the mitochondrial phylogeny of the genus. The putative converted tracts observed are explained as the results of past gene conversion events.

**Cliquennois, N.** (2003) A new species of *Leiophasma* from Mayotte (Phasmatodea, Pygirhynchinae?). Une nouvelle espece du genre *Leiophasma* de Mayotte (Phasmatodea, Pygirhynchinae?). *Bulletin de la Societe Entomologique de France*, **108**(4): 413-418. [in French]

*Leiophasma mayottensis* n. sp. is described; it is the first phasmid described from Mayotte of which it is maybe endemic. A key to species of *Leiophasma* is given.

**Cliquennois, N. & Brock, P.D.** (2002) *Apterograeffea*, un nouveau genre de Phasme de la Reunion et de l'île Ronde (Phasmatodea, Platycraninae). [*Apterograeffea*, a new genus of stick insect of Reunion and Round Island (Phasmatodea, Platycraninae).] *Bulletin de la Societe Entomologique de France*, **107**(4): 387-395. [In French]

Two new wingless species of stick insects from Reunion and Round Island (north of Mauritius) are described in a new genus *Apterograeffea*. *A. reunionensis* n.sp., is designated as the type species for this genus, which is related to *Graeffea* Brunner, 1868. *Ommatopseudes* Günther, 1942 is transferred from the family Phasmatidae, subfamily Platycraninae to the family Aschiphasmatidae, subfamily Aschiphasmatinae.

**Conle, O.V. & Hennemann, F.H.** (2002) Revision neotropischer Phasmatodea: Die Tribus Anisomorphi sensu Bradley and Galil 1977: (Insecta, Phasmatodea, Pseudophasmatidae). *Spixiana*, Supplement (28): 5-7. [in German]

The tribe Anisomorphi sensu Bradley and Galil 1977 (family Pseudophasmatidae, subfamily Pseudophasmatinae) including the genera *Paranisomorpha* Redtenbacher, 1906, *Autolyca* Stål, 1875, *Decidia* Stål, 1875, *Monticomorpha*, gen. nov., *Peruphasma*, gen. nov., *Atratomorpha* gen. nov., *Columbiophasma*, gen. nov., *Pseudolocyphides* Karny, 1923, *Anisomorpha* Gray, 1835, *Malacomorpha* Rehn, 1906, *Alloeophasma* Redtenbacher, 1906, and *Neophasma* Redtenbacher, 1906, is revised, based upon examination of the type material. Redescriptions of all known species belonging to this tribe are provided. Four new genera and

seven new species and subspecies are described and illustrated: *Monticomorpha*, n.gen., *Peruphasma*, n.gen., *Atratomorpha*, n.gen., *Columbiophasma*, n.gen., *Autolyca herculeana*, n.sp., *Autolyca punctata*, n.sp., *Monticomorpha marshallae*, n.sp., *Monticomorpha bispinosa*, n.sp., *Peruphasma anakena*, n.sp., *Peruphasma nigra*, n.sp., and *Neophasma rugosa flavolineata*, n.ssp. Previously unknown sexes and eggs of several species are described and illustrated for the first time. Several names of species and genera are synonymized, many species are transferred on to other genera. Lectotypes are designated for the following species: *Paranisomorpha insignis* Redtenbacher, 1906, *Autolyca pallidicornis* Stål, 1875, *Bacteria bogotensis* Goudot, 1843, *Monticomorpha roulinii* (Goudot, 1843), *Peruphasma pentlandi* (Redtenbacher, 1906), *P. unicolor* (Redtenbacher, 1906), *Columbiophasma quindensis* (Goudot, 1843), *Anisomorpha paromalus* Westwood, 1859, *Malacomorpha jamaicana* (Redtenbacher, 1906), *Alloeophasma poeyi* (Saussure, 1868), *Neophasma scabriusculum* Redtenbacher, 1906, *N. granulosum* Redtenbacher, 1906, *N. peruanum* Redtenbacher, 1906, *N. subapterum* Redtenbacher, 1906, *N. dentata* (Stål, 1875), *N. boliviana* (Redtenbacher, 1906), *N. fasciata* (Redtenbacher, 1906), *N. rugosa* (Redtenbacher 1906), and *Anisomorpha lurida* Redtenbacher, 1906. A type-species is designated for *Alloeophasma* Redtenbacher 1906. A diagnosis of the tribe, keys to the genera of Anisomorhini as well as information on the basic systematic background, and a discussion of the taxa and their geographic distribution is provided at the end of the paper.

**Delfosse, E.** (2002) Repartition, taxonomie et methodes d'elevage d'un Phasme tres colore: le Phasme du Perou *Oreophoetes peruana peruana* (Saussure, 1868) (Insecta Orthopteroidea Phasmatoptera Anaereolatae Diapheromeridae Diapheromerinae Oreophoetini). *Entomologiste (Paris)*, **58**(5-6): 265-281. [in French]

The Stick-insect *Oreophoetes peruana* (Saussure, 1868): distribution, biology, toxic product, synonymies, foodplants list, rearing, gynandromorphs, aggressivity, an other species in this genus, bibliography.

**DiCaprio, R.A., Wolf, H. & Bueschges, A.** (2002) Activity-dependent sensitivity of proprioceptive sensory neurons in the stick insect femoral chordotonal organ. *Journal of Neurophysiology (Bethesda)*, **88**(5): 2387-2398.

Mechanosensory neurons exhibit a wide range of dynamic changes in response, including rapid and slow adaptation. In addition to mechanical factors, electrical processes may also contribute to sensory adaptation. We have investigated adaptation of afferent neurons in the stick insect femoral chordotonal organ (fCO). The fCO contains sensory neurons that respond to position, velocity, and acceleration of the tibia. We describe the influence of random mechanical stimulation of the fCO on the response of fCO afferent neurons. The activity of individual sensory neurons was recorded intracellularly from their axons in the main leg nerve. Most fCO afferents (93%) exhibited a marked decrease in response to trapezoidal stimuli following sustained white noise stimulation (bandwidth=60 Hz, amplitudes from +5 to +30°). Concurrent decreases in the synaptic drive to leg motoneurons and interneurons were also observed. Electrical stimulation of spike activity in individual fCO afferents in the absence of mechanical stimulation also led to a dramatic decrease in response in 15 of 19 afferents tested. This indicated that electrical processes are involved in the regulation of the generator potential or encoding of action potentials and partially responsible for the decreased response of the afferents. Replacing Ca<sup>2+</sup> with Ba<sup>2+</sup> in the saline surrounding the fCO greatly reduced or blocked the decrease in response elicited by electrically induced activity or mechanical stimulation when compared with control responses. Our results indicate that activity of fCO sensory neurons strongly affects their

sensitivity, most likely via  $\text{Ca}^{2+}$ -dependent processes. [Work done with *Carausius morosus*].

**Diederich, B., Schumm, M. & Cruse, H.** (2002) Stick insects walking along inclined surfaces. *Integrative and Comparative Biology*, **42**(1): 165-173.

In the experiments stick insects walk on an inclined substrate such that the legs of one side of the body point uphill and the legs of the other side point downhill. In this situation the vertical axis of the body is rotated against the inclination of the substrate as if to compensate for the effect of substrate inclination. A very small effect has been found when the experiment was performed with animals standing on a tilted platform which shows that the effect depends on the behavioral context. When, however, animals first walked along the inclined surface and then, before measurement, stopped walking spontaneously, a rotation of the body has been observed similar to that in walking animals. In a second experiment it was tested whether the observed body rotation is caused by the change of direction of gravity vector or by the fact that on an inclined surface gravity necessarily has a component pulling the body sideways. Experiments with animals standing on horizontal ground and additional weights applied pulling the body to the side showed similar body rotations supporting the latter idea. In a simulation study it could be shown that the combined activity of proportional feedback controllers in the leg joints is sufficient to explain the observed behaviour. This is however only possible if the gain factors of coxa-trochanter joint controller and of femur-tibia joint controller show a ratio in the order of 1:0.05 to 1:1.8. In order to describe the behaviour of animals standing on a tilted platform, a ratio of 1:1.7 is necessary. In walking animals, this body rotation requires to change the trajectories of stance and swing movements. The latter have been studied in more detail. During swing, the femur-tibia joint is more extended in the uphill legs. Conversely, the coxa-trochanter joint appears to be more elevated in the downhill legs which compensates the smaller lift in the femur-tibia joint. The results are discussed in the context of different hypotheses.

**Dols, J.** (2004) Er was eens... een wandelende tak. *Phasma*, **14**(55): 11-12. [in Dutch]

The oldest known stick insects are fossils dating back some more than 44 million years ago. Most of these have been found in several types of amber, fossilized tree fluids, this is nothing more than hardened and by natural forces chemically altered sticky material that we find also often, unwanted flowing out of our Christmas trees (rosin). This article is the first part of an indepth, easy to read by all ages, story on all aspects of rosin, copal, amber and included insects, more specifically Phasmida. The second part to be issued in a next *Phasma* edition, will cover some information on the classification in different ways (Linnaean, cladistics and phylogenetics) of stick insects, without going in to deep to the facts. This will be a mere introduction to the different classification methods.

**Gabriel, J.P., Scharstein, H., Schmidt, J. & Bueschges, A.** (2003) Control of flexor motoneuron activity during single leg walking of the stick insect on an electronically controlled treadmill. *Journal of Neurobiology*, **56**(3): 237-251.

In the present study, motoneurons innervating the flexor tibiae muscle of the stick insect (*Cuniculina impigra*) middle leg were recorded intracellularly while the single leg performed walking-like movements on a treadmill. Different levels of belt friction (equivalent to a change in load) were used to study the control of activity of flexor motoneurons. During slow leg movements no fast motoneurons were active, but a recruitment of these neurons could be observed during faster leg movements. The firing rate of slow and fast motoneurons increased with incremented belt friction. Also, the force applied to the treadmill at different frictional levels was adapted closely to the friction of the treadmill to be overcome. The motoneurons

innervating the flexor tibiae were recruited progressively during the stance phase, with the slow motoneurons being active earlier than the fast (half-maximal spike frequency after 10-15% and 50-60% of the stance phase, respectively). The resting membrane potential was more hyperpolarized in fast motoneurons (64.6+/-6.5 mV) than in slow motoneurons (-52.9+/-5.4 mV). However, the threshold for the initiation of action potentials was not statistically significantly different in both types of flexor motoneurons. Therefore, action potentials were generated in fast motoneurons after a longer period of depolarization and thus later during the stance phase than in slow motoneurons. We show that motoneurons of the flexor tibiae receive substantial common excitatory inputs during the stance phase and that the difference in resting membrane potential between slow and fast motoneurons is likely to play a crucial role in their consecutive recruitment.

**Gregory, T.R.** (2002) Genome size of the northern walkingstick, *Diaperomera femorata* (Phasmida: Heteronemiidae). *Canadian Journal of Zoology*, **80**(7): 1303-1305.

The haploid genome size (C value) of the northern walkingstick, *Diaperomera femorata* (Say), was estimated to be  $1C = 2.55$  pg using Feulgen image-analysis densitometry of haemocyte and sperm nuclei. This relatively large genome is similar in size to the genomes of the few other phasmids studied so far, and is consistent with hypotheses regarding an upper limit to the size of many insect genomes imposed by the process of metamorphosis, which is relaxed among hemimetabolous orders. Comments on sperm morphology in *D. femorata* are also provided, and another possible relationship between genome size and the organismal phenotype in insects is suggested.

**Hamilton, K.G.A.** (2003) Cnemidolestodea: An ancient insect order resurrected. *Biodiversity (Ottawa)*, **4**(2): 22-24.

The newly discovered genus *Mantophasma* has been called a "new order" of insects, Mantophasmatodea. In this study it is synonymized with the fossil order Cnemidolestodea (pronounced with a silent C) which were previously thought to have died out at the end of the Carboniferous Era, 300 million years ago. Other "orders" that may prove to have evolved from Cnemidolestodea within the next 100 million years are Titanoptera and Caloneurodea. These three groups are at best suborders and represent a link between Dictyoptera (mantids, roaches, termites) and Phasmatodea (walking-stick insects). If *Mantophasma* are eventually found to lay foam-covered eggs, as do Dictyoptera and Phasmids, then the five suborders Cnemidolestodea, Titanoptera, Caloneurodea, Dictyoptera and Phasmatodea should be united as the order Oothecaria.

**Hennemann, F.H.** (2002) Notes on the Phasmatodea of Sri Lanka. *Mitt. Münch. Ent. Ges.*, **92**: 37-78.

Several taxa of Phasmatodea from Central Sri Lanka are revised, described and illustrated with special reference to the genera *Prisomera* Gray, 1835, *Stheneboea* Stål, 1875, *Ramulus* Saussure, 1862 and *Cuniculina* Brunner, 1907. A distinctive key is provided for the genera *Prisomera* Gray, 1835, *Paraprisomera* gen.n. and *Stheneboea* Stål, 1875. New diagnoses of specimens and eggs are included for all three genera. *Stheneboea* Stål, 1875 (Type-species: *Stheneboea malaya* Stål, 1875) is reinstated with its taxonomic placement discussed and a distinction as well as a list of species included is provided.

*Paraprisomera* gen.n. is established for *Clitumnus coronatus* Brunner, 1907. The male and egg of *Paraprisomera coronata* (Brunner, 1907) are described and figured for the first time and a redescription of the female is provided. *Prisomera degeneratum* Brunner, 1907, *Stheneboea esuriens* Brunner, 1907, *Stheneboea oppositifolia* Brunner, 1907, *Stheneboea*

*obtuselobata* Brunner, 1907 and *Stheneboea rarolobata* Brunner, 1907 are synonymised with *Clitumnus coronatus* Brunner (new synonyms).

The egg of *Prisomera spinicollis* Gray, 1835 is described and figured with both sexes being redescribed and figured for the first time. *Greenia ornata* Brunner, 1907 is synonymized with *P. spinicollis* Gray (syn.n.). *Lonchodes auscultator* Bates, 1865 and *Greenia ignava* Brunner, 1907 are transferred to *Prisomera* Gray, 1835 and redescrptions for both species are provided.

The egg of *Paramenexenus ceylonicus* (Saussure, 1868) is described and figured for the first time and redescrptions of the male and female are provided. *Paramenexenus molestus* Redtenbacher, 1908 is synonymized with *Anophelepis ceylonicus* Saussure (syn.n.).

The new species *Lopaphus srilankensis* sp.n. from Anuradhapura is described and illustrated from the male sex only. *Lopaphus srilankensis montanus* ssp.n. and *Parasipyloidea seiferti* sp.n. both from Nuwara Eliya region are described and figured in both sexes and the eggs. The egg of *Parasipyloidea seiferti* sp.n. is the first to be known from the genus *Parasipyloidea* Redtenbacher, 1908. A key is provided for the Sri Lankan taxa of *Parasipyloidea* Redtenbacher, 1908 as well as a new diagnosis, differentiation and brief discussion of the systematic placement of the genus.

Both sexes of *Sceptrophasma humilis* (Westwood, 1859) are redescribed and illustrated as is the egg for the first time. *Bacillus carinulatus* Saussure, 1868 is synonymized with *Bacillus humilis* Westwood, 1859 (syn.n.). *Cuniculina* Brunner, 1907 is reinstated and a new diagnosis, differentiation and a list of species included is provided. *Cuniculina cuniculus* (Westwood, 1859) is selected as the type-species of *Cuniculina* Brunner, 1907. Both sexes as well as the eggs of *Cuniculina cuniculus* (Westwood, 1859) are described and illustrated and its synonymy as well as intraspecific variation are discussed. The following species are synonymized with *Cuniculina cuniculus* (Westwood): *Cuniculina acute-cornuta* Brunner, 1907, *Clitumnus attingens* Brunner, 1907, *Lonchodes ceylonicus* Saussure, 1868, *Lonchodes grallator* Bates, 1865, *Bacillus hyphereon* Westwood, 1859, *Cuniculina insolens* Brunner, 1907, *Cuniculina inverse-cornuta* Brunner, 1907, *Cuniculina laevissima* Brunner, 1907, *Clitumnus rivalis* Brunner, 1907 and *Bacillus scytale* Bates, 1865 (new synonyms).

A discussion is provided for the identity and systematic placement of the genera *Baculum* Saussure, 1861 (Type-species: *Baculum ramosum* Saussure, 1861), *Ramulus* Saussure, 1862 (Type-species *Bacillus (Ramulus) humberti* Saussure, 1862) and *Ramulus* Saussure, 1869 (Type-species: *Bacillus carinulatus* Saussure, 1868). The systematics and synonymies of the genera *Ramulus* Saussure, 1862 and *Clitumnus* Stål, 1875 are briefly discussed.

*Paraclitumnus* Brunner, 1893 (Type-species: *Paraclitumnus lineatus* Brunner, 1893) is synonymized with *Ramulus* Saussure, 1862 (syn.n.). *Dubreuilia* Brunner, 1907 is a junior synonym of *Paraclitumnus* Brunner and finally becomes a new synonym of *Ramulus* Saussure, 1862 (syn. n.). *Clitumnus trilineatus* Brunner, 1907 is synonymized with *Ramulus humberti* (Saussure, 1862) (syn.n.). Redescrptions of both sexes are provided. *Clitumnus humberti* Carl, 1913 is given a replacement name and renamed as *Ramulus braggi* nom.nov.

The male and egg of *Ramulus lobulatus* (Brunner, 1907) are described and figured for the first time and a redescrption of the female is provided.

Lectotypes are designated for the following species: *Bacillus carinulatus* Saussure, 1868, *Bacillus (Ramulus) humberti* Saussure, 1862, *Bacillus hyphereon* Westwood, 1859, *Lonchodes ceylonicus* Saussure, 1868, *Clitumnus coronatus* Brunner, 1907, *Clitumnus trilineatus* Brunner, 1907, *Clitumnus rivalis* Brunner, 1907, *Cuniculina insolens* Brunner, 1907, *Greenia ornata* Brunner, 1907, *Lonchodes taprobanae* Westwood, 1859, *Prisomera degeneratum* Brunner, 1907, *Prisomera perlobatum* Brunner, 1907, *Stheneboea esuriens*

Brunner, 1907 and *Paramenexenus molestus* Redtenbacher, 1908.

Holotypes of new taxa are deposited in the ZSMC, paratypes in both the ZSMC and the author's collection.

**Hennemann, F.H. & Conle, O.V.** (2003) Catalogue of type specimens of Phasmatodea (Insecta) deposited in the Staatliche Museum für Naturkunde in Stuttgart. *Stuttgarter Beitrage zur Naturkunde*, Serie A (Biologie) **651**: 1-8.

A catalogue of all Phasmatodea type material lodged in the Staatliche Museum für Naturkunde in Stuttgart (SMNS) is provided (28 species: ten described by Brunner von Wattenwyl (1907), two by Hennemann, Conle & Brückner (1996a, 1996b), one by Hennemann, Gehler & Conle (1995a), one by Kevan (1955) and 14 by Redtenbacher (1906, 1908)). The taxa are listed alphabetically by species for each author along with the number of specimens, sex, locality and additional information if necessary. A few of the specimens, marked as types, are very doubtful to represent type material; their status is clarified. Some background information on the collection of the SMNS, important collectors and the type material is provided. The type material of four taxa described by Brunner von Wattenwyl (1907) and four taxa described by Redtenbacher (1908) from the SMNS could not be traced; it is listed separately. Lectotypes are designated for *Diardia battak* Redtenbacher, 1908 and *Ocnophila ornatissima* Brunner von Wattenwyl, 1907. *Bacteria imitans* Redtenbacher, 1908 is found to be a junior synonym of *Phanocloidea muricata* (Burmeister, 1838).

**Hennemann, F.H. & Conle, O.V.** (2004) *Paractenomorpha baehri*, gen. nov., spec. nov., a new Phasmid from South Australia (Insecta). *Spixiana*, **27**(1): 15-18.

An interesting new species of Phasmatodea from Gawler Ranges, South Australia is described and illustrated from the female sex. The new genus *Paractenomorpha*, gen. nov. is established for *P. baehri*, spec. nov., which is designated as the type species. One additional species, *P. macrotegmus* (Tepper, 1887) is included in the new genus *Paractenomorpha*, gen. nov. which is closely related to *Ctenomorpha* Gray, 1833. The holotype of *Paractenomorpha baehri*, spec. nov. is preserved in the collection of the Zoologische Staatssammlung Munich, Germany (ZSMC).

**Jewell, T. & Brock, P.D.** (2003) A Review of the New Zealand Stick Insects: New Genera and Synonymy, Keys, and a Catalogue. *Journal of Orthoptera Research*, **11**(2): 189-197.

This catalogue lists all genera and species of stick insects recorded or described from New Zealand. Genera are listed in alphabetical order within established subfamilies and tribes. Some taxonomic changes are made, with major changes as follows: two new genera in the subfamily Pachymorphinae are erected - *Niveaphasma* (type species - *Pachymorpha annulata* Hutton 1898) and *Asteliaphasma* (type species - *Spinotectarchus jucundus* Salmon 1991). *Mimarchus tarsatus* Carl 1913 is reduced to synonymy under *Argosarchus horridus* (White 1846), resulting in *Mimarchus* Carl 1913 becoming a synonym of *Argosarchus* Hutton 1898. Lectotypes are designated for *Argosarchus schauinslandi* Brunner 1907, *Clitarchus interruptelineatus* Brunner 1907, *Clitarchus laeviusculus* Stål 1875, *Micrarchus parvulus* Carl 1913, *Micrarchus tarsatus* Carl 1913 and *Pachymorpha bouvieri* Brunner 1907. Keys to adults and eggs of genera are given. The bibliography includes all references containing descriptions of species recorded or described from New Zealand.

**Klass, K.D., Zompro, O., Kristensen, N.P. & Adis, J.** (2002) Mantophasmatodea: A new insect order with extant members in the afrotropics. *Science*, **296**(5572): 1456-1459.

A new insect order, Mantophasmatodea, is described on the basis of museum specimens

of a new genus with two species: *Mantophasma zephyra* n.gen. & n.sp. (one female from Namibia) and *M. subsolana* n.sp. (one male from Tanzania). This is the first time since 1914 that a newly described extant insect taxon has proved unplaceable within a recognized order. Mantophasmatodeans are apterous carnivores. Their closest phylogenetic relationships may be to Grylloblattodea (ice-crawlers) and/or Phasmatodea (stick insects), but the morphological evidence is ambiguous. *Raptophasma* Zompro from Baltic amber is assigned to the Mantophasmatodea, revealing a wider previous range for the lineage.

**Lindigkeit, H.** (2003) Haltung und Nachzucht des Wandelnden Blattes *Phyllium* (*Phyllium*) *celebicum* de Haan, 1842 (Phasmatodea: Phylliidae). *Arthropoda*, **11**(2): 2-6. [in German]

A method for keeping and breeding the leaf insect *Phyllium* (*Phyllium*) *celebicum* de Haan, 1842 with rather seldom watering but good ventilation and the help of a PC fan is described, hints for troubleshooting, caring for the eggs and keeping fungus on the eggs low are given, a problem with time delayed death after a period with bad food supply is reported.

**Luchetti, A., Cesari, M., Carrara, G., Cavicchi, S., Passamonti, M., Scali, V., & Mantovani, B.** (2003) Unisexuality and molecular drive: Bag320 sequence diversity in *Bacillus* taxa (Insecta Phasmatodea). *Journal of Molecular Evolution*, **56**(5): 587-596.

Satellite DNA variability follows a pattern of concerted evolution through homogenization of new variants by genomic turnover mechanisms and variant fixation by chromosome redistribution into new combinations with the sexual process. *Bacillus* taxa share the same Bag320 satellite family and their reproduction ranges from strict bisexuality (*B. grandii*) to automictic (*B. atticus*) and apomictic (*B. whitei* = *rossius/grandii*; *B. lynceorum* = *rossius/grandii/atticus*) unisexuality. Thelytokous reproduction clearly allows uncoupling of homogenization from fixation. Both trends and absolute values of satellite variability were analyzed in all *Bacillus* taxa but *B. rossius*, on 906 sequenced monomers at all level of comparisons: intraspecimen, intrapopulation, interpopulation, intersubspecies, and interspecies. For unisexuality, allozymic and mitochondrial clones were also taken into account. Different reproductive modes (sexual/parthenogenetic) appear to explain observed variability trends, supporting Dover's hypothesis of sexuality acting as a driving force in the fixation of sequence variants, but the present analyses also highlight current spreading of new variants in *B. grandii maretimi* specimens and point to a biased sequence inheritance at the time of hybrid onset in the apomictic hybrids *B. whitei* and *B. lynceorum*. Evidence of biased gene conversion events suggests that, given enough time, sequence homogenization can take place in a unisexual such as *B. lynceorum*. On the contrary, the absolute values of sequence diversity in each taxon are linked to the species' range, time of divergence, and repeat copy number and, possibly, to transposon features. Satellite dynamics appears therefore to be the outcome of both general molecular processes and specific organismal traits.

**Marescalchi, O. & Scali, V.** (2003) Automictic parthenogenesis in the diploid-triploid stick insect *Bacillus atticus* and its flexibility leading to heterospecific diploid hybrids. *Invertebrate Reproduction and Development*, **43**(2): 163-172.

*Bacillus atticus carius* is a complex of diploid and triploid all-female parthenogens. In diploids the first meiotic divisions are regular and segregate two haploid nuclei which fuse back to restore an unreduced condition. Second meiotic divisions yield a polar body and a pronucleus which starts embryo development. In triploids univalent, heterologous and multivalent chromosome associations occur, leading to unbalanced segregating nuclei, as evidenced by DNA measurements. Fused prophase II nuclei reconstitute a triploid nucleus which undergoes metaphase II to originate a polar body and the pronucleus. These findings



explain both the heterozygosity pattern and the clonal maintenance of cytotypes in the progeny. They also suggest, in line with allozyme and NOR's findings, possible interracial crosses at the origin of the polyclonal *B. atticus* complex. Fertilised egg batches of *B. atticus* females mated to *B. grandii* or *B. rossius* males had a lower hatching than virgin egg controls, indicating that sperm-egg interaction occurs and that the ensuing hybrid embryos suffer from bringing together heterospecific gene pools. Nonetheless, a low number of diploid hybrids - via fertilisation by sperm of haploid ova which had resumed a normal meiosis - or triploid hybrids - via sperm genome addition to diploid ova - were obtained. On the whole, the maintenance of some recombination during prophase I and the ability to produce diploid and triploid hybrids demonstrates that these parthenogenetic strains are neither invariant nor reproductively isolated from related taxa, as also occurs in other unisexuals.

**Marescalchi, O., Zauli, C. & Scali, V. (2002)** Centrosome dynamics and inheritance in related sexual and parthenogenetic *Bacillus* (Insecta Phasmatodea). *Molecular Reproduction and Development*, **63**(1): 89-95.

In animals, some general features of centrosome dynamics and inheritance have been widely recognized. The most acknowledged model assigns to sperm the contribution of a centriole to the fertilized egg, which in turn provides the pericentriolar materials, including gamma-tubulin, recruiting them from the cytoplasm: the main zygote microtubule organizing centre (MTOC) is thus reconstituted to organize first the spermaster and then the full first embryonic spindle. Obviously the model cannot apply to parthenogenetic systems, which actually rely on egg components alone. In stick insects of the *Bacillus* genus, the spindle of both somatic and germ cells is clearly anastral, therefore we have been investigating their centrosome in sexual and parthenogenetic taxa by analyzing its component dynamics and transmissions through the use of monoclonal beta- and gamma-tubulin antibodies and transmission electron microscopy (TEM). It has been shown that in sexually reproducing species the spermatozoon does not contribute the centriole, so that the egg wholly provides the MTOC and the ensuing anastral spindle of the embryo: MTs appear to derive from pronuclear chromatin surroundings and no asters are observed. The parthenogenetic embryo development is the same as the sexual one if syngamy is excepted. The parthenogenetic mechanism realized by these panoistic insects appears to differ from observed in the meroistic hymenopteran and drosophilid species, where the embryo spindle derives from asters formed in the egg cortex. In stick insects, the lack of sperm contribution to embryonic centrosome appears to be a major trait accounting for the widespread occurrence of facultative and obligate parthenogenesis within the order.

**Meyer-Rochow, V.B. & Keskinen, E. (2003)** Post-embryonic photoreceptor development and dark/light adaptation in the stick insect *Carausius morosus* (Phasmida, Phasmatidae). *Applied Entomology and Zoology*, **38**(3): 281-291.

The aims of this paper have been (a) to document postembryonic eye growth in the common laboratory stick insect *Carausius morosus* and (b) to examine whether the capacity of the eye to adapt to changing light intensities varied with age. We found that number of facets, corneal thickness, ommatidial diameter, widths of cone and retinal layers, and rhabdom volume increased linearly. Interommatidial angles, pigment grain sizes, and microvillar diameters, however, remained approximately the same. On the basis of the morphometric data we calculated that sensitivity in the adult stick insect eye was at least tenfold that of the eye of first instar nymphs and could show that adults would be able to perceive a similar amount of detail at considerably dimmer ambient light than the smaller individuals. In terms of resolving power this means that light- and dark-adapted first instar

stick insects possess acceptance angles of 5.3° and 8°, respectively and that the corresponding figures for the adult eye are 4.7° and 7.3°. The bigger (and more light-sensitive) eye of fully grown *C. morosus* makes protection against radiation damage a more serious issue in the adult individual than the small first instar. The findings explain why smaller (=younger) stick insects are less nocturnal than mature, fully-grown individuals. It is, thus, not surprising to see that dark/light adaptational photomechanical changes affecting pigment position and rhabdom widths, are more pronounced in the eyes of the adults.

**Monteforti, G., Angeli, S., Petacchi, R. & Minnocci, A. (2002)** Ultrastructural characterization of antennal sensilla and immunocytochemical localization of a chemosensory protein in *Carausius morosus* Brunner (Phasmida: Phasmatidae). *Arthropod Structure and Development*, **30**(3): 195-205.

The aim of this work was to investigate the olfactory system of the walking stick insect, *Carausius morosus*. Morphological, ultrastructural and immunocytochemical studies of adult female antennae were conducted by scanning and transmission electron microscopy. Extensive cross-section series were made through the last antennal segment to define the cuticular apparatus, wall pore distribution and the number of innervating receptor neurons of each sensillum type. Single-walled wall pore sensilla occur in three subtypes: (i) with 27 or 28 branched receptor neurons, (ii) with two branched neurons and (iii) with one or two unbranched neurons, respectively. Double-walled wall pore sensilla were found in two subtypes with spoke channels, one with four unbranched neurons, the other with two unbranched neurons. One terminal pore sensillum was found, showing two cavities within the hair and being innervated by six sensory cells.

Immunocytochemical experiments were performed to show the localization of a 19 kDa soluble protein found in the chemosensory organs of *C. morosus*. This protein shows an amino acid sequence homologous to the family of chemosensory proteins (CSP). The polyclonal antibody raised against the purified protein (CSP-cmA) showed, for the first time in CSPs, a strong labelling in olfactory sensilla, specifically in the sensillum lymph surrounding the dendritic branches of SW-WP sensilla and in the uninnervated lumen between the two concentric walls of DW-WP type one sensilla.

**Nel, A., Marchal-Papier, F., Bethoux, O. & Gall, J. (2004)** A "stick insect-like" from the Triassic of the Vosges (France) ("pre-Tertiary Phasmatodea"). *Annales de la Societe Entomologique de France*, **40**(1): 31-36.

*Palaeochresmoda grauvogeli*, new genus and species of "stick insect-like" is described from the Lower-Middle Triassic of France. It is the oldest known Prochresmodidae and probably "pre-Tertiary Phasmatodea". The importance of phylogenetic analyses is emphasized for the estimations of the insect palaeobiodiversity and the crises that could have affected it.

**Nosil, P. (2002)** Transition rates between specialization and generalization in phytophagous insects. *Evolution*, **56**(8): 1701-1706.

Although most species of animals exhibit specialized patterns of resource use, it is unclear whether specialization evolves at a faster rate than generalization. To test this hypothesis, transition rates toward specialization and toward generalization were estimated using phylogenies from 15 groups of phytophagous insects. Among the groups studied, maximum-likelihood analyses showed that the forward transition rate from generalization to specialization was significantly higher than the reverse transition rate from specialization to generalization (mean ratio of forward to reverse transition rate = 1.47 using uniform branch lengths and 1.76 using Grafen branch lengths). Although phylogenetic conservatism of host-

plant use is common, the results suggest that the evolution of specialization is a highly dynamic process. For example, higher transitions rates both toward and away from specialization as well as equal transition rates were inferred. Collectively, the results reveal a tendency for directional evolution toward increased specialization but also indicate that specialization does not always represent an evolutionary dead-end that strongly limits further evolution.

**Nosil, P.** (2004) Reproductive isolation caused by visual predation on migrants between divergent environments. *Proceedings of the Royal Society of London, Series B*, **271**(1547): 1521-1528.

In theory, natural selection can drive adaptation within species while simultaneously promoting the formation of new species by causing the evolution of reproductive isolation. Cryptic coloration is widespread in nature and is generally considered to be a clear visual example of adaptation. I provide evidence that population divergence in cryptic coloration can also cause reproductive isolation. First, a manipulative field experiment using walking-stick insects demonstrates that the relative survival of different colour-pattern morphs depends on the host-plant species on which they are resting, but only in the presence of avian predation. Second, natural populations adapted to different host plants have diverged in colour-pattern-morph frequencies such that between-host migrants are more likely to be the locally less-cryptic morph than are residents. Collectively, these data indicate that high rates of visual predation on less-cryptic migrants are likely to reduce encounters, and thus interbreeding, between host-associated populations. Comparison with previous estimates of sexual isolation reveals that the contribution of selection against between-host migrants to total premating isolation is as strong as, or stronger than, that of sexual isolation. These findings highlight the potential role of natural selection against migrants between divergent environments in the formation of new species.

**Nosil, P., Crespi, B.J. & Sandoval, C.P.** (2002) Host-plant adaptation drives the parallel evolution of reproductive isolation. *Nature*, **417**(6887): 440-443.

Parallel evolution of similar traits in independent populations that inhabit ecologically similar environments strongly implicates natural selection as the cause of evolution. Parallel speciation is a special form of parallel evolution where traits that determine reproductive isolation evolve repeatedly, in closely related populations, as by-products of adaptation to ecological conditions. The outcome of such parallel evolution is that ecologically divergent pairs of populations exhibit greater levels of reproductive isolation than ecologically similar pairs of populations of a similar or younger age. The parallel evolution of reproductive isolation provides strong evidence for natural selection in the process of speciation, but only one conclusive example from nature is known. Populations of the walking-stick insect *Timema cristinae* that use different host-plant species have diverged in body size and shape, host preference, behaviour and the relative frequency of two highly cryptic colour-pattern morphs. Here we report that divergent selection for host adaptation, and not genetic drift, has promoted the parallel evolution of sexual isolation in this species. Our findings represent a clear demonstration that host-plant adaptation can play a crucial and repeatable role in the early stages of speciation.

**Nosil, P., Crespi, B.J. & Sandoval, C.P.** (2003) Reproductive isolation driven by the combined effects of ecological adaptation and reinforcement. *Proceedings of the Royal Society of London, Series B*, **270**(1527): 1911-1918.

Recent years have seen a resurgence of interest in the process of speciation but few

studies have elucidated the mechanisms either driving or constraining the evolution of reproductive isolation. In theory, the direct effects of reinforcing selection for increased mating discrimination where interbreeding produces hybrid offspring with low fitness and the indirect effects of adaptation to different environments can both promote speciation. Conversely, high levels of homogenizing gene flow can counteract the forces of selection. We demonstrate the opposing effects of reinforcing selection and gene flow in *Timema cristinae* walking-stick insects. The magnitude of female mating discrimination against males from other populations is greatest when migration rates between populations adapted to alternate host plants are high enough to allow the evolution of reinforcement, but low enough to prevent gene flow from eroding adaptive divergence in mate choice. Moreover, reproductive isolation is strongest under the combined effects of reinforcement and adaptation to alternate host plants. Our findings demonstrate the joint effects of reinforcement, ecological adaptation and gene flow on progress towards speciation in the wild.

**Novotny, V., Basset, Y., Miller, S.E., Kitching, R.L., Laidlaw, M., Drozd, P. & Cizek, L. (2004)** Local species richness of leaf-chewing insects feeding on woody plants from one hectare of a lowland rainforest. *Conservation Biology*, **18**(1): 227-237.

Local species diversity of insect herbivores feeding on rainforest vegetation remains poorly known. This ignorance limits evaluation of species extinction patterns following various deforestation scenarios. We studied leaf-chewing insects feeding on 59 species of woody plants from 39 genera and 18 families in a lowland rainforest in Papua New Guinea and surveyed all plants with a stem diameter at breast height of  $\geq 5$  cm in a 1-ha plot within the same area. We used two extrapolation methods, based on randomized species-accumulation curves, to combine these two data sets and estimate the number of species of leaf-chewing herbivores feeding on woody plants from the 1-ha area. We recorded 58,483 feeding individuals from 940 species of leaf-chewing insects. The extrapolation estimated that there were 1567-2559 species of leaf-chewing herbivores feeding on the 152 plant species from 97 genera and 45 families found in 1 ha of the forest. Most of the herbivore diversity was associated with plant diversity on the familial and generic levels. We predicted that, on average, the selection of 45 plant species each representing a different family supported 39% of all herbivore species, the 52 plant species each representing a different additional genus from these families supported another 39% of herbivore species, and the remaining 55 plant species from these genera supported 22% of herbivore species. Lepidoptera was the most speciose taxon in the local fauna, followed by Coleoptera and orthopteroids (Orthoptera and Phasmatodea). The ratio of herbivore to plant species and the estimated relative species richness of the Lepidoptera, Coleoptera, and orthopteroids remained constant on the spatial scale from 0.25 to 1 ha. However, the utility of local taxon-to-taxon species ratios for extrapolations to geographic scales requires further study.

**Park, Y.S., Kwon, T.S., Kim, J.K., Kim, C.S. & Park, J.D. (2003)** Effect of temperatures on the development of the stick insect, *Baculum elongatus* (Phasmida: Phasmidae) and the life cycle. *Journal of Korean Forestry Society*, **92**(1): 62-70.

Characteristics of development and life cycle of the stick insect (*Baculum elongatus*) were studied through the laboratory experiments at 16, 20, 24, 28, 32°C of different constant temperatures and the field study in the American locust forest in the Geomo mountain in Gumi of Gyeongbuk-do. The stick insect showed five developmental stages for a nymph. The adult stage consisted of two periods: preoviposition and oviposition. During the former period, a time to mature eggs in ovary, the body length of the stick insect adult increased. The developmental periods of the young nymph were 97.3 days at 16°C, 65 days at 25°C.

49.7 days at 24°C, and 42.8 days at 28°C, displaying higher growth rate at higher temperatures. All the test insects were died before the 3rd nymph stage at 32°C of temperature. The lower growth-limit temperature and the effective accumulated temperature above the limit temperature required to complete nymph stages were 6.6°C and 909 degree days, respectively. The duration of adult period increased according to the increase of experimental temperatures. The optimum temperature for the oviposition was around 24°C, and it was coincident with the mean temperature of Gumi, where the field study was carried out, in July and August considered as the oviposition period in the field. The developmental stages of the stick insects were seasonally determined on the population of the *Geomo* mountain in Gumi, using the body length of the stick insects. Based on these results, a suitable time to control the stick insects in the their outbreaking areas was considered before mid June.

**Passamonti, M., Mantovani, B. & Scali, V. (2004)** Phylogeny and karyotype evolution of the Iberian *Leptynia attenuata* species complex (Insecta Phasmatodea). *Molecular Phylogenetics and Evolution*, **30**(1): 87-96.

An in-depth analysis of the *Leptynia attenuata* species complex has been performed by cytochrome oxidase subunit two (cox2) gene sequencing as well as karyotype and allozyme analysis. The whole set of data allows to largely resolve the taxonomy of the group and suggests an overall trend of chromosomal repatternings through a progressive reduction of the chromosome number. A previously suggested new species has been also confirmed on a genetic basis. Data are discussed in order to depict a phylogenetic and phylogeographic scenario fitting the observed genetic relationships between the different species of the group. Chromosome rearrangements are proposed as the major speciation driving force within the group and androgenetic reproduction is suggested as a shortcut to overcome the problem of fixing chromosomal rearrangements that are strongly underdominant in heterozygotes.

**Potvin, W. (2002)** Soortbeschrijving van *Oxyartes honestus* Redtenbacher, 1908, PSG-nr. 162. *Phasma*, **12**(46): 25-27. [In Dutch]

Brief descriptions of adults and eggs of *Oxyartes honestus* Redtenbacher, 1908 (PSG 182) are given, with colour photographs of adults and a monochrome photograph of the egg. Their defensive behaviour is explained and housing, care and breeding of this beautiful species are discussed. This species is not distributed well in captivity and needs some extra attention because of that. It can be an easy species to breed if given the correct conditions.

**Potvin, W. (2002)** Notities over *Neopromachus doreyanus* (Bates, 1865), PSG-nr. 233. *Phasma*, **12**(46): 41. [In Dutch]

Some brief notes about *Neopromachus doreyanus* (Bates, 1865) (PSG culture 233), a new addition to the PSG culture list are given, with colour photographs of the female and a monochrome photograph of the eggs. This small spiny species from New Guinea feeds on ferns and needs humid conditions. Colour varies from brown to bright green.

**Potvin, W. (2002)** Soortbeschrijving van *Abrosoma festinatum* Brock & Seow-Choen, PSG-nr. 231. *Phasma*, **12**(47): 49-51. [In Dutch]

Brief descriptions of the adults and eggs of *Abrosoma festinatum* are given and housing, feeding and keeping are explained; male, female and egg are illustrated. This small attractive species was found by Stijn Bauwens and the author in Bina Negara (in 2001), about 10km from Kuala Kangsar in Peninsular Malaysia. The culture in captivity is from those found in Bina Negara.

**Potvin, W.** (2002) Kweekresultaten van de ontdekkingsres Maleisië 2001. *Phasma*, **12**(47): 55-61. [In Dutch]

In July 2001 the author and Stijn Bauwens went to Peninsular Malaysia to collect stick insects and found over 500 specimens from about 40 different species. The author reports the breeding results of some species from this collecting trip. The conclusion is that it can be hard and unpredictable to bring new species into culture, either because not enough material was found, or one fails to find a suitable alternative foodplant, or failure to create the right breeding conditions for that species.

**Potvin, W.** (2002) Soortbeschrijving van *Prisomera repudiosa* (Brunner). *Phasma*, **12**(48): 75-77. [In Dutch]

The author and Stijn Bauwens found some specimens of *Prisomera repudiosa* in West Malaysia in 2001. From the 13 eggs collected, ten nymphs hatched and at the moment four males and five females are adult. This beautiful species seems easy to breed in captivity although they only lay a few eggs each week. Brief descriptions of the adults and eggs are given, with colour photographs of the adults and a drawing of the egg. The breeding conditions are explained.

**Priddel, D., Carlile, N., Humphrey, M., Fellenberg, S. & Hiscox, D.** (2003) Rediscovery of the 'extinct' Lord Howe Island Stick-insect (*Dryococelus australis* (Montrouzier)) (Phasmatodea) and recommendations for its conservation. *Biodiversity and Conservation*, **12**(7): 1391-1403.

The Lord Howe Island Stick-insect (*Dryococelus australis*) was formerly abundant on Lord Howe Island, Australia, but was extirpated by Black Rats (*Rattus rattus*) in the 1920s. The species was thought to be extinct, until freshly dead remains were found by climbers on Balls Pyramid during the 1960s. In February 2001, a survey of Balls Pyramid led to the discovery of a small population of *D. australis* on a precipitous terrace 65 m above sea level. Two adults and one nymph (all females) were located feeding on an endemic tea-tree (*Melaleuca howeana*). An accumulation of plant debris at the base of the shrub, kept moist by water seepage, provided the insects with damp hollows suitable for use as daytime refugia. All evidence indicated that the species was confined to this single small terrace. A second survey, in March 2002, located a total of 24 *D. australis*. Twelve individuals were in the same shrub as that occupied the previous year, and 12 were dispersed among five nearby, smaller shrubs. Ten individuals were able to be sexed - eight females and two males. A number of threats to the population of *D. australis* on Balls Pyramid are identified and several management actions are proposed to ensure the conservation of the species.

**Rabaey, K.** (2002) Hong Kong en wandelende takken. *Phasma*, **12**(47): 52-54. [In Dutch]

The stick insects of Hong Kong are represented by nine species, including five new to science. Two species, *Neohirasea hongkongensis* and *Pylaemenes hongkongensis* are discussed and illustrated with drawings and colour photographs.

**Rabaey, K.** (2002) Het kweken van *Megacrania batesii*, de Australische pepermunt tak. *Phasma*, **12**(48): 78-79. [In Dutch]

*Megacrania batesii* is a beautiful stick insect but difficult to breed in captivity. They need *Pandanus* which is their native foodplant in Australia, and need great care.

**Rabaey, K.** (2002) Unidentified Obrimini (PSG-nr. 235), een wandelende tak uit de Filippijnen. *Phasma*, **12**(48): 83-84. [In Dutch]

Two years ago Andy Maluche sent the author eggs from seven species of stick insects from the Philippines. They are established in culture with several people from the PSG and Phasma. This article describes breeding of PSG culture 235, an unidentified Obrimini species, with a colour photograph of the adults.

**Rabaey, K.** (2004) Kweekbeschrijving *Parectatosoma mocquerysi*. *Phasma*, **14**(54): 7-8. [in Dutch]

Nicholas Cliquennois travelled to Madagascar in 2003 and found *Parectatosoma mocquerysi* Finot, 1897, a very beautiful species. He sent eggs to the author who has bred them successfully on *Hypericum*. Includes photograph of the eggs.

**Rabaey, K. & Simoens, R.** (2003) *Monandroptera acanthomera*, een wandelende tak uit La Reunion. *Phasma*, **13**(49): 2-3. [In Dutch]

Nicholas Cliquennois sent us eggs of *Monandroptera acanthomera* from La Reunion. It is difficult to rear in captivity in Belgium because of the absence of a good foodplant. We succeeded in rearing some on *Eucalyptus* sp., *Laurus nobilis*, *Quercus ilex*. Those reared are much smaller than the wild specimens.

**Ren, D.** (2002) Progress in the study of Mesozoic fossil insects during the last decade in China. *Acta Entomologica Sinica*, **45**(2): 234-240.

During the last decade abundant Mesozoic fossil insects have been collected from China. More than 100 papers and monographs, most of them focused on taxonomy, have been published. In this paper the history, current status and some problems on the taxonomic researches of Mesozoic fossil insects are reviewed briefly. The important results achieved by the Chinese palaeoentomologists on biodiversity, internal morphology, phylogeny of Raphidioptera, biogeography, biostratigraphy, ecostratigraphy, co-evolution between pollinating insects and angiosperms are introduced. The table of the oldest insect families in the world found from China is given. The alimentary canal of fossil stick-insects from Liaoning Late Jurassic rocks are the first authenticated records of internal anatomy in Palaeoentomological history. It was in 1994 that the cladistic method was first used to study familial phylogeny of fossil and living snake-flies in China. The first non-marine ecostratigraphic research was made in dividing Late Mesozoic strata of Fengning, Hebei Province, and revealed a general pattern of basin evolution which appears in many other sections of Northeast China. The fossil anthophilous brachycera found from the Yixian Formation of Western Liaoning demonstrated that the flowers were in existence in Late Jurassic and represented by at least two different types of flowers. The East Asia, especially Northeast China, is one of the origin places of angiosperms.

**Scali, V., Passamonti, M., Marescalchi, O. & Mantovani, B.** (2003) Linkage between sexual and asexual lineages: Genome evolution in *Bacillus* stick insects. *Biological Journal of the Linnean Society*, **79**(1): 137-150.

The sexually reproducing stick insects *Bacillus rossius* and *B. grandii* are sharply differentiated in terms of allozyme gene alleles; *B. atticus* is a polyclonal automictic parthenogen sister to *B. grandii grandii*. Although well differentiated for coding genes, these hybridize to produce diploid (*B. whitei* = *rossius/grandii*) or triploid (*B. lynceorum* = *rossius/grandii/atticus*) clonal forms which reproduce apomictically. Allozyme analyses of unisexual *Bacillus* clearly establish their relationships from bisexual ancestor species as does

the existence in all of them of several clones (especially in *B. atticus*) whose egg maturation allows regular recombination to occur. *Bacillus* taxa share the Bag320 satellite DNA family within different reproductive frameworks, allowing satellite variant homogenization to be uncoupled from fixation. The nested analysis of monomers reveals different patterns of sequence diversity: sexual reproduction includes both homogenization and variant fixation, whereas the slowing of molecular turnover processes and the absence of syngamy in the parthenogens realizes a similar range of sequence diversity at the level of the individual and supra-individual, but with no fixation. On the other hand, the actual values of sequence diversity appear mostly linked to species traits - range size, copy number of repeats, number of hybrid crosses - and possibly transposon activity, rather than to the reproductive mode. In addition, the mitochondrial genome reveals a comparable level of *cox2* sequence variability in sexual and parthenogenetic taxa, thus adding to clonal variability. From *Bacillus* and other stick insect complexes, an overall picture of genomic diversification of parthenogens is therefore beginning to emerge. To define those animals that reproduce by non-canonical sexual modes (i.e. parthenogenesis, hybridogenesis), but make use of egg and meiotic mechanisms, the term meta-sexual is proposed.

**Seow-Choen, F.** (2003) *Sosibia mohamedsaidi*, a new species of stick insect, and a new record of male *Sosibia aurita* from Malaysia (Phasmoptera: Heteronemiidae: Necrosiinae). *Serangga*, **8**(1-2): 39-47.

*Sosibia mohamedsaidi*, a new species of stick insect from Malaysia, is described and illustrated. The recently discovered male of *Sosibia aurita* (Fabricius) is also described and illustrated.

**Simoens, R.** (2002) Wat als Phasmiden geen braam eten... *Phasma*, **12**(46): 32-33. [In Dutch]

The author gives a brief description of some unusual foodplants for phasmids, how to get, how to grow, and how to propagate them.

**Simoens, R.** (2002) Determinatiesleutel voor *Haaniella*. *Phasma*, **12**(48): 80-82. [In Dutch]  
A key to the determination of *Haaniella*.

**Simoens, R.** (2002) Bezoek aan de Plantentuin van de universiteit Gent. *Phasma*, **12**(48): 85-86. [In Dutch]

The Gent University Botanical Garden as a source for new foodplants for phasmids.

**Simoens, R.** (2004) Spreekbeurt op de 34e Phasmameeting: HACCP in het insectarium. *Phasma*, **14**(55): 17-20. [in Dutch]

My work as microbiologist in the food industry inspired me to work out a HACCP-system (Hazard Analysis of Critical Control Points) in an insect room. HACCP is used in the food industry to assure safe food of the best quality. This article gives a step by step procedure which describes all the critical points in breeding phasmids and how to control them.

**Stone, G. & French, V.** (2003) Evolution: Have wings come, gone and come again? *Current Biology*, **13**(11): R436-R438.

Can complex traits be re-evolved by lineages that have lost them? Phylogenetic study now suggests that wings may indeed have reappeared several times within the ancestrally wingless stick insects.



**Stone, T.** (2004) Het eten van wandelende takken door de mens. *Phasma*, **14**(52-53): 19. [in Dutch]

A translation of "The eating of stick insects by humans" by Thomas Stone which was originally published in the March 1991 issue of *The Food Insect Newsletter*.

**Toms, R.** (2004) Ontmoet de langste wandelende tak van Zuid-Afrika, de lengte van een 30cm lange meetlat. *Phasma*, **14**(55): 6-7. [in Dutch]

Dr. Rob Toms, from the invertebrates research department at the Transvaal Museum, in Pretoria, explained the misclassification: "What happened was that around the turn of the last century, there was a lot of activity, and people from Europe were finding species and giving them names. "A lot of stick insects were discovered. The *Bactrododenum tiaratum* (a type of giant stick insect) was described seven different times, and that species was later confused with the *Bactrododema krugeri*," Toms said. He said the first specimens of the *krugeri* were brought to the Transvaal museum in 1912. They were mounted and incorrectly named, and not investigated any further. Since then several specimens were collected from the Kruger Park, the Musina Nature Reserve and even from Botswana. "Nobody worked on them for about 90 years because there is actually a fairly small group of researchers here," Toms said. It was only when British entomologist Paul Brock arrived at the museum that the new species was identified. His findings were published in the *Annals of the Transvaal Museum* and most recently in the online science journal, *Science in Africa*.

**Trueman, J.W.H., Pfeil, B.E., Kelchner, S.A. & Yeates, K.** (2004) Did stick insects really regain their wings? *Systematic Entomology*, **29**(2): 138-139.

The authors conclude that Whiting, Bradler & Maxwell (2003) have not made a convincing case for the re-evolution of wings in stick insects. Moderate differential rates of change to and from winglessness will cause the ancestor to be no longer reconstructed as very probably wingless, but the central issue is that Whiting *et al.* have been misled by conflating the retrodiction of an ancestral state with a comparison of the numbers of steps required under different ancestral states. Multiple wing losses without gains are all that is necessary to explain these data.

**Wanner, K.W., Willis, L.G., Theilmann, D.A., Isman, M.B., Feng, Q. & Plettner, E.** (2004) Analysis of the insect os-d-like gene family. *Journal of Chemical Ecology*, **30**(5): 889-911.

Insect OS-D-like proteins, also known as chemosensory (CSP) or sensory appendage proteins (SAP), are broadly expressed in various insect tissues, where they are thought to bind short to medium chain length fatty acids and their derivatives. Although their specific function remains uncertain, OS-D-like members have been isolated from sensory organs (including the sensillum lymph in some cases), and a role in olfaction similar to that of the insect odorant binding proteins (OBP) has been suggested for some. We have identified 15 new OS-D-like sequences: four from cDNA clones described herein and 11 from sequence databases. The os-d-like genes from the *Anopheles gambiae*, *Apis mellifera*, *Drosophila melanogaster*, and *Drosophila pseudoobscura* genomes typically have single, small introns with a conserved splice site. Together with all family members entered on GenBank, a total of 70 OS-D-like proteins, representing the insect orders Diptera, Dictyoptera, Hymenoptera, Lepidoptera, Orthoptera, and Phasmatodea, were analyzed. A neighbour joining distance phenogram identified several protein similarity classes that were characterized by highly conserved sequence motifs, including (A) N-terminal YTTKYDN(V/I)(N/D)(L/V)DEIL, (B) central DGKELKXX(I/L)PDAL, and (C) C-terminal KYDP. In contrast, three similarity

classes were characterized by their diversion from these conserved motifs. The functional importance of conserved amino acid residues is discussed in relation to the crystal and NMR structures of MbraCSPA6.

**Whiting, M.F., Bradler, S. & Maxwell, T. (2003)** Loss and recovery of wings in stick insects. *Nature*, **421**(6920): 264-267.

The evolution of wings was the central adaptation allowing insects to escape predators, exploit scattered resources, and disperse into new niches, resulting in radiations into vast numbers of species. Despite the presumed evolutionary advantages associated with full-sized wings (macroptery), nearly all pterygote (winged) orders have many partially winged (brachypterous) or wingless (apterous) lineages, and some entire orders are secondarily wingless (for example, fleas, lice, grylloblattids and mantophasmatids), with about 5% of extant pterygote species being flightless. Thousands of independent transitions from a winged form to winglessness have occurred during the course of insect evolution; however, an evolutionary reversal from a flightless to a volant form has never been demonstrated clearly for any pterygote lineage. Such a reversal is considered highly unlikely because complex interactions between nerves, muscles, sclerites and wing foils are required to accommodate flight. Here we show that stick insects (order Phasmatodea) diversified as wingless insects and that wings were derived secondarily, perhaps on many occasions. These results suggest that wing developmental pathways are conserved in wingless phasmids, and that 're-evolution' of wings has had an unrecognized role in insect diversification.

**Zakotnik, J., Matheson, T. & Duerr, V. (2004)** A posture optimization algorithm for model-based motion capture of movement sequences. *Journal of Neuroscience Methods*, **135**(1-2): 43-54.

We have developed and evaluated a new optical motion capture approach that is suitable for a wide range of studies in neuroethology and motor control. Based on the stochastic search algorithm of Simulated Annealing (SA), it utilizes a kinematic body model that includes joint angle constraints to reconstruct posture from an arbitrary number of views. Rather than tracking marker trajectories in time, the algorithm minimizes an error function that compares predicted model projections to the recorded views. Thus, each video-frame is analyzed independently from other frames, enabling the system to recover from incorrectly analyzed postures. The system works with standard computer and video equipment. Its accuracy is evaluated using videos of animated locust leg movements, recorded by two orthogonal views. The resulting joint angle RMS errors range between 0.7° and 4.9°, limited by the pixel resolution of the digital video. 3D-movement reconstruction is possible even from a single view. In a real experimental application, stick insect walking sequences are analyzed with leg joint angle deviations between 0.5° and 3.0°. This robust and accurate performance is reached in spite of marker fusions and Occlusions, simply by exploiting the natural constraints imposed by a kinematic chain and a known experimental setup.

**Zompro, O. (2002)** A revision of *Oreophoetes* Rehn, 1904, and description of a new genus (Insecta: Phasmatodea: Anareolatae: Diapheromeridae: Diapheromerinae: Oreophoetini). *Revue Suisse de Zoologie*, **109**(1): 143-153.

The genus *Oreophoetes* Rehn, 1904, is revised. Diagnoses are given for all species included and synonyms are listed. *Bacteria nigripes* Scudder, 1875, is reduced to a subspecies of *O. peruana* (Saussure, 1868). A lectotype is designated for *Bacteria peruana* Saussure, 1868. The egg of *Oreophoetes mima* (Giglio-Tos, 1898) is described for the first time. A new genus and species of this tribe from Northern Peru. *Oreophoetophasma hennemanni* gen. n.,

sp. n., is described.

**Zompro, O.** (2002) Catalogue of type material of the insect order Phasmatodea at the Zoologisches Museum der Universität Hamburg. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut*, **99**: 179-201.

The type material in the Zoologisches Museum der Universität Hamburg, Germany (ZMH) is listed. The collection contains type specimens of 113 species, mainly described by Brunner v. Wattenwyl, Günther and Redtenbacher. The collection is especially strong in material from Borneo, Costa Rica, Fiji, Madagascar and Brazil. Lectotypes are designated for *Creoxylus hagani* Redtenbacher, 1906, *Xerosoma michaelis* Redtenbacher, 1906, *Bacteria tenella* Redtenbacher, 1908 and *Leprocaulus insularis verrucifer* Günther, 1934.

**Zompro, O.** (2003) *Prisopus wolfgangjunki* n.sp., a new species of *Prisopus* St. Fargeau & Audinet Serville, 1827, from Brazil (Phasmatodea: Prisopodidae). *Amazoniana*, **17** (3-4): 509-511.

A new species of Phasmatodea: Prisopodidae is described from Brazil. *Prisopus wolfgangjunki* n.sp. is characterized by the uniformly yellow abdominal sternites and the lack of prominent posterior spines on the head. Types are housed in the Staatliches Museum für Tierkunde, Dresden, Germany.

**Zompro, O.** (2004) *Revision of the genera of the Areolatae, including the status of Timema and Agathemera (Insecta, Phasmatodea)*.

This 327-page book represents a revision of the phylogenetic relationships of the more than 150 genera of the Areolatae, a suborder of Phasmatodea. The order Phasmatodea includes such unique winged insects as walking leaves and stick insects. Egg morphology was the main factor in making decisions about phylogenetic relationships. The status of *Timema* and *Agathemera* were also reconsidered. The book begins with brief discussions of phasmid taxonomy, sister groups to the Phasmatodea, terms for the taxon Phasmatodea, characters and evolutionary trends, an ootaxonomy, and biogeography. Keys to adults and eggs of all Areolateae genera are included, as well as a list of all genera of the Phasmatodea, including their type species. The author establishes fourteen new genera and describes thirteen species for the first time. An appendix includes a checklist for the genera of Phasmatodea. This book is part of the German series *Abhandlungen des Naturwissenschaftlichen Vereins in Hamburg*. The text is in English, including an English abstract and list of key words. There are 161 figures, the majority of which are photographs of specimens. The book includes a list of references, comments on some recent publications, and an index. Users of this book will include entomologists and taxonomists.

**Zompro, O. & Brock, P.D.** (2003) Catalogue of type-material of stick-insects housed in the Museum d'histoire naturelle, Geneva, with descriptions of some new taxa (Insecta: Phasmatodea). *Revue Suisse de Zoologie*, **110**(1): 3-43.

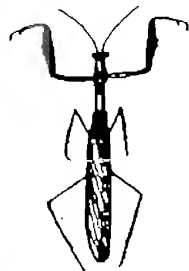
Type specimens for 157 species-group names of Phasmida have been identified in the collection of the Museum d'histoire naturelle, Geneva. The names are listed alphabetically, with the number of specimens, sex and locality data. The material includes most species described by Saussure and the majority of those described by Carl; in addition there is material of Bolivar, Brock, Brunner von Wattenwyl, Fritzsche & Gitsaga, Günther, Harz, Kirby, Redtenbacher, Werner and Zompro. *Clitumnus humberti* Carl, 1913 is re-named *Ramulus carli* Zompro nom.n. Lectotypes are designated for *Xera debilis* Redtenbacher, 1906, *Clonistria guatemalensis* Redtenbacher, 1908, *Ramulus humberti* (Saussure, 1861) and

*Anophelepis poeyi* Saussure, 1868. One genus and four species are described as new.

*Parapodacanthus* Brock gen.n., with the type-species *P. hasenpuschorum* Brock sp. n., is described from Queensland, Australia. Three Philippine species are provisionally placed in the genus *Lonchodes* Gray, 1835: *L. putingmantsa* Zompro sp.n., *L. magayon* Zompro sp. n. and *L. dalawangsungay* Zompro sp.n.; this complex urgently needs a generic revision. The eggs of *Alienobostra godmani* (Redtenbacher, 1908) and *Lonchodes palawanicus* (Carl, 1913) are described and figured for the first time. *Xylodus* Saussure, 1859, formerly synonymized with *Cladomorphus* Gray, 1835, and *Micrarchus* Carl, 1913 formerly synonymized with *Pachymorpha* Gray, 1835, are re-established as valid genera. *Bacteria divergens* Redtenbacher, 1908 is found to be a new synonym of *Phanocloidea muricata* (Burmeister, 1838), and *Ocnophila adulterina* Brunner v. Wattenwyl, 1907 of *Lamponius guerini* (Saussure, 1868). *Prisomera palawanica* Carl, 1915 is transferred to *Stheneboea* Stål, 1875, and *Myronides trilineatus* Carl, 1913 to *Lopaphus* Westwood, 1859.

**Zompro, O. & Größer, D. (2003)** A generic revision of the insect order Phasmatodea: The genera of the areolate stick insect family Phylliidae (Walking Leaves) (Insecta, Orthoptera). *Spixiana*, **26**(2): 129-141.

The genera of the family Phylliidae (Walking Leaves) (Phasmatodea: Areolatae) are revised and the relationships between them discussed. *Nanophyllum* Redtenbacher, 1906 differs strikingly from the other genera and is transferred in the Nanophylliini, trib. nov. A key to genera and species is provided. *Nanophyllum adisi*, spec. nov. from New Guinea is described for the first time. The paper includes a key to the species of *Nanophyllum*.

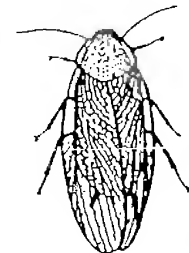


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