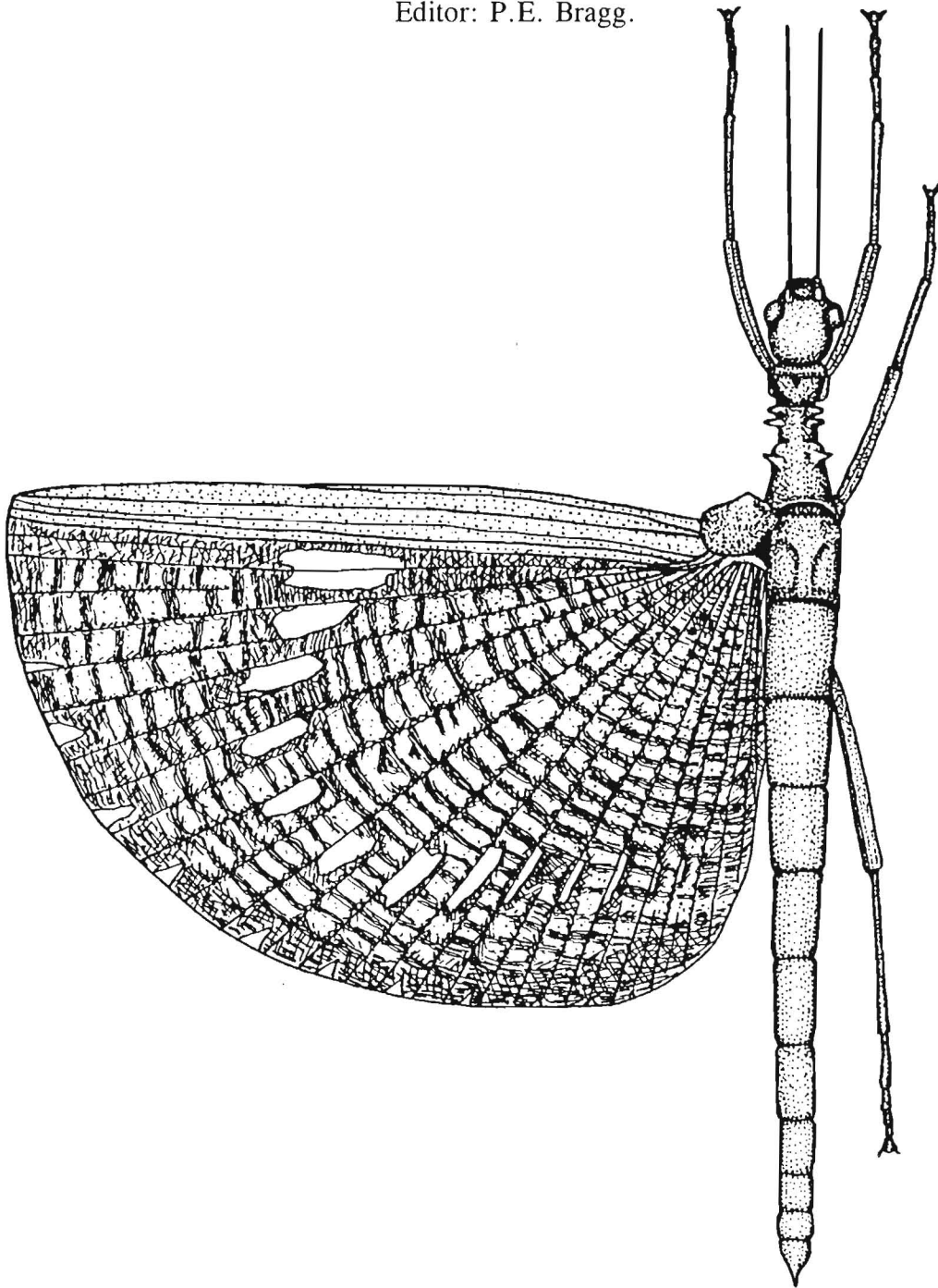


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# The eggs of some Chilean phasmids (Phasmida: Pseudophasmatidae)

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## Abstract

Descriptions are given of the eggs of two species of *Agathemera* and three of *Bacunculus*.

## Key words

Phasmida, Pseudophasmatidae, *Agathemera*, *Bacunculus*, eggs.

## Introduction

Camousseight and Bustamente (1991) published a scanning electron microscope study of the eggs of four genera of Chilean phasmids *Agathemera* Stål, *Bacunculus* Burmeister, *Paraprisopus* Redtenbacher and *Xeropsis* Redtenbacher. Whilst three species of *Agathemera* and four of *Bacunculus* were listed in their introduction, the subsequent account and photographs identified the eggs to genus level only. The *Paraprisopus* was not identified to species level; the other species was *Xeropsis crassicornis* (Philippi). This paper is abbreviated here to CB1991.

Ariel Camousseight later sent me material of five of the species and the purpose of this paper is (a) to describe the egg characters of the individual species *Agathemera crassa* (Brunner), *A. elegans* (Philippi), *Bacunculus blanchardi* Camousseight, *B. granulicollis* (Blanchard) and *B. phyllopus* (Gray), (b) to illustrate the conventional dorsal and lateral views of these eggs (which was not done in CB1991) and (c) to present some observations which differ from those in CB1991. The description conventions are those set out in Sellick (1997).

## Egg descriptions

Eggs were examined under a light stereo-microscope and measured with an eyepiece graticule. In the figures the scale line in each case represents one millimetre.

### *Agathemera* Stål (tribe Anisomorphini)

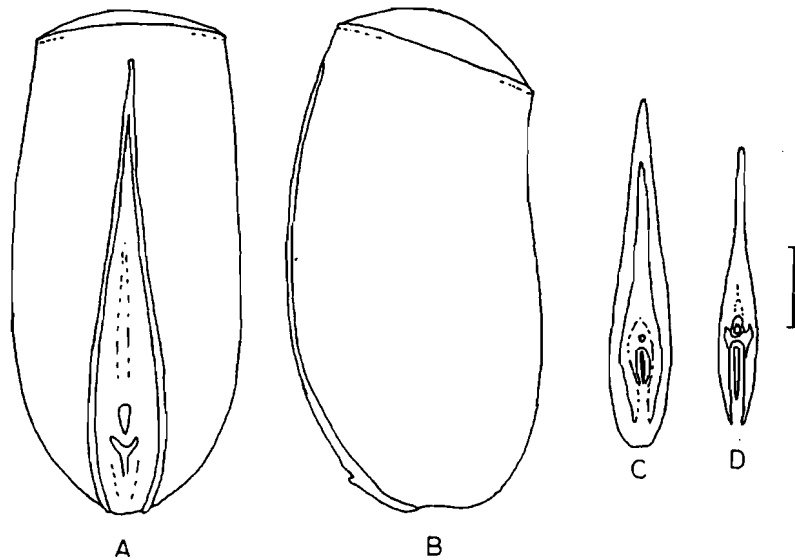
The eggs of this genus are quite unlike the eggs of other Anisomorphini known (3 species of *Anisomorpha* and one of *Autolyca*); I have suggested that the tribe is polyphyletic (Sellick in press). Eggs of the other four genera of this tribe are not known. The eggs of the two species described here are very similar in size, proportions, colour and micropylar plate. For this genus CB1991 cited *talla* (height) of 6.4mm (n=20). This would seem to be the same as their *largo* (length) in the cited ratio and *alto* (height) defined in their *Figura 1*, itself an error as their figure is supposed to be derived from my early paper (Clark, 1979) defining dimensions. This dimension is length and should be measured from the midpoint of the capsule rim (Sellick, 1997). No other dimensions are cited, except for *largo/ancho* (length/width) as 7:3, which is not one of the conventional ratios, and an opercular angle of  $27.5^\circ \pm 0.5^\circ$ , cited as positive, whereas it is in fact negative (their *Figura 1* showed a left and not a right lateral view, hence the error). Their ratio of 7:3 equals a width/length ratio of 43%. In *A. crassa* this would be 48-51% and in *A. elegans* 52-57% using the conventional definition of length. The species figured in CB1991 appears to be *A. crassa*. *A. millipunctata* Redtenbacher was also included in the CB1991 account but without specific details. More recently Camousseight (1995) has described two more species of Chilean *Agathemera*, but included no egg descriptions.

### *Agathemera crassa* (Brunner) (Fig. 1)

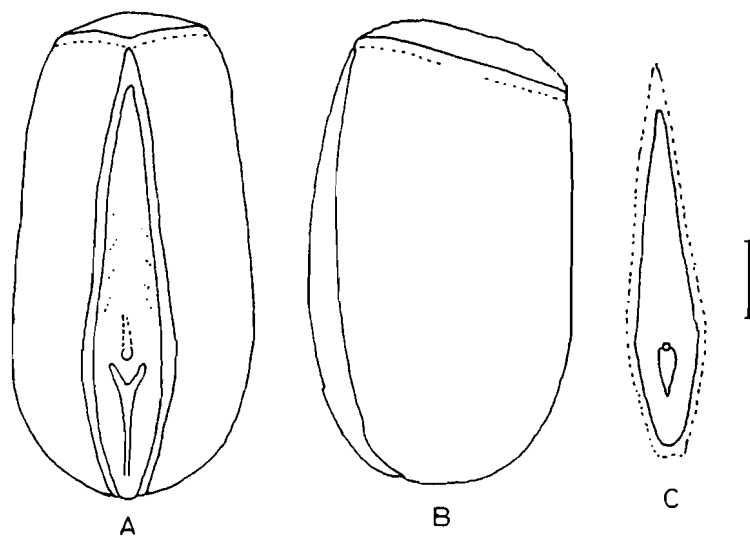
Based on 8 eggs. The whole capsule and operculum is an almost uniform smooth very dark brown or black. The micropylar plate has a conspicuous raised edge and an obvious Y-

shaped cup. Dimensions: length 5.8-6.1mm; width 2.85-2.95mm; height 3.0-3.3mm; opercular width 2.4-2.65mm; opercular height 2.4-2.9mm; micropylar plate length 6.0-6.1mm; micropylar plate width 1.05mm; height/length 50-55%, width/height 87-98%; opercular angle c.  $-25^{\circ}$ . This gives an apparent anomaly of a micropylar plate longer than the capsule, since the dorsal edge of the capsule is longer than the mid-length. The "length" taken in the dorsal view is c. 6.5mm, and is even longer if the operculum is included.

The internal micropylar plate matches the external plate in shape and is closed, but has a complex structure (Fig. 1C). The outer part of this plate is dark and this can merge with the main internal capsule surface so that the plate appears to be open, with a median line (Fig. 1D). It is presumably this that led CB1991 to illustrate an open plate for this genus, though that of the next species is clearly closed.



**Figure 1.** *Agathemera crassa*. A. dorsal, B. Lateral, C. Full internal plate, D. Internal plate with outer area obscure, giving false "open" appearance.



**Figure 2.** *Agathemera elegans*. A. Dorsal, B. Lateral, C. Internal plate.

***Agathemera elegans* (Philippi) (Fig. 2)**

Based on 3 eggs. The capsule and operculum are again dark brown/black, with a very slight sculpturing. The edge of the micropylar plate, which is less raised than in the previous species, may be slightly paler than the rest of the capsule. Dimensions: length 5.5-6.0mm; width 3.1-3.15mm; height 3.4-3.5mm; opercular width 2.0mm; opercular height 2.8mm; micropylar plate length 5.5-6.0mm; micropylar plate width 1.15-1.25mm; height/length 57-63%, width/height 90-91%; opercular angle *c.* -20°.

The internal micropylar plate is a typical closed type, with a gap posterior to the micropylar stalk. The plate is surrounded by a dark edge.

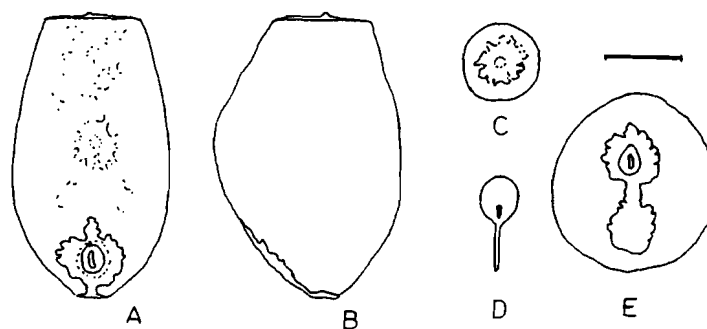
***Bacunculus* Burmeister (tribe Bacunculini)**

The three species described here, with *B. cornutus* (Philippi) and *Xeropsis crassicornis* (Philippi) are the only ones of this tribe whose eggs are known. *B. cornutus* was included in the CB1991 account, but no specific details were given. *Xeropsis* was transferred from Xerosomatini to Bacunculini in CB1991. There are no other genera in the tribe. CB1991 cite *talla* 3.3mm and *largol ancho* 9:5 as the only dimensions for *Bacunculus*. The species they illustrate is not *B. blanchardi*, which differs significantly from the other two species described here, particularly in its opercular structures. The internal plate they illustrate is similar to that of *B. phyllopus*.

***Bacunculus blanchardi* Camousseight (Fig. 3)**

Based on 3 eggs. As in all three species examined, the capsule colour is variable. In this case it is uniform but varies from pale straw to a mid brown. There is a distinct dorsal bulge in the centre of which is a shallow depression. The rim of the depression merges into a general warty sculpturing of the capsule. The elliptical micropylar plate is surrounded by a raised area, which extends across the posterior pole. The operculum lacks the capitular structures seen in the other species, being slightly raised in the centre with a surrounding irregular ring, the whole being almost flat. Dimensions: length 3.6-3.7mm; width 2.1mm; height 4.35-4.4mm; opercular width 1.2-1.4mm; opercular height 1.3-1.4mm; micropylar plate width 0.3-0.35mm; micropylar plate length 0.3-0.35mm; height/length 64-67%, width/height 88-89%; opercular angle *c.* 0°.

The internal micropylar plate is closed, with an unusual median line-like extension which follows the line of the extension of the area around the exterior plate across the posterior pole.



**Figure 3.** *Bacunculus blanchardi*. A. Dorsal, B. Lateral, C. Operculum, D. Internal plate, E. Posterior.

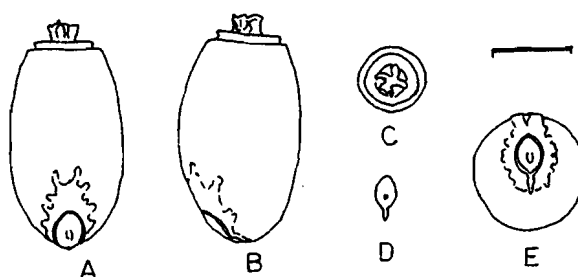


Figure 4. *Bacunculus granulicollis*. A. Dorsal, B. Lateral, C. Operculum, D. Internal plate, E. Posterior.

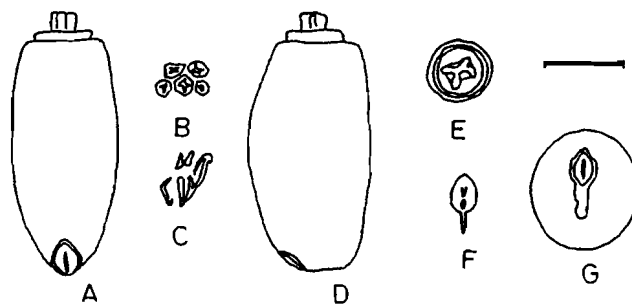


Figure 5. *Bacunculus phyllopus*. A. Dorsal, B. & C. Types of surface sculpturing, D. Lateral, E. Operculum, F. Internal plate, G. Posterior.

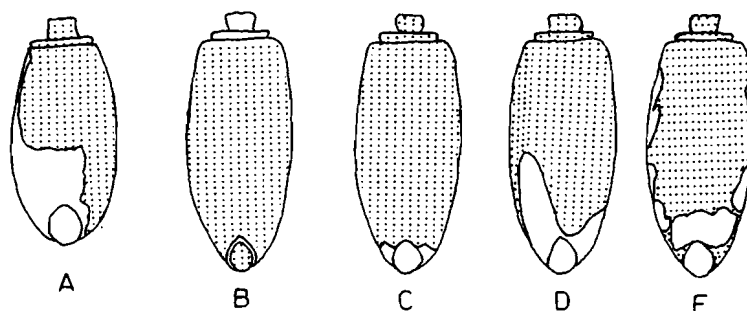


Figure 6. Colour patterning in *Bacunculus*: A. *B. granulicollis*, B-E. *B. phyllopus*.

***Bacunculus granulicollis* (Blanchard) (Figs. 4 & 6A)**

Based on 2 eggs. One of these eggs is uniformly a very pale straw; the other has about half of the capsule black and the other half almost white (Fig. 5A). There is a slightly raised area around the micropylar plate, with a distinct line extending over the posterior pole. The operculum has a raised rim and a central capitulum with three or four arms. Dimensions: length 2.6-2.65mm; width 1.35-1.5mm; height 1.5mm; opercular width 0.9-1.0mm; opercular height 0.9-1.0mm; capitular length 0.3mm; micropylar plate width 0.35-0.45mm; micropylar plate length 0.45-0.5mm; height/length 57-58%; width/height 90-100%; opercular angle c. -3°.

The internal micropylar plate is similar to that of the preceding species, but with a much shorter median line-like extension.

***Bacunculus phyllopus* (Gray) (Figs. 5 & 6B-E)**

Based on 34 eggs. There is a great range of colour in these eggs. Amongst those uniformly coloured some are a uniform pale cream, some a mid brown and some dark brown. There is a common variety which is brown but with a cream operculum/capitulum and a cream rim to the micropylar plate (Fig. 6B). Others show various patterns of cream and brown, some of which are illustrated in figures 6C-E. There is no wide raised area around the micropylar plate, but there is an extension over the posterior pole. The operculum and capitulum are similar to those of the previous species. Dimensions: length 2.6-3.15mm; width 1.4-1.6mm; height 1.55-1.65mm; opercular width 0.65-0.75mm; opercular height 0.65-0.75mm; capitular length 0.3-0.5mm; micropylar plate width 0.35-0.45mm; micropylar plate length 0.4-0.5mm; height/length 50-54%; width/height 88-100%; opercular angle almost zero.

The internal micropylar plate is like that of the other two species.

**References**

- Camousseight, A. (1995) Revision taxonomica del genero *Agathemera* (Phasmatodea: Pseudophasmatidae) en Chile. *Revista Chilena Entomologica*, Santiago **22**: 35-53.
- Camousseight, A. & Bustamente, I. (1991) Descripción de los huevos de los Fásmidos (Phasmatodea: Pseudophasmatidae) de Chile. *Revista Chilena Entomologica*, Santiago **19**: 39-43.
- Clark, J.T. (1979) A key to the eggs of stick and leaf insects (Phasmida). *Systematic Entomology*, **4**: 325-331.
- Sellick, J.T.C. (1997) Descriptive terminology of the phasmid egg capsule, with an extended key to the phasmid genera based on egg structure. *Systematic Entomology*, **22**: 97-122.
- Sellick, J.T.C. (in press) The micropylar plate of the eggs of Phasmida, with a survey of the range of plate form within the order. *Systematic Entomology*.

# List of type specimens of stick-insects in the Zoölogisch Museum, Universiteit van Amsterdam

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## Abstract

Type material of 16 species of Phasmida have been located in the Zoölogisch Museum, Universiteit van Amsterdam. The species are listed alphabetically, with the status/number of specimens, details of sex, locality and collector (if recorded), along with the valid name (if different), details of 'missing' specimens and details of further type material deposited in other museums. The most important material relates to species described by Brunner von Wattenwyl and Redtenbacher (mainly published in their monograph, between 1906-08) and one species described by Brock & Shlagman (1994). *Pseudodiacantha obscura* Redtenbacher, 1908 is listed as a new synonym of *Orxines macklottii* (de Haan, 1842); accordingly, the genus *Pseudodiacantha* Redtenbacher, 1908 (Type species: *P. obscura*, by monotypy) becomes a new synonym of *Orxines* Stål, 1875. General notes are given on the extent of the phasmid collection.

## Key words

Phasmida, type material, Zoölogisch Museum, Amsterdam.

## Introduction

The Zoölogisch Museum, Universiteit van Amsterdam collection contains type material of 16 species of Phasmida, examined during visits to the museum in 1992 and 1997. All except one species were described by Brunner von Wattenwyl and Redtenbacher in their monograph published in 1906-1908. In addition there is one species described by Brock & Shlagman in 1994. Type material is included in the phasmid collection, housed in cabinet drawers.

## Methods

Neither Brunner von Wattenwyl or Redtenbacher selected any holotype when dealing with a type series, nor gave an indication of the actual number of type specimens. To assist with their monograph, these authors obtained specimens on loan from several museums; in some instances, specimens have been retained in the Naturhistorisches Museum Wien i.e. "Mus. Amsterdam., coll. m." in the monograph, could refer to either:

- i) The only specimen(s) are in Brunner von Wattenwyl's collection in Vienna (= Wien), with "Mus. Amsterdam" recorded on the data label(s).
- ii) There is material in both the Amsterdam and Vienna collections. Brock (1998) gives further background on the Brunner von Wattenwyl collection.

A complete check has been made on the collection to ensure that all type material has been identified and to establish which reported type material is absent from the collection. In addition, the literature has been thoroughly examined. Type material has been divided into two categories, as follows:

- 1) Type material recorded in the literature from Amsterdam. Explanations are given for "missing material". Specimens retained in Vienna with a "Mus. Amsterdam" data label are assumed to be holotypes, where they are the only known specimen and agree with the locality and measurements recorded.

Curators' red type-labels had already been pinned beneath specimens in most cases. With regard to Brunner von Wattenwyl and Redtenbacher's specimens, New Guinea material collected in 1903 and 1906 have a large yellowish folded label with a handwritten (ink or pencil) name of the species, pinned beneath the specimen; all other type material has a white, Vienna museum, thin card label "Brunner v. Wattenwyl, det. 1904".

- 2) Likely type material, not previously associated with Amsterdam.



Museum codes are given below:

ANSP	Academy of Natural Sciences, Philadelphia, USA.
HNHM	Hungarian Natural History Museum, Budapest, Hungary.
ISNB	Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium.
MNHN	Museum National d'Histoire Naturelle, Paris, France.
NHMW	Naturhistorisches Museum Wien, Austria.
RMTO	Museo Regionale di Scienze Naturali, Torino, Italy.
SMTD	Staatliches Museum für Tierkunde, Dresden, Germany.
TAUI	Zoological Museum, Tel Aviv University, Israel.
ZMAN	Zoologisch Museum, Universiteit van Amsterdam, Netherlands.
ZMHB	Museum für Naturkunde der Humboldt Universität zu Berlin, Germany.

### 1. Type material associated with Amsterdam museum

(\* = denotes missing from Amsterdam)

*Arrhidaeus aemulus* Redtenbacher, 1908: 376. Holotype ♂ [52mm, not 55mm], New Guinea: Manikion, 14-28.ii.[1906]. Valid name: *Ophicrania aemula* (Redtenbacher).

\**Arrhidaeus bifasciatus* Redtenbacher, 1908: 379. Not traced in ZMAN or NHMW. There should be ♂, ♀ type material from "New Guinea: Kamp Cykloop". Valid name: *Ophicrania bifasciata* (Redtenbacher).

\**Carausius bilineatus* Brunner, 1907: 270. Not traced in ZMAN or NHMW. There should be ♀ specimen(s) from "Dutch New Guinea" [i.e. Irian Jaya].

*Dimorphodes carinatus* Redtenbacher, 1908: 364. Syntype ♀, New Guinea: Manikion Gebiet, 14-28.ii.1906. Syntypes also in SMTD: ♀, New Guinea: K[aiser] Wilhelmsland, Bongu; ZMHB: ♀ [number of specimen(s) not known], New Guinea.

\**Dimorphodes catenulatus* Redtenbacher, 1908: 365. In NHMW: Syntypes: ♀, New Guinea: Key Is., leg. Staudinger; ♂, 2♀♀, New Guinea: Key Is., leg. Fruhstorfer. Not traced in MNHN and ZMHB. Valid name: *Dimorphodes mancus catenulatus* (Redtenbacher), see Günther (1934: 88).

*Dimorphodes clypeatus* Redtenbacher, 1908: 366. Holotype ♂ [44mm, not 52mm], New Guinea: Manikion Gebiet, 14-28.ii.1906. Valid name: *Dimorphodes mancus cristatipennis* (Redtenbacher, 1908), see Günther (1934: 89).

\**Neocles cordifer* Redtenbacher, 1908: 505. Not traced in ZMAN or NHMW. There should be ♀ specimen(s) from "N.O. Borneo". Valid name: *Neoclides cordifer* (Redtenbacher).

*Dimorphodes cuspidatus* Redtenbacher, 1908: 367. Holotype ♂ [51mm, not 56mm], New Guinea: Manikion Gebiet, 14-28.ii.1906. Valid name: *Dimorphodes mancus cuspidatus* (Redtenbacher), see Günther (1934: 89).

*Ramulus eitami* Brock & Shlagman, 1994: 106. Paratype ♀, Israel: Eilat, 28.iv.-2.v.1967, leg. C.A.W. Jeekel. Other material in TAUI: Holotype ♂, Israel: Samar, 19.i.1992, leg. A.Eitam. Paratypes: ♂, same data as holotype; ♀, Samar, 25.i.1992, leg. A. Eitam; 2♀♀, Yotvata, 22.xii.1991 and 27.xi.1992, leg. A. Eitam; ♀, Ze'elim, 25.viii.1992, leg. Y. Zvik. Valid name: *Gratidia eitami* (Brock & Shlagman).

*Eurycantha immunis* Redtenbacher, 1908: 342. Holotype ♀, New Guinea: Tawarin, 14-20.vi.1903.

*Creoxylus impennis* Redtenbacher, 1906: 143. Syntype ♀, No locality. Syntypes also in NHMW: ♂, ♀, No locality, "Mus. Dresden".

*Leptinia lineolata* Brunner, 1907: 231. Holotype ♂, Natal: lower Illoso, [18]94, leg. M.Wehr. Valid name: *Leptynia lineolata*.

- \**Promachus meijerei* Brunner, 1907: 297. Syntypes in NHMW: 2♂♂, New Holland, "Mus. Amsterdam" [♀ - not traced]. Valid name: *Neopromachus meijerei* (Brunner).
- \**Promachus modestus* Brunner, 1907: 299. In NHMW: Holotype ♂, New Holland, "Mus. Amsterdam". Valid name: *Neopromachus strumosus modestus* (Brunner), see Günther (1929: 723).
- Otocrania mutica* Redtenbacher, 1908: 424. Holotype ♀, ["Java" is recorded on a specimen label in error? Redtenbacher recorded the locality as "?". The genus is found in Brazil.], 1856.
- Pseudodiacantha obscura* Redtenbacher, 1908: 552. Holotype ♂, Java: Tjibodas, i.[18]94, Siboga exp[edition]. Valid name: *Orexines macklottii* (de Haan, 1842: 126) New synonym. As *P. obscura* is the type species of the genus *Pseudodiacantha* Redtenbacher (by monotypy), this genus becomes a new synonym of the genus *Orexines* Stål, 1875.
- \**Promachus perspinosus* Brunner, 1907: 299. In NHMW: Syntype ♀, New Holland, "Mus. Amsterdam". Günther (1929: 746), did not regard the specimen as a type, as Brunner only referred to a ♂, which has not been traced. However, Brunner may have recorded the sex in error. Valid name: *Pseudopromachus perspinosus* (Brunner).
- \**Carausius reductus* Brunner, 1907: 269. In NHMW: Holotype ♀, New Holland, "Mus. Amsterdam". Valid name: *Leprocaulinus vipera* (Kaup, 1871).
- Dimorphodes serripes* Redtenbacher, 1908: 364, plate 16: 14-15. Syntype ♂, Celebes, v. Musschenbroek, 1884 [Locality recorded by Redtenbacher as "?"]. Syntypes also in NHMW: ♀, New Guinea, leg. Deniseb; ♀, New Guinea: Stephansort, leg. Rolle; ♀, New Guinea, leg. Fruhstorfer; ♀, New Guinea, NE coast, 1904-05, leg. Dr. Poch; ♀ nymph, New Guinea: Milne Bay, leg. Staudinger; ♂, New Guinea: Takar, leg. Fruhstorfer; ♂, New Guinea, Kaiser Wilhelmsland, leg. Schlüter; MCSN: ♀, New Guinea: Paumotu, ix.-xii.1892, leg. Loria. Not traced in SMTD from Borneo [Locality appears to be in error], although there are ♂, 2♀♀, 2♀♀ nymphs, New Guinea: K[aiser] Wilhelmsland. HNHM material from New Guinea was destroyed in fire. Valid name: *Dimorphodes prosthesis serripes* (Redtenbacher), see Günther (1934: 88).
- Gratidia simplex* Brunner, 1907: 221. Holotype ♂, Z. Afrika, 18[94], leg. M. Wehr.
- Myronides spinulosus* Brunner, 1907: 254. Holotype ♂, Celebes: Is. Saleyer, Siboga exp[edition].
- \**Promachus vestitus* Brunner, 1907: 299. Holotype ♂, New Holland, "Mus. Amsterdam". Valid name: *Neopromachus vestitus* (Brunner).

## 2. Type material in Amsterdam not recorded in the literature

- Dixippus jejunos* Brunner, 1907: 278. Syntype ♀, ? locality [Data label reads "Eiland Zuid Broeder, Riouw Arch., iii.99, Kluit leg. (met 3 jonge ex. van 14 dagen oud)" i.e. Island south of Broeder island, Riouw Archipelago, iii.1899, leg. Kluit (with 3 young specimens of 14 days old).]. Syntypes also in NHMW: 2♂♂, 2♀♀, Borneo, leg. Frivaldsky; ♂, Borneo, "Mus. Budapest"; ♂, Borneo: Labuan, leg. Swinhoe; ♀, Borneo, leg. Xantus; 2♂♂, Brunei, leg. Staudinger; ♂, Borneo; alcohol material - Sarawak: Baramfluss, leg. Kükenthal. Also in NHMB: Sumatra: Indragiri. Valid name: *Lonchodes catori* Kirby, 1896.
- Promachus obrutus* Brunner, 1907: 296. Syntype ♂, New Guinea: Skanto-Gebied, 4-8.vi.1903. Syntypes also in NHMW: 2♀♀, New Guinea: Sattelberg, Huon Golf, leg.

Staudinger; ♂, ♀, New Guinea: Sattelberg, Huon Golf, 1899, leg. Biró. HNHM material was destroyed in fire. Valid name: *Neopromachus obrutus* (Brunner).

*Clitumnus serrulatus* Brunner, 1907: 190, pl. 7: 3a-b. Syntype ♀, Java: Tengger-Geb., x.[18]98, leg. Drescher. Syntypes also in NHMW: 4♂♂, 4♀♀, 1 nymph, Java: Tengger-Geb., leg. Fruhstorfer; ♂, Malaysia: Penang, viii.1889, leg. Fruhstorfer [misidentified ♂ of *Baculum nematodes* (de Haan, 1842), det. Brock]; ANSP: ♀, Java; ISNB: ♀, Java, leg. Fruhstorfer; RMTD: 2♂♂, Java. HNHM material from Borneo was destroyed in fire. Valid name: *Baculum serrulatum* (Brunner).

### Notes on the phasmid collection in Amsterdam

There is a modest sized collection of phasmids, housed in 54 cabinet drawers, which includes many unidentified specimens. Specimens from a wide range of countries have been examined by known specialists in Orthoptera: P.D. Brock, K. Brunner von Wattenwyl [a wide range of common material, identified in 1904, in addition to types], K. Günther, C. Willemse and F. Willemse. Brock (in press) used a male *Eurycnema versirubra* (Serville, 1838) and other males reared from Javan stock in the Amsterdam zoo, 1940's to formally redescribe the male of this species (due to uncertainty with Redtenbacher's 1908 description).

### Conclusion

During completion of the monograph on phasmids, it appears highly probable that Brunner von Wattenwyl (1907) overlooked reference to type material in Amsterdam, in the case of three species. Having identified these specimens in 1904, along with other material from Amsterdam actually described in the monograph, the obvious conclusion is that he intended them to be part of the type series. Other errors in omitting material in some museums has already been identified (Brock, 1998). Redtenbacher described material in 1908 some of which had been collected as recently as 1906 e.g. "Nieuw Guinea Expeditie, 14-28.ii.1906, Manikion Gebied", indicating close contact with the curator of the Amsterdam museum prior to completion of the manuscript.

Some measurements were found to be inaccurate, although the specimens concerned otherwise agreed with the original descriptions. It is probable that Redtenbacher (1908) recorded the body lengths incorrectly (or was provided with the wrong information) and I have therefore concluded that they are holotypes.

Type material of *Arrhidaeus bifasciatus*, *Carausius bilineatus* and *Neocles cordifer* has not yet been traced in any museum collection.

### Acknowledgements

I wish to thank Willem Hogenes for kindly allowing access to the Amsterdam collection, and for clarifying information on the data labels in several instances. In addition, I also thank curators of the other collections mentioned.

### References

- Audinet Serville, J.G. (1838) *Histoire Naturelle des Insectes*. Librairie Encyclopédique de Roret, Paris. 18, pp. 776.
- Brock, P.D. (1998) *Catalogue of type specimens of Stick- and Leaf-Insects in the Naturhistorisches Museum Wien (Insecta: Phasmida)*. Naturhistorisches Museum Wien, Katalogue Band 13 der wissenschaftlichen Sammlungen des Naturhistorischen Museums in Wien. Entomologie (ISBN 3 900 275 67 X).
- Brock, P.D. (in press) *Stick & Leaf Insects of the Malay Peninsula and Singapore*. Malaysian Nature Society, Kuala Lumpur.
- Brock, P.D. & Shlagman, A. (1994) The stick-insects (Phasmatodea) of Israel, including the description of a new species. *Israel Journal of Entomology*, 28: 101-117.
- Brunner von Wattenwyl, K. (1907) *Die Insektenfamilie der Phasmiden*, Volume 2. [pp. 181-338, plates 7-15]

Verlag Engelmann, Leipzig.

Günther, K. (1929) Die Phasmoiden der deutschen Kaiserin-Augusta-Fluss-Expedition 1912-13. Ein Beitrag zur Kenntnis der Phasmoidenfauna Neuguineas. *Mitteilungen aus dem Zoologischen Museum in Berlin*, **14**: 599-746.

Günther, K. (1934) Phasmoïden von den Talaud-Inseln und von der Insel Moratai, mit kritischen Bemerkungen über einzelne Arten und einem zoogeographischen Anhang. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin*. 75-94.

Haan, W. de (1842) Bijdragen tot de kennis der Orthoptera. [pp. 45-248, plates 10-23]. In: C.L.Temmick: *Verhandelingen over de natuurlijke Geschiedenis der Nederlandsche overzeesche Bezittingen*. Volume 2. Leiden.

Kaup, J.J. (1871) Neue Phasmidae. *Berliner Entomologische Zeitschrift*, **15**: 25-42.

Kirby, W.F. (1896) On some new or rare Phasmidae in the collection of the British Museum. *Transactions of the Linnean Society of London*, (2)**6**: 447-475.

Redtenbacher, J. (1906) *Die Insektenfamilie der Phasmiden*, Volume 1. [pp. 1-180, pls. 1-6] Verlag Engelmann, Leipzig.

Redtenbacher, J. (1908) *Die Insektenfamilie der Phasmiden*, Volume 3. [pp. 339-589, pls. 16-27] Verlag Engelmann, Leipzig.

Stål, C. (1875) *Recensio Orthopterorum*. *Revue critique des Orthoptères décrits par Linné, de Geer et Thunberg*. P.A. Norstedt & Söner, Stockholm, **3**: 4-105.

# ***Bacillus grandii maretimi* Scali & Mantovani, 1990 of the island of Marettimo (Egadi Archipelago, North-western Sicily): observations on its distribution and behaviour**

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## **Abstract**

Presence and distribution of the subspecies *Bacillus grandii maretimi* Scali & Mantovani, 1990 on the island of Marettimo (Egadi Archipelago, north-western Sicily) are analyzed. Observations are made on its ethology and actual distribution over the island, with notes on its reproduction in captivity.

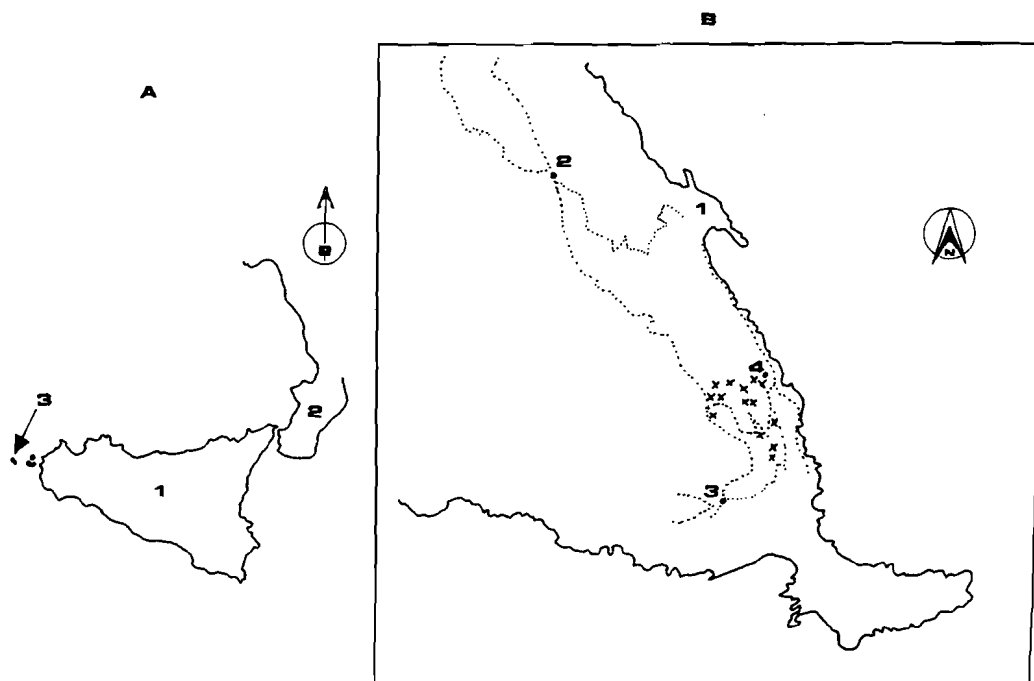
## **Key words**

Phasmida, *Bacillus*, island of Marettimo, lentisk, ocular pigmentation, disruptive coloration, mimesis, breeding.

## **Introduction**

In October 1996 and October 1997, the author made a series of excursions over the island of Marettimo (Northwest Sicily) in an attempt to evaluate the actual distribution of the stick insect *Bacillus grandii maretimi* Scali & Mantovani, 1990, its growth season, and some of its environmentally-linked ethological peculiarities.

During the same period, observations were made on the behaviour in captivity of the first stocks collected in October 1996. *B. grandii maretimi* feeds only on lentisk (*Pistacia lentiscus* Linnaeus), called "stinco" by the islanders.



**Figure 1.** a) Location of Marettimo Island: 1 = Sicily, 2 = Calabria, 3 = Marettimo.  
b) South-eastern Marettimo. 1 = Inhabited resort, 2 = Case Romane, 3 = Carcaredda, 4 = Electricity Station, X = Findings of *Bacillus grandii maretimi*.

## ***Bacillus grandii maretimi* - a recent discovery**

In 1982, researchers Giuseppe Nascetti and Luciano Bullini of the "Istituto di Genetica" at Rome University described a new species of the holomediterranean genus *Bacillus*, under the name of *B. grandii*, in honour of the notable Italian entomologist Guido Grandi (Nascetti & Bullini, 1982). This taxon was located in a very small area in the Iblean Hills (province of

Syracuse, south-eastern Sicily), near Noto, Palazzolo Acreide and Canicattini Bagni. *Bacillus grandii* is now known as the only Mediterranean species which is exclusively amphigonic (sexually reproducing). At the beginning of the 1990s, researchers Valerio Scali and Barbara Mantovani of the "Dipartimento di Biologia Evoluzionistica" at Bologna University also reported the presence of the species in western Sicily (Scali & Mantovani, 1990; Scali, 1991; Scali *et al.*, 1991; Mantovani & Scali, 1993).

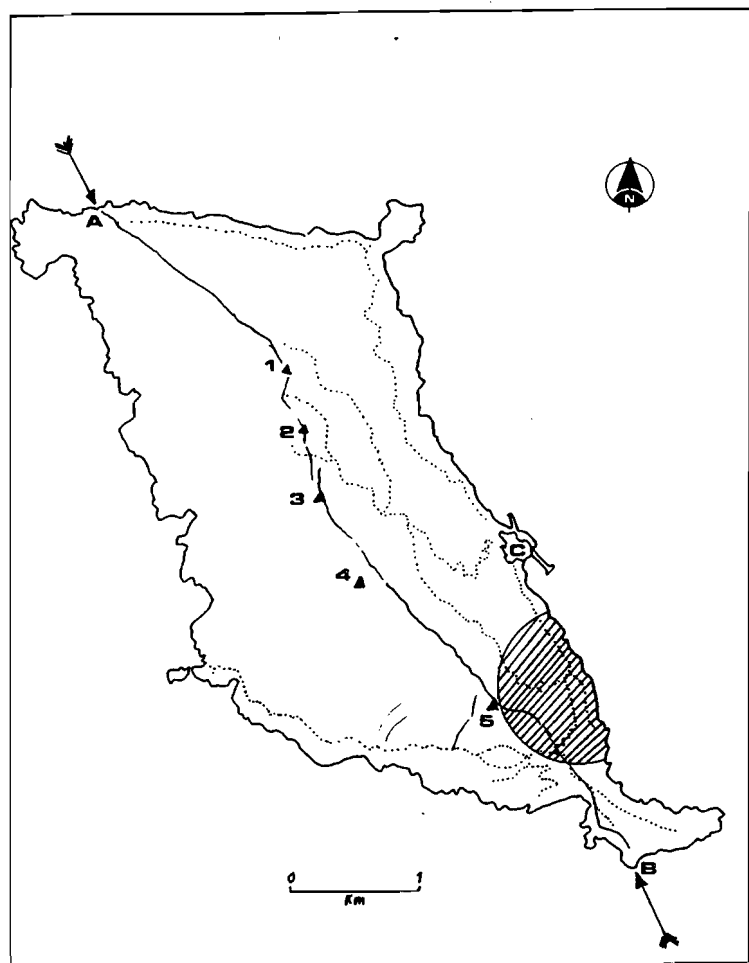
Several characteristics were noted that distinguished these new populations from the original one in south-eastern Sicily. Such characteristics led up to the description of the subspecies *B. grandii benazzii* (along the Trapanese coast and on the island of Levanzo) and *B. grandii maretimi* only on the island of Marettimo (Scali & Mantovani, 1990; Mantovani *et al.*, 1992; Mantovani & Scali, 1993).

Observation of *B. grandii maretimi* revealed populations made up of a considerable number of specimens, in contrast with the other two subspecies, which are very scarce in number. The Marettimo stick insect is also genetically pure, since it is the only phasmid on the island.

### The island of Marettimo

Marettimo is the last island in the Egadi Archipelago. It is located west of Favignana and Levanzo, in the direction of the coast of Tunisia (see Fig. 1a). The island is particularly mountainous, with peaks reaching over 600m above sea level: Pizzo Falcone (686m), Punta Campana (630m) and Pizzo del Capraro (627m). The mountainous spine divides the island into two distinct parts. The western slope is steep, with calcareous faces which fall sheer to the sea (the so-called "barranchi"). The eastern slope has a more gentle incline and it is there that is located the island's only inhabited resort.

Marettimo is very rich in lentisk. The plant is part of the garigue vegetation, essentially formed by the genera *Rosmarinus*, *Erica*, *Cistus*, *Pistacia* and *Euphorbia* (Massa, 1995). The genera *Rosa* and *Rubus* are not present on Marettimo.



**Figure 2.** Marettimo.

A to B = mountainous spine of the island; C = Inhabited resort; 1 = Pizzo Falcone (686m); 2 = Pizzo del Capraro (627m); 3 = Punta Campana (630m); 4 = Punta Ansini (495m); 5 = Punta Lisandro (482m); Dotted lines indicate paths covered by the author; Shaded area indicates region where *B. g. maretimi* were found.

### Distribution of the populations

The populations of *B. grandii maretimi* are found only on the eastern slope of the Island. Their lentisk is located in an Aleppo pine wood (*Pinus halepensis* Miller), along the stretch from the electrical station to the path leading to the fork for Carcaredda and Case Romane (see Fig. 1b and Fig. 2). The altitude of the area ranges from 20m to 190-200m. The lentisk is located in the undergrowth, in a shaded position, with bushes of about 1.5-2m in height (Fig. 5).

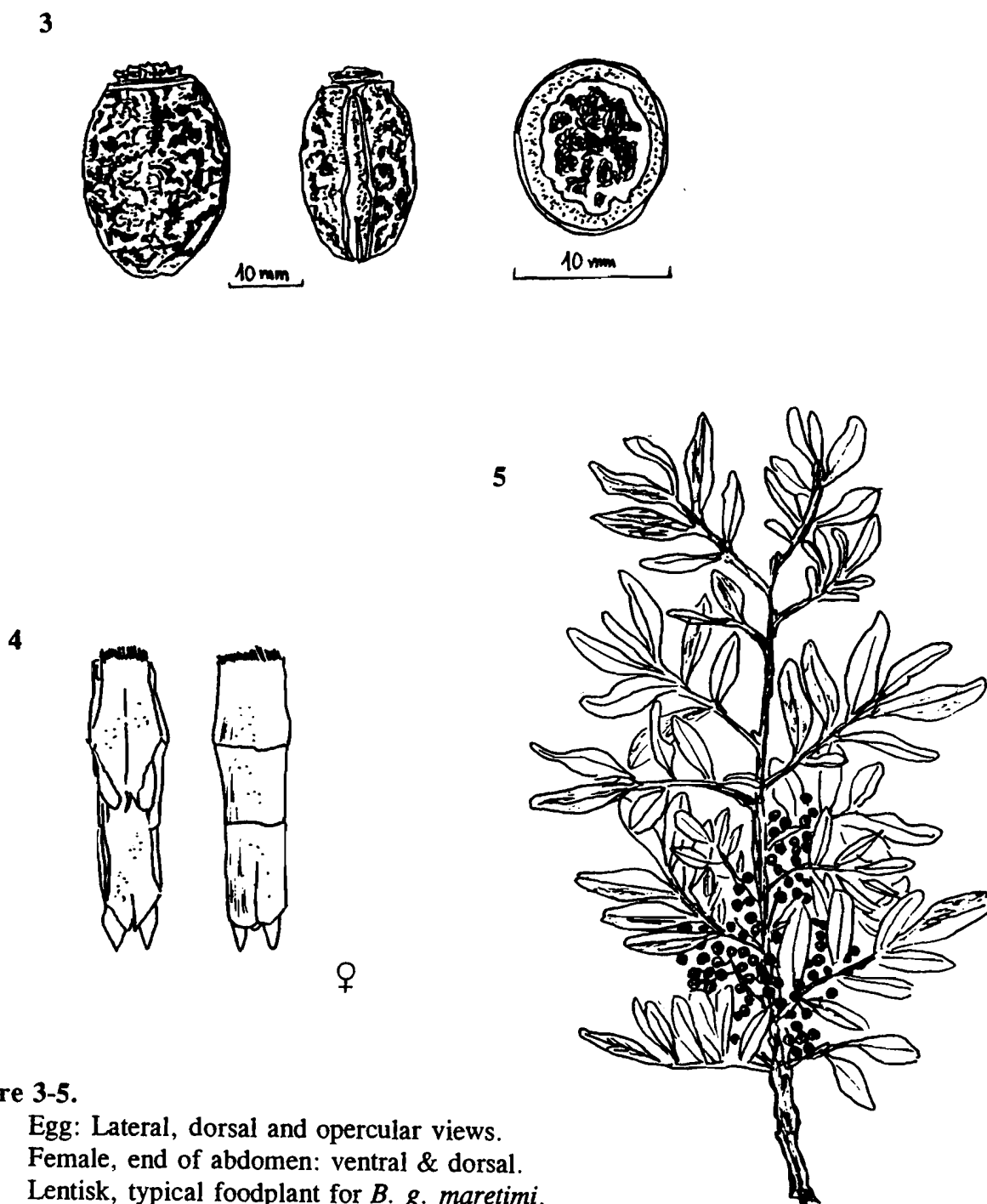


Figure 3-5.

3. Egg: Lateral, dorsal and opercular views.
4. Female, end of abdomen: ventral & dorsal.
5. Lentisk, typical foodplant for *B. g. maretimi*.

The author made reconnaissance trips almost entirely during the daytime, due to the ease of locating the insects. It was possible to work with both hands while collecting specimens in the lentisk, fortunately a non-thorny plant. Of course, such ease of operation is not possible in the *Rosa* and *Rubus* spp. (rose and bramble) of the Iblean area.

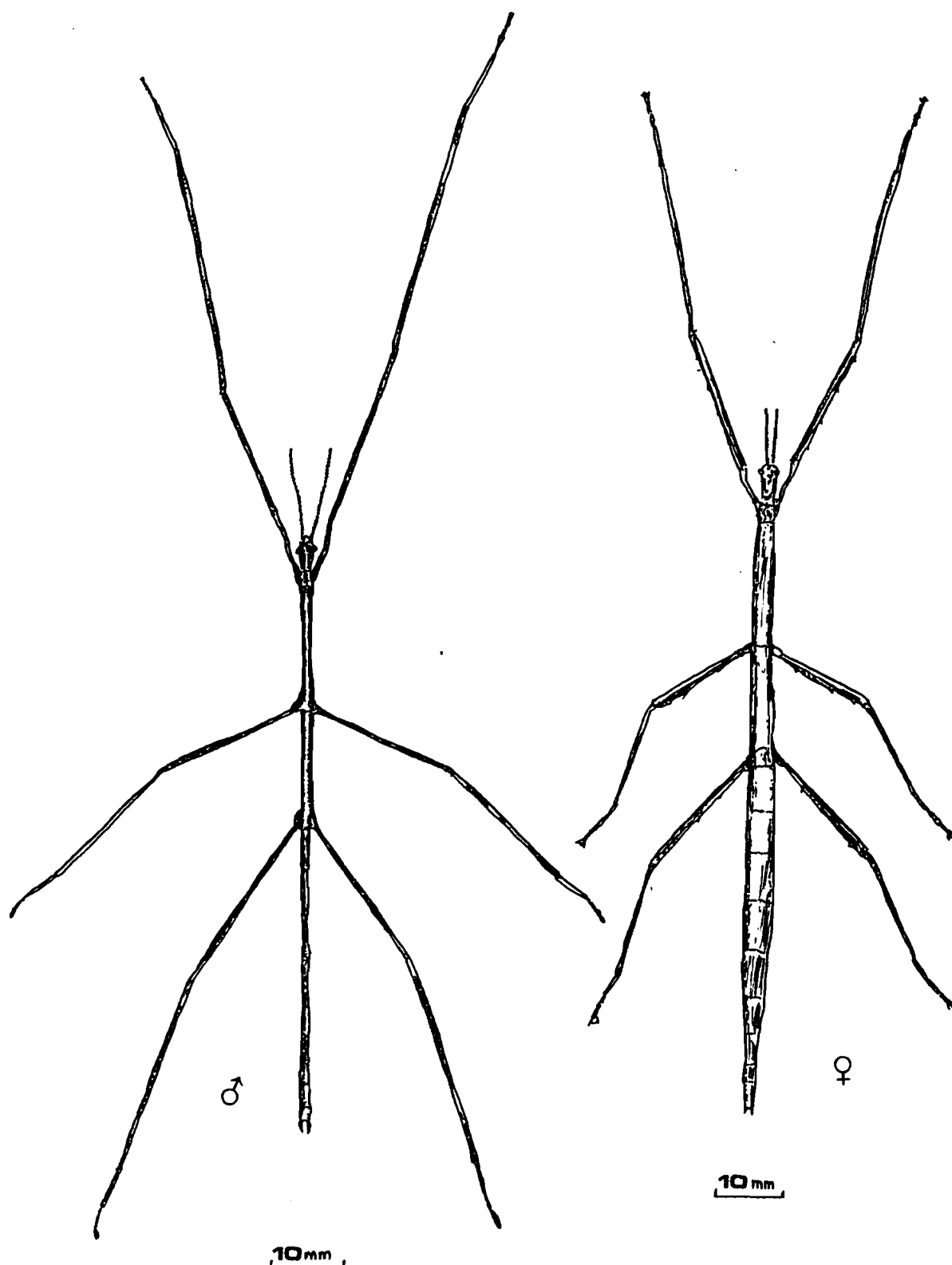


Figure 6. Adult male and female *Bacillus grandii maretimi*.



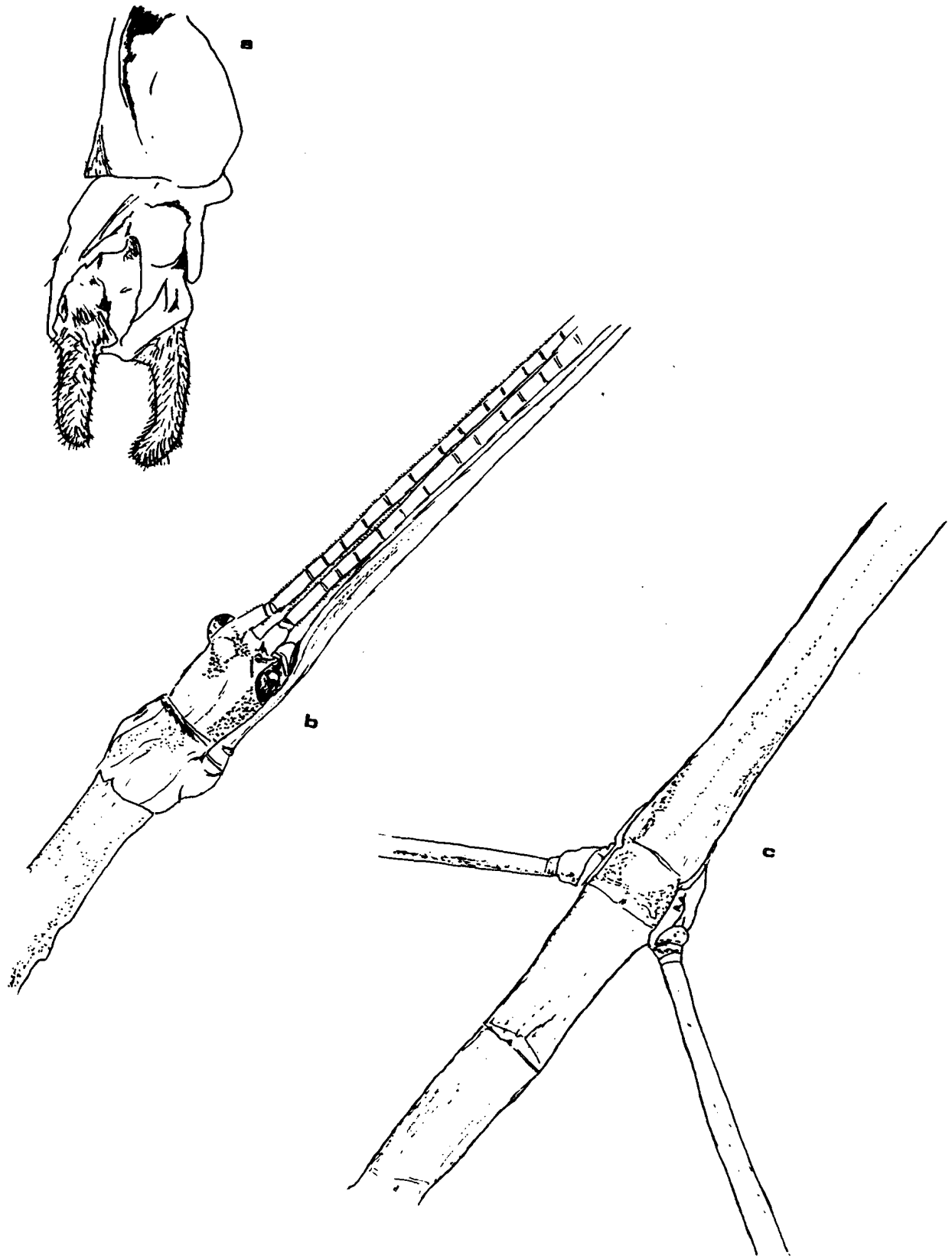


Figure 7. Male.

a) Ventral view of abdomen; b) Head; c) Mid legs.

Findings were made at the beginning of October 1996 and 1997, but only young nymphs of *B. grandii maretimi* were found. All these nymphs were from the first and the third instar, except for one of them (probably at the fourth instar). This fact leads us to believe that the annual period of egg hatching occurs in August and September. In fact, although the island enjoys a mild climate, only a negligible proportion of these insects seems to be able to overwinter at the nymphal stage. The sex ratio appears to be equal.

Areas of Marettimo in which the author found specimens are marked on the map (Figs. 1b & 2). As noted above, the only area in which the presence of *B. grandii maretimi* was observed was a small pine wood, which maintains uniform shade over the lentisk of the area. *B. grandii maretimi*, in fact, seems to shun any area parched by the sun. This observation applies equally to the two other subspecies of the taxon. However, it must be borne in mind that *Pinus halepensis* was brought to the island as part of the reforestation process of 1962-63. Prior to that date, there was only a small autochthonous station of this tree, located near spring Pegna next to the fork for Punta Troia (Vaccaro, 1998, personal correspondence). The same marked area for the Marettimo's phasmid also plays host to two interesting endemic molluscs of the genera *Sicilaria* and *Oxychilus* (Gastropoda: Pulmonata: Stylommatophora), also observed by the author.

### Ethological observations

Males of *B. grandii maretimi* differ from their counterparts in the Iblean Hills (*B. grandii grandii*) by their ocular pigmentation, having a wide pigmented bar which horizontally crosses each compound eye. In addition, males do not have - to any clear degree - the black and white areas of chromatic desegregation (disruptive coloration) at the beginning of each tibia, which is a typical morphological characteristic of the Iblean sub-species.

During the daytime, nymphs of *B. grandii maretimi* remain motionless, hanging onto leaves of lentisk, both upwards and downwards.

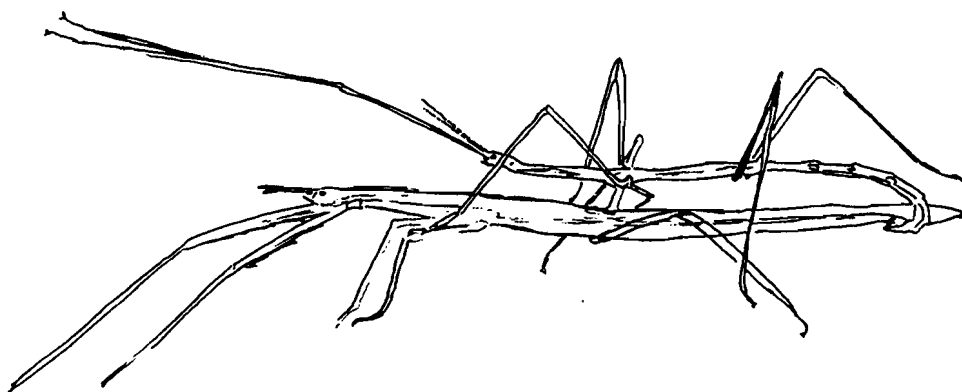


Figure 8. Mating pair of *Bacillus grandii maretimi*.

The author has observed some females whose thorax and abdomen showed clear yellow streaking; these specimens were perfectly camouflaged when on decaying and yellowing twigs of lentisk. However, as a rule, mimesis in this stick insect manifests itself by reproducing green shades, since lentisk leaves are dark green (to greater and lesser degrees depending on whether they are in the shade or under direct sunlight). The male is brown in colour but is able to generate a reddish tint in the meta- and meso- thoracic segments so as to mingle with the twigs of lentisk.

In the wild, the age limit of *B. grandii maretimi* seems to be about five or six months,

or until winter, though not all the individuals die at that point. Populations kept in captivity may easily double their lifespan, if housed at suitable temperatures.

In the wild, the females (see Figs. 4 & 6) survive on average about one month longer than do the males. The males (see Figs. 6 & 7) are quite fragile and vulnerable to drops in temperature. The author has bred females that have lived for one year; similarly kept males have not surpassed ten months. Once they have reached sexual maturity, the insects go about mating (Fig. 8). Each copula may persist some hours. As it is typical of most stick insects, the activity of *B. grandii maretimi* is prevalently nocturnal. The male is clearly more active because its instinct is to move about in search of females.

### Acknowledgements

The author is grateful to Vito Vaccaro, and to The "Associazione Culturale C.S.R.T." of Marettimo for their support. Also thanks to Carmelo Milluzzo for his invaluable photos, used as a basis by the author for drawings.

### References

- Failla, M.C., La Greca, M., Lombardo, F., Messina, A., Scali, V., Stefani, R. & Vigna Taglianti, A. (1994) Blattaria, Mantodea, Isoptera, Orthoptera, Phasmatodea, Dermaptera, Embioptera. In: Minelli A., Ruffo S. & La Posta S. (eds) *Checklist delle specie della fauna italiana*, 36: 19-20, Calderini, Bologna.
- Mantovani, B. & Scali, V. (1993) Genetic characterization of *Bacillus grandii maretimi* (n. subsp.) (Insecta Phasmatodea) in relation to its ecology. *Vie et Milieu*, 43 (4): 241-246.
- Mantovani, B., Scali, V. & Tinti, F. (1992) New Morphological and Allozymic Characterization of *Bacillus whitei* and *B. lynceorum* Hybrid Complexes (Insecta Phasmatodea). *Biologische Zentralblatt*, 111: 75-91.
- Massa, B. (1995) Isole Egadi. In: Giusti F. (ed.) *Le isole minori: la fauna - I Quaderni di Italia Nostra*, 26: 13-23.
- Nascetti, G. & Bullini, L. (1982) *Bacillus grandii* n. sp. and *B. whitei* n. sp.: two new stick insects from Sicily (Cheleutoptera, Bacillidae). *Bollettino Istituto di Entomologia*, Bologna, 36: 245-256.
- Scali, V. (1991) Un nuovo insetto stecco (Phasmatodea) della Sicilia: *Bacillus grandii benazzii* (n. subsp.). *Frustula entomologica*, 12: 397-408.
- Scali, V. & Mantovani, B. (1990) Caratterizzazione morfologica e allozimatica di *Bacillus grandii maretimi* (n. subsp.) (Insecta Phasmatodea). 53° Congresso Unione Zoologica Italiana, Palermo: 289-290.
- Scali, V., Mantovani, B. & Tinti, F. (1991) Primi dati sull'ibridogenesi, androgenesi e ginogenesi di *Bacillus whitei* Nascetti & Bullini (Insecta, Phasmatodea). *Frustula entomologica*, 12: 103-108.

# **An updated survey of the distribution of the stick insects of Britain**

**Malcolm Lee, Gullrock, Port Gaverne, Port Isaac, Cornwall, PL29 3SQ, UK.**

## **Abstract**

Since the 1995 British stick insect survey (Lee, 1995), around 40 further reports have been received, including some at new locations. This report summarises 180 reports from 38 localities and comments on the life cycle, predators, and foodplants of the British phasmids.

## **Key words**

Phasmida, *Acanthoxyla prasina geisovii*, *Acanthoxyla prasina inermis*, *Acanthoxyla prasina prasina*, *Clitarchus hookeri*, *Bacillus rossius*, Distribution, United Kingdom, Eire.

## **Introduction**

Since the 1995 stick insect survey (Lee, 1995), around 40 further reports have been received, including some at new locations. Photographs accompanying several of these reports have enabled identification of the species present in most of the new locations, as well as in some sites where the species was formerly unconfirmed. Prior to commencing this survey almost 50 sightings in 18 locations had appeared in print. This paper brings the total to some 180 reports in 38 locations. This large number gives a clear picture about how these parthenogenetic insects are adapting to their alien environment in respect of life cycle, foodplants and predators.

## **Life Cycle**

Principally, nymphs emerge from the egg in spring. The tiny nymphs are much more easily spotted after dark. Throughout the year, I record the moths which settle beneath my outside lights, so from March onwards this nightly monitoring is extended to include a torchlight check of garden bushes. The earliest I have recorded a first instar nymph was a singleton on 1st April this year on a climbing rose, but the main emergence is towards the end of the month. In 1997 the only nymphs in my garden were a first instar on 15th April, and a second instar on 10th June. In 1996, three first instars were spotted on 24th April on a small potentilla bush. Within three days this had increased to 10, and two days later to 26. On the night of 3rd May 56 were observed, all on that same bush. Evidence of how well they hide during the day came the following morning, when 15 minutes of searching the bush (approximately 60cm high, 1m across, and 30cm deep against a north east facing wall) found only 12 nymphs all clamped tight against the stems with their front and middle legs facing forward along the body, and their rear legs facing backwards. That night 56 were there again, prominently up on their legs with their abdomen arched over their backs.

Whilst spring is clearly the main time for emergence, occasional first instars have been recorded in summer and autumn. After a very hard frost at the end of November 1993, followed by a period of mild weather, a dozen first instars were seen on a bush in Port Isaac in mid December. In New Zealand, insects have had many thousands of millennia to standardise their emergence with the seasons, but it seems that complete synchrony has still to happen here. Adults from the spring emergence have been found in my garden from mid July through into January. From all the survey reports, adults have been seen in every month of the year and some insects are most clearly able to survive hard frosts. An article in the *West Briton* newspaper on 13th February 1997 brought in nineteen reports, no less than nine of which were of insects seen in the previous few weeks, and from six separate Cornish locations. Two Port Isaac sightings were also made that January. The period around Christmas 1996 and into January 1997 had been one of the coldest on record, with 10 days of subzero temperatures, yet all these insects from many different parts of Cornwall had survived those frosts and were still active.

As previously recorded (Lee, 1993), these insects can lay more than 200 eggs in their lifetime. The brown insect referred to in that report, which was kept indoors over the winter, eventually laid 694 eggs in 166 days, an average of 4.2 eggs per day: on some days it laid 8 or 9 eggs. Outdoors, most eggs would be laid in late summer, or early autumn, before the onset of cold weather. This suggests an incubation period of six to eight months before eggs hatch to start the annual cycle again.

### Foodplants

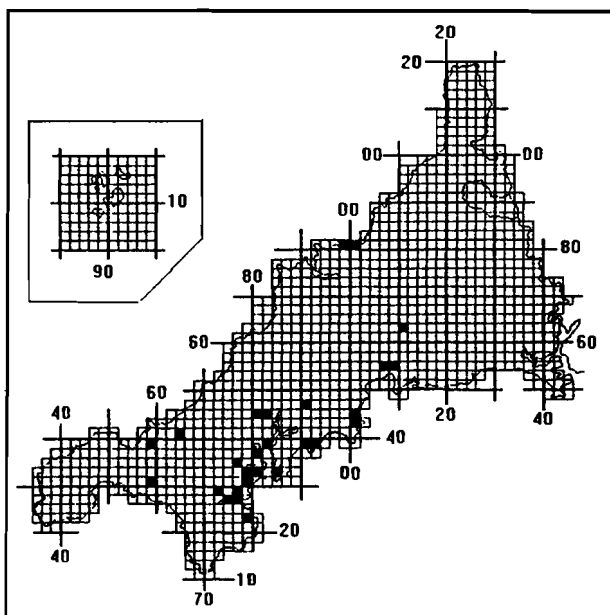
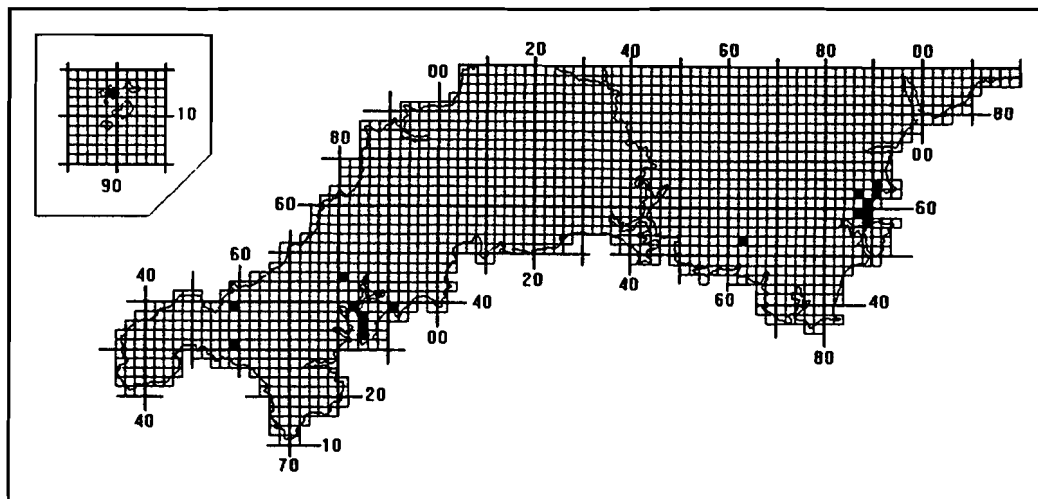
There have been a considerable variety of garden plants mentioned, and it seems likely that these insects are widely polyphagous here. Since eggs are simply dropped below the plant on which the parent is feeding, next year's nymphs are most likely to climb onto that same plant when they hatch out. Were it to climb up an adjacent, but unsuitable, plant, the nymph would die and a new colony would not be started. The most frequently reported foodplants are Rosaceae (roses, brambles, raspberry and potentilla) and conifers, especially *Leylandii* hedges. Other species mentioned are *Ceanothus* sp., *Cistus* sp., *Dahlia* sp., *Erica arborea*, *Erica erigena*, *Erica lusitanica*, *Fuchsia* sp., honeysuckle, myrtle, pittosporum and red valerian. From the reports received, there is no difference in foodplants between either *Acanthoxyla* subspecies.

### Predators

If the potential life inside every egg were to make it to a mature adult, simple arithmetic shows that we would be overwhelmed with stick insects in just a few years. That this rarely happens must mean that most of this potential life fails. With each insect laying several hundred eggs, an overall mortality of 99% would still lead to an increasing population. Undoubtedly there are many causes for failure, but the survey gave several examples of predation. Most commonly reported were birds feeding on small nymphs. Nymphs keep a very low profile, but will often move if disturbed. A bird foraging for food may accidentally disturb an insect and, once seen, a colony could be decimated in a very short time. Three reports spoke of adults or nymphs being attacked by "wasps". When used by a non-naturalist, the term "wasps" could mean almost any yellow and black Hymenoptera, not necessarily of the family Vespidae. Chris Haes (pers. comm.) has observed moribund adults and active nymphs being attacked by wasps, which were confirmed as common wasps (*Vespula vulgaris*). Chris observed insects being bitten and cut up, presumably to get them into the nest for feeding to the larvae. A daddy-long-legs spider (*Pholcus phalangioides*) was observed and photographed eating a third instar nymph which it had caught.

### Survey Results

The report below lists all recorded sites, together with 1km Ordnance Survey squares. Where recent records have not been received, the date of the last record is given. Corrections to my last report (Lee, 1995) are also included. With the exception of specific requests in the Ivybridge area, few of my articles since 1995 have reached outside Cornwall, so there is a distinct Cornish bias. Plotting all reports to date on large scale maps reinforces my 1995 comments on the very localised nature of colonies in all areas, with the possible exception of those around the Helford River (Budock Vean, Glendurgan, Helford Passage and Trebah, and possibly including Mawnan Smith) which may be one large colony.



### British Stick Insect Locations

Top: *Acanthoxyla prasina geisovii* (Kaup).

Left: *Acanthoxyla prasina inermis* Salmon.

These tetrad (2km x 2km) maps show all the recorded locations of both our widely distributed species within Britain. All tetrad records are post-1984. *Clitarchus hookeri* (White) is only found on Treseco, Isles of Scilly in the same tetrad as *Acanthoxyla prasina geisovii*.

#### (a) Cornwall

**ANGARRACK (SW5838):** Insects continued to be found in one garden up to this spring, and have also been reported in neighbouring gardens. *A. p. inermis* is present, as well as *A. p. geisovii* and *Acanthoxyla prasina prasina* (Westwood). All originated from a spillage of eggs. An unusual over-wintered *A. p. geisovii* was recorded this spring, in which the insect was brown, but with green upper parts. (Chris Haes, pers. comm.)

**BLISLAND SCHOOL (SX1072):** No reports since Lee, 1995. No reason to doubt a colony still exists in the school grounds. Species present not confirmed, but likely to be *A. p. inermis*, probably originating from the Penryn distribution to Cornish schools. Last record: 1992.

**BUDOCK VEAN (SW7527):** Three 1997 reports. A clear photograph from one garden was of *A. p. inermis*. This site was only a 100m from the 1990 report of *A. p. geisovii* (Brock, 1991), which Lee (1995) considered was an error for *A. p. inermis*. The photograph confirms *A. p. inermis* is the species present here.

**BUDOCK WATER (SW7832):** This village is just to the west of Falmouth, and was previously (Lee, 1995) included with that location. A sighting report was received via

Chris Haes shortly before writing the 1995 report. Subsequent efforts to obtain further information have been inconclusive, and no other reports have been received. The proximity to the Falmouth *A. p. inermis* colonies leads me to conclude the report was likely to be valid. The record was most likely in 1994.

CONSTANTINE (SW7329): A new location. One report in 1996 of four insects in a single garden on a Privet bush. A clear photograph sent subsequently showed they were *A. p. inermis*. The photograph also showed bramble mixed in the Privet bush, and those bramble leaves showed clear evidence of feeding bites, so the Privet was incidental. The location is not close to any school, and I suspect the insects arrived in a nearby garden on plants from Treseder's nursery.

FALMOUTH (SW7931, SW7933, SW8032, SW8033): Four reports received in 1997: three from around the 1981 colony, and one from a close in west Falmouth. The species which has been confirmed as present in Falmouth is *A. p. inermis*. The CBRU report of *A. p. geisovii* (which Lee (1995) felt was in error) was in October 1992 in Neil Treseder's garden (SW7933), although Chris Haes only found *A. p. inermis* on visiting the garden in 1993. A report of another Falmouth *A. p. geisovii* has not proved possible to track down, so this species' presence requires confirmation.

FEOCK (SW8238): No new reports, but no reason to doubt both *A. p. inermis* and *A. p. geisovii* are still present here. The last *A. p. geisovii* record was in 1987, the last *A. p. inermis* was in 1993.

GLENDURGAN (SW7727): In July 1995 a visit to this garden with Chris Haes found evidence of feeding near an old nursery, but no stick insects. On 27th July 1995, Rob James, Head Gardener, found a 5cm nymph on a pittosporum plant in that old nursery. Species confirmed as *A. p. inermis* by Lee (1995).

GREAT WORK (SW5930): No new reports, but no reason to doubt both *A. p. inermis* and *A. p. geisovii* are still present here. Last record: 1993.

HELFORD PASSAGE (SW7527, SW7626, SW7627): One 1997 report, accompanied by a clear photograph of *A. p. inermis*. Lee (1995) concluded that the earlier references to *A. p. geisovii* at this location were in error.

MAWNAN SMITH (SW7728, SW7729): Four 1997 reports from several parts of this large village. Species present is *A. p. inermis*, (Lee, 1995).

MEVAGISSEY (SX0144, SX0145): One 1997 report. Species present confirmed as *A. p. inermis*, (Lee, 1995).

MYLOR BRIDGE (SW8036): A new location. One 1997 report, accompanied by a clear photograph of *A. p. inermis*. The origin of the colony is most likely to have arisen from plants from Treseder's nursery in a nearby garden.

PENRYN (SW7734, SW7735): Two reports in 1996 and three in 1997. All came from the same estate in North Penryn where insects were released in 1982. Species is *A. p. inermis*, (Lee, 1995).

PORT GAVERNE (SX0080): Present in my own garden in 1995, 1996, 1997 and 1998. The species present here was confirmed as *A. p. inermis* by Lee (1993).

PORTHALLOW (SW7923): A new location. One report in 1997 was accompanied by clear photos of *A. p. inermis*. Insects have been present here for some years. This location is some distance from the nearest stick insect site. The house has a New Zealand name, and the garden was laid out many years ago with New Zealand plants. It is not known whether they were obtained from Treseder's nursery, or imported direct, either of which would be a likely source of origin.

PORT ISAAC (SW9980): Many reports in 1995, 1996, 1997 and 1998. The species present here was confirmed as *A. p. inermis* by Lee (1993).

- PORTMELLON (SX0143): A new location adjacent to Mevagissey. One 1997 report. The owner of the garden regularly exchanges plants with a friend in Mevagissey who lives in a street where there have been several stick insect reports. This is the undoubted source of these insects, in which case the species present will prove to be *A. p. inermis*.
- PROBUS (SW9047): One 1997 report from the same close as earlier reports. The species present has been confirmed as *A. p. inermis*, (Lee, 1995).
- ROSEWARNE (SW6441): A new location. Two 1997 reports, 100m apart. The species present is not confirmed, but one report was of a 12cm non-spiny insect on raspberry canes, strongly suggesting *A. p. inermis*.
- ST IVES: No further information from this site reinforces the conclusion (Lee, 1995) that this report was of discarded Laboratory stick insects *Carausius morosus* (Sinéty).
- ST JUST-IN-ROSELAND (SW8535): No new reports, but no reason to doubt *A. p. geisovii* is still present here. Last record: 1994.
- ST MAWES (SW8432, SW8433, SW8532, SW8533): Very surprisingly, the February 1997 "West Briton" article, which produced a total of nineteen sightings, gave none from this area. The continuing existence of insects from one of the garden sites mentioned by Lee (1995) was confirmed by letter in 1996. Despite this lack of reports, there can be no reason to doubt these insects remain well established here. The principal species present is *A. p. geisovii*, with *A. p. inermis* in one garden at least. *Acanthoxyla p. prasina* and *Bacillus rossius* (Rossi) were reported as present in small numbers in one garden (Lee, 1995), but it is not known if they still survive.
- TREBAH GARDENS (SW7627): A new location. One 1996 report via Chris Haes. Mike Paviour, garden manager, found an insect in the garden on 9th August. From the description, Chris was able to confirm it was *A. p. inermis*. Although the garden has many New Zealand plants, this garden is adjacent to Glendurgan, and near to several *A. p. inermis* sites, so insects probably moved into the garden by natural spread.
- TRETHEM (SW8536): A new location. Two 1997 reports: a 7cm nymph in February, and two 12cm adults in August which had black spines on their body. From the description, the species is *A. p. geisovii*. This site is only a few kilometres from St Mawes, and St Just-in-Roseland, and they probably arrived here via children finding them in one of these sites and bringing them back.
- TRESCO (SV8914, SV8915): No new reports, but no reason to doubt both *Clitarchus hookeri* and *A. p. geisovii* are still present. The last *C. hookeri* record was in 1992; the last *A. p. geisovii* in 1993.
- TRURO (SW8044, SW8244, SW8245, SW8345): Seven new reports: one in 1995, one in 1996, and five in 1997. A clear photograph from the 1996 report (in a garden on the former site of Treseder's nursery) was of *A. p. inermis*, confirming that this is the species present here. The day after the final proof of my last report (Lee, 1995) had been sent back to the editor, I received a report from a west Truro garden together with a photograph of the insect. This was unclear, having been taken without the benefit of a close up lens. Both Chris Haes and Paul Brock agreed with me that the photo had the look of *A. p. geisovii*, but as the image was so small none of us could be certain. The owner of the garden was asked to keep a look out for more insects, and on 22nd July 1995 the owner forwarded the remains of a nymph which had been attacked by "wasps". There was no doubt whatsoever that this was *A. p. geisovii*, a new location for this species in 1km OS square SW8044. One of the 1997 reports was from an adjacent garden, and was likely to have been *A. p. geisovii* as well. One other report (in Lee, 1995) was from SW8044, but 400m from this site. It is not known which species was in that garden. In Cornwall there are few confirmed reports of



*A. p. geisovii* outside of the St Mawes area, so the origin is a mystery. It is known that Victor Heath, who introduced *A. p. geisovii* to St Mawes, sent plants to other Cornish gardens (West Briton, 1969) and this may be a possible source for the insects.

TYWARDREATH (SX0754, SX0854): No new reports, but no reason to doubt the colony still exists. Species not confirmed, but most likely *A. p. inermis*. Last record: 1994.

VERYAN (SW9139): No reports since Lee (1995), but no reason to doubt *A. p. geisovii* is still present here. Last record: 1994.

VERYAN GREEN (SW9139, SW9239): No new reports, but no reason to doubt *A. p. inermis* is still present here. Last record: 1994.

#### (b) Devon

BROADSANDS (SX8957): Not in Lee (1995). Colin Bath, Curator Paignton Zoo, received a 1986 record of *A. p. geisovii* from this location. No subsequent reports, but no reason to doubt a colony still survives here.

COLLATON-ST-MARY (SX8659): Not mentioned by Lee (1995). The earliest record from this site was in the Paignton Observer of 2nd January 1947, where Herbert Whitley reported finding a crushed and dead insect in the Collaton area. This site is only a kilometre or so west of Paignton Botanical Gardens and Zoo, where *A. p. geisovii* has been known for a long time. They may have spread there by children taking them home, by transfer of plants between the sites, or even by natural spread. Colin Bath received a 1986 record from St Mary's School, and there is no reason to doubt that a colony of *A. p. geisovii* still survives here.

ERMINGTON (SX6352, SX6353): Two newspaper articles in March 1998 brought three reports from this village. At one site, the owner reported that it was he who had sent one of his garden stick insects up to the Natural History Museum c.1983, which was confirmed as *A. p. geisovii*. He was also able to offer an explanation as to how they had arrived in his garden. In c.1975 his company was responsible for demolishing Paignton Corporation Nursery, and he had brought back plants from there to his garden. Insects were first seen the following year and have been seen regularly ever since. He often receives stick insects from other parts of the village with the comment "Here is one of your insects I am returning", so they have clearly become widespread there in the last 20 years.

GALMPTON (SX8856, SX8956): No new reports, but no reason to doubt *A. p. geisovii* is still present here. Last record 1994.

IVYBRIDGE: Ermington should now be used for all previous "Ivybridge" reports.

MARLDON (SX8662, SX8663): Not in Lee (1995). In August 1985, Colin Bath wondered whether the Torbay insects were dying out, as he knew of only two stick insect sightings in the previous 12 months, one of which was from a garden in Marldon (Western Morning News, 1985). No subsequent reports, but no reason to doubt a colony of *A. p. geisovii* still survives.

PAIGNTON (SX8759, SX8859, SX8860, SX8861): One 1996 report. Species present is confirmed as *A. p. geisovii*. Claude Rivers, who rediscovered stick insects at Paignton in 1952 (Rivers, 1953), kindly provided me with some previously unpublished correspondence which he received following his 1953 "Country Life" article (of which Rivers (1953) was an adaption). This was from a lady who, as a 10 year old child, returned in May 1903 from New Zealand with her father Edward Kirby (presumably no relation to the W.F. Kirby who reported Mrs Arbuthnot's 1908 find (Kirby, 1910)) and stayed temporarily at Paignton, near the railway station. The family had returned on the ship *Corinthic* with a large box of young New Zealand shrubs embedded in

earth, which was kept on deck for daily watering and attention. Coincidentally, she also remembers her teacher in Paignton was a Miss Arbuthnot. Shortly after, the family moved to London and the plants were left behind. Where the family stayed in 1903 is only a few hundred metres from where Claude Rivers found the 1952 insects, and this may well have been their source. This is four years earlier than the report of plants being sent from Tresco Abbey Gardens to Paignton (presumably the botanical gardens, where insects have been known for a very long time) in 1907 (Uvarov, 1944). The Botanical gardens are some 1500m from where Rivers found the insects, and experience in other locations shows that colonies are very localised with an extremely slow rate of natural spread (eg. Truro around Treseder's nursery: 400m from the 1920s to date; Port Isaac: 200m from 1983 to date; Falmouth main colony: 300m from mid-1970s to date). The possibility exists, as found at other locations, that there may well have been more than one introduction here.

TORQUAY (SX9063, SX9064, SX9164): No new reports, but no reason to doubt *A. p. geisovii* is still present here. The last Palm House area (SX9063) record was in 1985. Colin Bath received a report in the late 1980s from km square SX9164. The last Torbay Mill record (SX9064) was in 1947.

**(c) Eire**

BAY OF KENMARE, COUNTY KERRY: No new reports, but no reason to doubt *A. p. inermis* is still widespread here. Records include: Claddanure in 1994 (Lee, 1995), the Island of Rosdohan, Viscount Mersey's Estate opposite the island, and nearby Kilmakillage Harbour; the latter three have been known since the 1960s, but the insects were likely there much earlier, arriving on Treseder's plants.

**(d) Other stick insect reports**

BANFF, SCOTLAND: A single insect was seen on a montbretia plant in September 1996. This was undoubtedly a discarded *Carausius morosus*.

DARTFORD, KENT: Rivers (1953) noted the keeping outdoors of the *A. p. geisovii* collected from Paignton. Claude Rivers informed me that, following advice by Herbert Whitley at Paignton Zoo, they were kept outdoors on cypress. They undoubtedly laid many eggs outdoors, but there is no evidence that any of these survived, nor, with the heavy frosts expected at this location, was it likely that they would. I merely note this location in Shepherds Lane, Dartford for the record.

HILLINGDON, NORTH LONDON: McNamara (1996) reported a single adult female *Bacillus rossius* found in July 1994 resulting from a deliberate release in 1986. McNamara rules out releases subsequent to 1986, and concludes the insects have survived outdoors for eight years. Other reports of this species surviving outdoors are from St Mawes (Lee, 1995) and Plympton (Lee, 1995; Jope, 1996).

PORTHCAWL, SOUTH WALES: A single insect found in a garden about 1967. This was undoubtedly a discarded *Carausius morosus*.

STRATFORD-UPON-AVON, WARWICKSHIRE: The distribution map in Haes & Harding (1997) shows a stick insect record for Warwickshire. Chris Haes advises that *Carausius morosus* are well established under glass at a butterfly farm near Stratford-upon-Avon, having been present for some years.

**Acknowledgements**

I would like to thank Chris Haes, Stella Turk, Colin Bath, and Paul Brock for their assistance in my survey work, and to thank Leon Truscott for providing the tetrad distribution maps.

The new information from Claude Rivers was greatly appreciated, particularly the 1953 correspondence giving a fresh light on the Paignton story. On a sad note, I have to record the death in December 1996 of Neil Treseder, whose family nursery is inextricably linked with the British stick insect story. His ready assistance and first hand information was invaluable, confirming the earliest commercial importations of New Zealand flora to Britain, the supply of New Zealand plants to Viscount Mersey in the Bay of Kenmare, Ireland, and the presence of *A. p. inermis* in Truro back to the 1920s.

## References

- Brock, P.D. (1991) *Stick insects of Britain, Europe and the Mediterranean*. Fitzgerald Publishing. London.
- Haes, E.C.M. & Harding, P.T. (1997) *Atlas of grasshoppers, crickets & allied insects in Britain and Ireland*. HMSO. London.
- Joep, M. (1996) A discarded? colony of *Bacillus rossius* in Plymouth. *Phasmid Study Group Newsletter*, 66:11.
- Kirby, W.F. (1910) An undetermined species of stick-insect found in Devonshire. *Zoologist*, (4)14: 197-198.
- Lee, M. (1993) A survey of the distribution of the unarmed stick insect *Acanthoxyla inermis* in Port Gaverne and Port Isaac, North Cornwall in 1992. *Phasmid Studies*, 2(1): 25-32.
- Lee, M. (1995) A survey into the distribution of the stick insects of Britain. *Phasmid Studies*, 4(1): 15-23.
- McNamara, D. (1996) A note on *Bacillus rossius*, the Corsican stick insect. *Bulletin of the Amateur Entomologists' Society*, 55(404): 31-32.
- Rivers, C.F. (1953) A New Zealand stick insect in South Devon. *Bulletin of the Amateur Entomologists' Society*, 12: 92-94.
- Uvarov, B.P. (1944) A New Zealand phasmid (Orthoptera) established in the British Isles. *Proceedings of the Royal Entomological Society of London*, (B)13: 94-96.
- West Briton Newspaper (1969) Article: "That stick insect; no threat to gardens" 9/10/69.
- Western Morning News (1985) Article: "Campaign to save vanishing Paignton stick insect" 31/8/85.

# The description of a new genus for a Jamaican stick-insect

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## Abstract

The holotype female of *Diapherodes (Cranidium) pumilio* Westwood, 1843 has been traced in the Bristol Museum and Art Gallery collection (not in the Natural History Museum, London as reported by Kirby (1904)). This species is transferred to a new genus *Paracranidium*, reflecting its affinity with *Cranidium* Westwood, 1843, and designated type species of the new genus. A key is provided to distinguish these genera, which belong to the family Phasmatidae, subfamily Bacteriinae.

## Key words

Phasmida, *Paracranidium* new genus.

## Introduction

During a visit to Bristol Museum and Art Gallery (BMAG) in February 1998, I examined a female of *Diapherodes (Cranidium) pumilio* Westwood, 1843 which appeared to exactly match Westwood's figure and description, although it had no identification or data label, and the type was listed by Kirby (1904) as being present in the Natural History Museum, London (BMNH). Following my initial research in the literature, where Westwood's original description referred to "Bristol", and a check of my photographic records of non-type material, including the BMNH specimen referred to by Kirby, enquiries were made at the BMNH, to check the origin of certain data labels pinned beneath the specimen. J.C. Bradley (senior author of a major taxonomic work of phasmids: Bradley & Galil (1977)) had written to Bristol Museum in 1971, enquiring whether they had any type material of *pumilio*. In the absence of a specimen label in that name, it is understandable why the museum informed Bradley that the specimen must have been lost.

On 13 February 1998, Judith Marshall (BMNH) replied to my letter: "I have examined our specimen of *Diapherodes (Cranidium) pumilio* Westwood, and agree it is not the holotype although Kirby clearly thought it was. I cannot trace a source for the '240' label, but the specimen does have a standard registration label: a small round label bearing '47-62' on one side, and 'Jamaica' on the other.

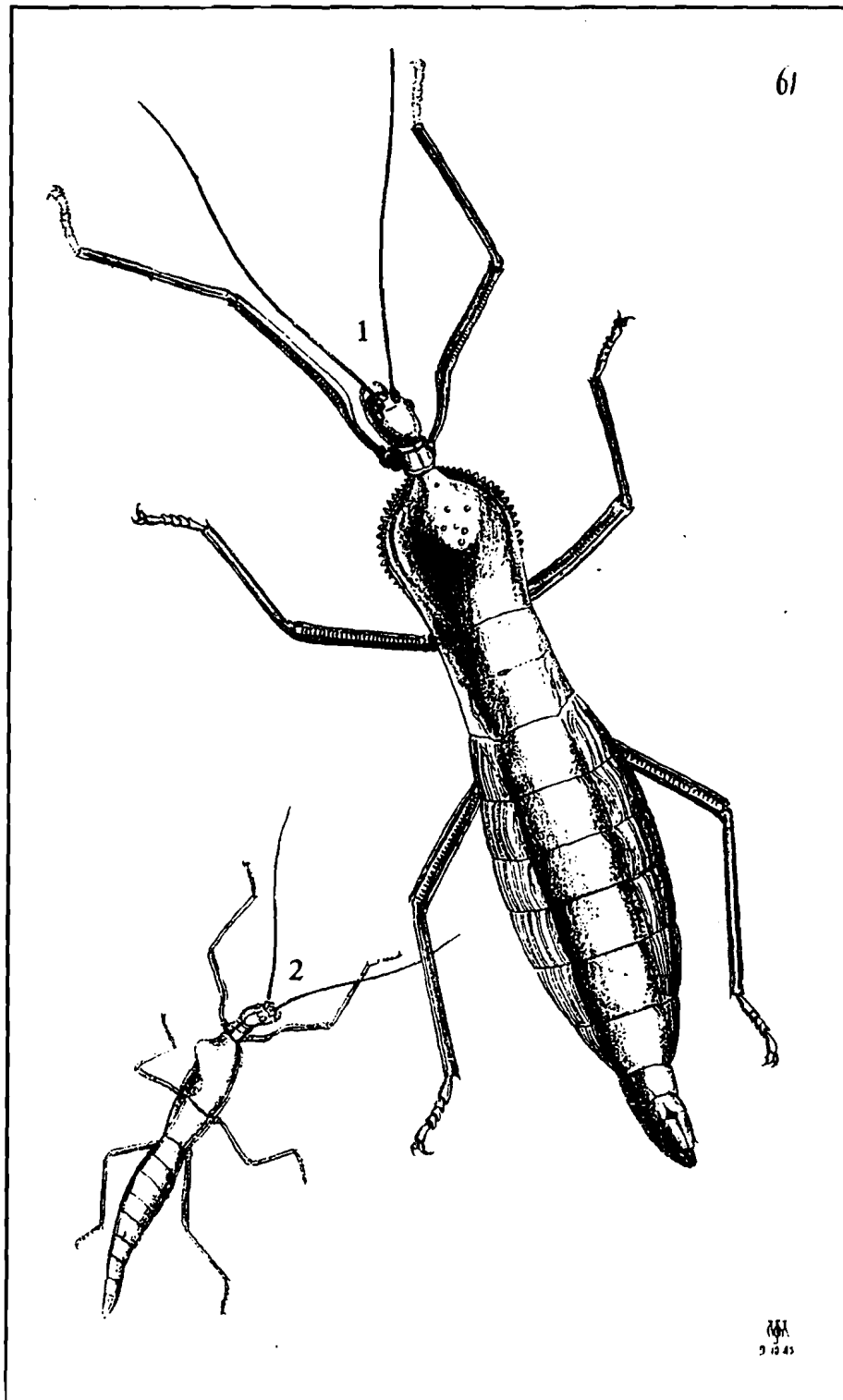
The Registration information for 1847-62 includes 26 Orthoptera, 'Purchased of Mr Gosse'. Other entries indicate that this is a Mr P.H. Gosse.

In one of our copies of Westwood, 1859: 80, following the entry for 4 (208) *Monandroptera Pumilio*, is the pencilled note 'Jamaica (certe) P.H. Gosse. B.M.' where 'certe' means 'certain'. The writing is by the same hand as that in the register, and on the other labels on the specimen quoting the Westwood 1843 reference etc."

I was later able to re-examine the BMNH insect in person and, having previously checked all known material of *pumilio* from the Academy of Natural Sciences, Philadelphia (ANSP), noted that they significantly differ from the only representative of the genus *Cranidium* Westwood, 1843 (see key below), hence I have taken this opportunity to transfer *pumilio* to a new genus. The new genus belongs in the family Phasmatidae, subfamily Bacteriinae, tribe Cranidiini (= Craspedoniini of Bradley & Galil (1977)).

## Key to the tribe Cranidiini

1. Females up to approximately 140mm. Head rounded, mesonotum very rounded and spiny laterally; abdomen very broadened, operculum extending well beyond end of anal segment. Distribution: Brazil and French Guiana (Fig. 1) . . . . . *Cranidium*
- Females 50-54mm. Head rectangular, mesonotum with semicircularly elevated central carina, granulated but not spined; abdomen triangular in cross section, not broadened, operculum just extending beyond end of anal segment. Distribution: Jamaica. (Fig. 2).  
. . . . . *Paracranidium* New genus



**Figures 1 & 2.** (Life-size reproduction of Westwood, 1843, plate 61)

1. Female *Paracranidium pumilio* (Westwood).
2. Female *Cranidium gibbosum* (Burmeister).

The genera *Cranidium* Westwood, 1843 and *Craspedonia* Westwood, 1841 have caused confusion in the literature, following Bradley & Galil's (1977: 187) incorrect conclusions, which included changing the tribe Cranidiini to Craspedoniini. The correct details are recorded below:

*Cranidium* Westwood, 1843: 49. Type species: *Diapherodes (Cranidium) serricollis* Westwood, 1843: designated by Bradley & Galil, 1977: 187. The type species is a synonym of *Cranidium gibbosum* (Burmeister, 1838).

*Craspedonia* Westwood, 1841: 25. Type species: *Diapherodes (Craspedonia) undulata* Westwood, 1843 [= *Monandropoda undulata* (Westwood, 1843)], by monotypy. The specimen was originally misidentified as *Phasma (Craspedonia) gibbosa* Burmeister. *Craspedonia* became a synonym of *Monandropoda* Audinet-Serville, 1838 when Westwood (1859: 80) placed *undulata* in the genus *Monandropoda*.

It is also appropriate to mention Carrera (1960) who erected a replacement genus, *Phasmilliger*, for *Cranidium* Westwood, 1843. The replacement name was unnecessary, because *Cranidium* was valid; Westwood was entitled to use it as an available name, because Burmeister (1838) had only used *Cranidium* as a synonym of *Diapherodes* (quoting a manuscript name of Illiger).

#### *Paracranidium* New genus

Type species: *Diapherodes (Cranidium) pumilio* Westwood, 1843: 50, pl. 61: 2, here designated.

This genus is represented by a single, small species (50-54mm). Body broad, moderately long, wingless species known only from the female, with a very conspicuous shape, unique in the Phasmida. Although the holotype has brown patches, exactly in accordance with Westwood's plate, in nature it is likely that the insect would be almost entirely green.

Head: Longer than wide, granulated. Antennae slightly longer than fore legs. Eyes small, ocelli absent.

Thorax: Pronotum elongate, but much shorter than head, hind part of segment raised in centre; whole of segment with conspicuous central brown carina, with many large granulations thereon, extending to first half of mesonotum. Mesonotum over 4 times to almost 5 times the length of pronotum, aptly described by Westwood as "almost semicircularly elevated carina..."; rounded at front of segment, broadened in hind part, which is 2-2.7 times wider than front of segment. When viewed ventrally, the expansion takes the form of a triangular cross-section, with height 6.4mm to almost 7mm (compared with 4mm at hind part of segment). Second part of segment with gentler slope. Uneven granulations present centrally, on brown carina as described above, also present on thorax laterally and ventrally. Metanotum much shorter than mesonotum, suture between metanotum and median segment (first abdominal segment) absent.

Abdomen: Triangular in cross-section. Segments 8-10 tapering to apex, anal segment slightly rounded at apex, supraanal plate very small, triangular. Operculum slender, tapering to pointed tip, slightly exceeding end of anal segment. Cerci of moderate length, slender, tapering towards tip.

Legs: Long and slender, fore femora strongly curved basally.

#### *Paracranidium pumilio* (Westwood, 1843) New combination (Fig. 2).

*Diapherodes (Cranidium) pumilio* Westwood, 1843: 50, pl. 61: 2.

*Monandropoda pumilio* (Westwood); Westwood, 1859: 80.

*Cranidium* (?) *pumilio* (Westwood); Kirby, 1904: 361.

#### Material examined and notes

Holotype ♀, No locality "Africa tropicali?" (BMAG). "In Mus. Bristol Philos. Institution" [whose collection was merged with Bristol Museum].

- ♀, Jamaica (BMNH). A standard "holotype" label was present, in error. Data labels include "240" (source not traced) and "47-62" relating to registration information for 1847-62, hence specimen leg. P.H. Gosse.
- ♀, Jamaica, Newton, 3000ft. (ANSP).
- ♀, Jamaica, Cinchona, 5000ft. (ANSP).

Westwood's brief description of this species referring to a measurement of "unc. 2" [unc. = inch (1 inch = 2.54cm)] was followed up in 1859 by the same author, with more detailed measurements. Kirby (1904) is the first literature reference to "Jamaica"; the specimen in BMNH clarifies why Kirby referred to the locality in his catalogue.

## Discussion

Although Kirby clearly believed that the holotype of *pumilio* was present in the BMNH, the specimen is from Jamaica (compared with Westwood's "unknown locality", which he speculated was in tropical Africa), and was lodged in the BMNH in 1847, four years after Westwood's description was published. The colours of the specimen in BMAG (which differ from other known material), perfectly matches Westwood's hand-coloured plate. Furthermore, it agrees with measurements given by Westwood (1859), who did not mention either a locality or the presence of a specimen in BMNH, resulting in a confident assessment that this is the "lost" holotype. It is the only phasmid type specimen presently in BMAG. The collection in BMAG otherwise houses a selection of mainly fairly common phasmids in seven cabinet drawers, some specimens collected around the 1920s, from various countries. Very little research has been made on the collection, although I identified some material in 1998.

## Acknowledgements

I would like to particularly thank Ms Sam Hallett and Mr Ray Barnett (BMAG) for their valuable assistance, and to Mrs Judith Marshall (BMNH) for her prompt comments clarifying the position with the Jamaican *pumilio* specimen. She also remarked on the incorrect treatment of *Craspedonia* by Bradley & Galil, identified several years ago. Dr Daniel Otte (ANSP) kindly allowed access to the collection. and Phil Bragg (Ilkeston, Derbyshire) gave constructive comments on the manuscript.

## References

- Audinet-Serville, J.G. (1838) *Histoire Naturelle des Insectes*. Librairie Encyclopédique de Roret, Paris.
- Bradley, J.C. & Galil, B.S. (1977) The taxonomic arrangement of the Phasmatodea with keys to the subfamilies and tribes. *Proceedings of the Entomological Society of Washington*, **79**: 176-208.
- Carrera, M. (1960) Insecta Amapaensia. *Diapherodes gibbosa* Burmeister, 1839, tipo de um novo genero de Phasmida. *Papéis avulsos do Departamento de Zoologia, Secretaria da Agricultura, São Paulo*, **14**(12): 99-104.
- Kirby, W.F. (1904) *A Synonymic Catalogue of Orthoptera*. Volume 1, *Orthoptera, Euplexoptera, Cursoria, et Grescoria (Forficulidae, Hemimeridae, Blattidae, Mantidae, Phasmidae)*. Longmans & Co., London.
- Westwood, J.O. (1841) *Arcana Entomologica; or Illustrations of new, rare, and interesting Insects*. Volume 1. William Smith, London.
- Westwood, J.O. (1843) *Arcana Entomologica; or Illustrations of new, rare, and interesting Insects*. Volume 2. William Smith, London.
- Westwood, J.O. (1859) *Catalogue of Orthopterous Insects in the Collection of the British Museum. Part 1, Phasmidae*. London.

# Reviews and Abstracts.

## Computer software

**Bragg, P.E.** (1998) *The Phasmid Database - version 1.6*. P.E. Bragg, Ilkeston. ISBN 0 9531195 2 1. Price £10.00. Available from P.E. Bragg, 8 The Lane, Awsworth Nottinghamshire, NG16 2QP, U.K.

The disk contains three database files, and some associated files. The database files deal with families, genera, and species. The family and subfamily names are contained in the families database. The genera database contains generic names, author, date, bibliographic details and type species for all described genera. The species file contains the name, author, bibliographic details and type locality for all described species, and most subspecies. There are separate fields for: genus, subgenus, species, subspecies, author, date, publication and locality.

*The Phasmid Database* has been compiled in Dbase3 and it should be possible to import the data into any IBM-compatible database system. *The Phasmid Database version 1.6* occupies approximately 1MB.

## 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, i.e. *Phasma*, only the longer papers are summarised. Abstracts of articles in the *Phasmid Study Group Newsletter* are not included.

**Berni, S.** (1997) Alcune osservazione di etologia e biogeografia relative all'insetto stecco *Bacillus grandii grandii* (Insecta: Phasmatodea) dell'area iblea. *Grifone*, 6(30): 4-5. [in Italian].

Observations on *Bacillus grandii grandii*.

**Berni, S.** (1998) Viaggio negli Iblei in cerca di insetti stecco. *Il Corriere degli Iblei*, 5(1): 5; 5(2): 5; 5(3): (in press). [in Italian].

An account of visits to Sicily to collect stick insects. The article is published in five parts.

**Bradley, J.T. & Estridge, B.H.** (1997) Vitellogenin uptake and vitellin localization in insect follicles examined using monoclonal antibodies and confocal scanning microscopy. *Invertebrate Reproduction and Development*, 32(3): 245-257.

Confocal scanning immunofluorescent microscopy and monoclonal antibodies were used to examine the route of uptake of vitellogenin (VG) by vitellogenic follicles and the ooplasmic localization of vitellin (VN) in the cricket, *Acheta domesticus*, and the stick insect, *Carausius morosus*. Uptake and cytoplasmic regionalization of a non-vitellogenic sulphated protein, sp 157/85, by *C. morosus* oocytes were also examined. By indirect immunofluorescence VG in both species and sp 157/85 were visualized in spaces between follicle cells and in



peripheral yolk spheres. One cricket VG polypeptide had a regionalized distribution in the follicular epithelium, and VN polypeptides in both species and sp 157/85 in *C. morosus* had regionalized distributions within the ooplasm. Localization of sp 157/85 to the anterior pole of the oocyte appeared to be stage-specific.

**Bragg, P.E.** (1998) A revision of the Heteropteryginae (Insecta: Phasmida: Bacillidae) of Borneo, with the description of a new genus and ten new species. *Zoologische Verhandelingen*, **316**: 1-135.

The three tribes of Heteropteryginae Kirby, 1896 occurring in Borneo are nocturnal, and ground dwelling species, easily found in both primary and secondary rainforest. The subfamily is reviewed, with keys and redescriptions of all Bornean species; one new species of a predominantly Bornean genus is described from the Philippines. Lectotypes have been selected for a number of species. The eggs of 17 species are described and illustrated. Distribution maps are given for all species. Many of the species have been collected by the author and reared in the UK; some observations on their natural history and behaviour are included.

In the tribe Heteropterygini the synonymy has been re-examined with a revision to the status of several taxa. The five syntypes of *Haaniella grayii* (Westwood) were found to belong to two different species.

In the tribe Datamini new terms are introduced for the spines and tubercles. A new genus, *Spinodares*, is described with *S. jenningsi* spec. nov. as the type species. All recorded Bornean specimens of *Dares* Stål, 1875 have been re-examined and the synonymy revised. Seven new species of *Dares* are described, six from Borneo: *D. kinabaluensis*, *D. mjobergi*, *D. multispinosus*, *D. murudensis*, *D. navangensis*, *D. planissimus*, and one from Palawan: *D. philippinensis*; this is the only record of the tribe Datamini from the Philippines. *Acanthoderus otys* Westwood, 1859 has previously been placed in the genus *Dares* Stål, 1875, it is found to belong in *Datames* Stål, 1875 with *Pylaemenes infans* Redtenbacher, 1906 as a new junior synonym; the female is described for the first time from a specimen in the Nationaal Natuurhistorische Museum, Leiden (RMNH). Two new species of *Datames* are described, one with three subspecies: *D. borneeensis borneensis*, *D. b. sepilokensis* and *D. b. waterstradti*, *D. muluensis*. Of the twelve new taxa described eight are represented in the RMNH collection.

**Büschges, A.** (1998) Inhibitory synaptic drive patterns motoneuronal activity in rhythmic preparations of isolated thoracic ganglia in the stick insect. *Brain Research*, **783**(2): 262-271.

During active leg movements of an insect leg, the activity of the motoneuron pools of each individual leg joint is generated by the interaction between signals from central rhythm generating sources, peripheral signals as well as coordinating signals from other leg joints and legs. The nature of the synaptic drive from the central rhythm generators onto the motoneuron pools of the individual leg joints during rhythmic motor activity of the stick insect (*Carausius morosus*) middle leg has been investigated. In the isolated mesothoracic ganglion central rhythm generators were activated pharmacologically by topical application of the muscarinic agonist pilocarpine. Motoneurons supplying the femur-tibia (FT) joint were investigated in detail. Recordings from neuropil processes of these motoneurons revealed that patterning of their rhythmic activity is based on cyclic hyperpolarizing synaptic inputs. These inputs are in clear antiphase for extensor and flexor motoneurons. DCC (discontinuous current clamp) and dSEVC (discontinuous single electrode voltage clamp) recordings showed reversal potentials of the inhibitory inputs between -80 to -85mV (FETi, N = 7; Flex MN, N = 3). After intracellular injection of TEA rhythmic inhibition in FETi was decreased by about 84% (N = 4). Both findings indicate that the cyclic inhibition is mediated by potassium ions. Thus, it appears that central rhythm generators pattern motor activity in

antagonistic tibia) motoneuron pools by cyclic alternating inhibition.

**Chen, S. & He Y.** (1997) A new genus and new species of Heteronemiidae from Guangxi, China (Phasmatoidea: Heteronemiidae). *Acta Entomologica Sinica*, **40**(3): 297-299. [In Chinese].

In the present paper, a new genus and a new species (*Paragongylopus sinensis* sp. nov.) of Heteronemiidae are described. The type specimens are kept in the Insect Collection of China Agricultural University. All measurements in descriptions are in mm.

**Chen, S. & He, Y.** (1997) A new species of *Prosentoria* from Yunnan (Phasmatoidea: Phasmatidae). *Acta Entomologica Sinica*, **40**(2): 183-184. [In Chinese].

In this paper, a new species of *Prosentoria* (*P. bannaensis* sp. nov.) from Yunnan Province is described. The type specimen is deposited in the Institute of Zoology, Academia Sinica.

**Clare, R.** (1998) Insects own moth-balls. *Chemistry in Britain*, **34**(1): 19.

A magazine article commenting on the discovery (see abstract of Eisner *et al.* below) that the phasmid *Oreophoetes peruana* produces quinoline as a defensive chemical; the article includes a colour photograph of a mating pair.

**D'Hulster, K.** (1998) PSG 19: *Lonchodes brevipes* - Gray 1835. *Phasma*, **8**(29): 14-18.

An illustrated account of rearing *Lonchodes brevipes* Gray; with illustrations of male, female and egg.

**Eisner, T., Morgan, R.C., Attygalle, A.B., Smedley, S.R., Herath, K.B. & Meinwald, J.** (1997) Defensive production of quinoline by a phasmid insect (*Oreophoetes peruana*). *Journal of Experimental Biology*, **200**: 2493-2500.

Adults and nymphs of the Peruvian stick insect *Oreophoetes peruana* have a pair of thoracic glands from which they discharge a malodorous fluid when disturbed. The secretion contains a single volatile component, quinoline. Quinoline has not been reported previously from an animal source. The compound proved repellent or topically irritant in assays with ants, spiders, cockroaches and frogs. *Oreophoetes peruana* nymphs, at moulting, do not extricate the shed cuticular lining of the glands, thereby managing not to lose their secretory supply when they cast their skin. They are able, as a consequence, to discharge secretion even while still teneral after moulting.

**Frantsevich, L.I., Mokrushov, P.A., Shumakova, I.D. & Gladun, D.V.** (1995) Kinematics of insects walking on narrow ground. *Vestnik Zoologii*, 1995, No. 4: 41-48. [In Russian].

The kinematics of walking on a plane and on a narrow ground (stems etc.) was compared in two bug (*Graphosoma italicum* Mull., *Coreus marginatus* L.) and two beetle species (*Leptinotarsa decemlineata* Say, *Coccinella septempunctatum* L.) and a stick insect (*Carausius morosus* L. [sic]). Insect movements were videorecorded and photographed. The position of the distal end of the tibia in the body-fixed coordinate system was measured on recordings. The values of joint angles were reconstructed with the aid of a 3D kinematic model of insect's legs. The adjustment of the posture to the narrow ground was achieved by the depression of femora and flexion of tibiae. The first element is stronger expressed in bugs than in beetles, because the former increases the body distance to the substrate on the narrow ground while the beetles maintain it as if on the plane. Beetles control the distance to the ground touching the substrate with maxillar palps at each step. Sometimes, the

doubling of the tibia flexion-extension and femur depression-elevation frequency was pointed out within the single coxa retraction-protraction cycle. This phenomenon is especially well expressed in stick insect walking on the narrow ground with the reduced distance to the ground: the tibial excursions amplitude reaches 60°. It is not yet known whether the biphasic change of joint angle within the step cycle was caused by the active contraction of the relevant muscles with double frequency or the leg was passively flexed, being coupled mechanically with other legs in the stance phase via the common substrate.

**Giorgi, F., Cecchetti, A., Locci, M.T., Masetti, M. & Peccatori, M. (1997)** Native vitellins are modified during ovarian development in the stick insect *Carausius morosus* (Br.). *Archives of Insect Biochemistry and Physiology*, **36**(4): 335-348.

Vitellins from ovarian follicles and newly laid eggs of the stick insect *Carausius morosus* were examined by ion exchange chromatography on a HPLC Mono Q column. Under these conditions, vitellins from newly laid eggs resolved as two distinct peaks, referred to as VtA and VtB, that eluted at 8.5 and 12.0 min, respectively. On native gels, both VtA and VtB separated into two different variant forms (VtA' and VtA'', VtB' and VtB''). By two-dimensional gel electrophoresis, VtA' and VtA'' were shown to contain polypeptides A-1, A-2 and A-3. On the other hand, VtB' and VtB'' appeared to comprise polypeptides B-1 and B-2 and B-1, A-1, A-2, B-2 and A-3\*, respectively. A similar Vt polypeptide composition was also observed by size-exclusion chromatography of vitellins from newly laid eggs. Vitellins from early vitellogenic ovarian follicles resolved into a single chromatographic peak at 7.5 min that coeluted with a major peak from the haemolymph of egg-laying females. Ovarian follicles progressively more advanced in development exhibited a more complex chromatographic profile, consisting of three separate peaks. By two-dimensional gel immunoelectrophoresis, vitellins from ovarian follicles appeared to consist of two closely related, immunologically cross-reacting antigens that gradually shifted apart as ovarian development proceeded to completion. By size-exclusion chromatography, each Vt from ovarian follicles was shown to consist of a unique set of polypeptides different from those listed above. Single ovarian follicles were fractionated into yolk granules and yolk fluid ooplasm and tested by immunoblotting against Mab 12. Under these conditions, VtA variant forms in yolk granules and yolk fluid ooplasm reacted differently. Sections from ovarian follicles in different developmental stages were exposed to Mab 12 and stained with a peroxidase-conjugated, goat anti-mouse antibody. Regardless of the developmental stage attained, staining for peroxidase was restricted to free yolk granules, suggesting that native vitellins in stick insects are structurally modified upon fusion into the yolk fluid ooplasm.

**Hess, D. & Büschges, A. (1997)** Sensorimotor pathways involved in interjoint reflex action of an insect leg. *Journal of Neurobiology*, **33**(7): 891-913.

Coordination of motor output between leg joints is crucial for the generation of posture and active movements in multijointed appendages of legged organisms. We investigated in the stick insect the information flow between the middle leg femoral chordotonal organ (fCO), which measures position and movement in the femur-tibia (FT) joint and the motoneuron pools supplying the next proximal leg joint, the coxa-trochanteral (CT) joint. In the inactive animal, elongation of the fCO (by flexing the FT joint) induced a depolarization in eight of nine levator trochanteris motoneurons, with a suprathreshold activation of one to three motoneurons. Motoneurons of the depressor trochanteris muscle were inhibited by fCO elongation. Relaxation signals, i.e. extension of the FT joint, activated both levator and depressor motoneurons; i.e. both antagonistic muscles were coactivated. Monosynaptic as well as polysynaptic pathways contribute to interjoint reflex actions in the stick insect leg.

fCO afferents were found to induce short latency EPSPs in levator motoneurons, providing evidence for direct connections between fCO afferents and levator motoneurons. In addition, neuronal pathways via intercalated interneurons were identified that transmit sensory information from the fCO onto levator and/or depressor motoneurons. Finally, we describe two kinds of alterations in interjoint reflex action: (a) With repetitive sensory stimulation, this interjoint reflex action shows a habituation-like decrease in strength. (b) In the actively moving animal, interjoint reflex action in response to fCO elongation, mimicking joint flexion, qualitatively remained the same sign, but with a marked increase in strength, indicating an increased influence of sensory signals from the FT joint onto the adjacent CT joint in the active animal.

**Mantovani, B., Tinti, F., Bachmann, L. & Scali, V. (1997)** The Bag320 satellite DNA family in *Bacillus* stick insects (Phasmatodea): Different rates of molecular evolution of highly repetitive DNA in bisexual and parthenogenetic taxa. *Molecular Biology and Evolution*, 14(12): 1197-1205.

The Bag320 satellite DNA (satDNA) family was studied in seven populations of the stick insects *Bacillus atticus* (parthenogenetic, unisexual) and *Bacillus grandii* (bisexual). It was characterized as widespread in all zymoraces of *B. atticus* and in all subspecies of *B. grandii*. The copy number of this satellite is higher in the bisexual *B. grandii* (15%-20% of the genome) than in the parthenogenetic *B. atticus* (2%-5% of the genome). The nucleotide sequences of 12 Bag320 clones from *B. atticus* and 17 from *B. grandii* differed at 13 characteristic positions by fixed nucleotide substitutions. Thus, nucleotide sequences from both species cluster conspecifically in phylogenetic dendrograms. The nucleotide sequences derived from *B. grandii grandii* could be clearly discriminated from those of *B. grandii benazzii* and *B. grandii maretimi* on the basis of 25 variable sites, although all taxa come from Sicily. In contrast, the Bag320 sequences from *B. atticus* could not be discriminated accordingly, although they derive from geographically quite distant populations of its three zymoraces (the Italian and Greek *B. atticus atticus*, the Greek and Turkish *B. atticus carius*, and the Cyprian *B. atticus cyprius*). The different rate of evolutionary turnover of the Bag320 satDNA in both species can be related to their different modes of reproduction. This indicates that meiosis and chromosome segregation affect processes in satDNA diversification.

**Nederlof, L. (1997)** *Heteropteryx dilatata* (Parkinson, 1798), over kweken en veel geduld... *Phasma*, 7(27-28): 4-9.

Notes on rearing *Heteropteryx dilatata* (Parkinson, 1798).

**Potvin, W. (1998)** Soortbeschrijving van *Orxines macklottii*. *Phasma*, 8(29): 2-8.

An illustrated account of rearing *Orxines macklottii* (de Haan); illustrations include black-and-white photographs of adults, and drawings of adults and the egg.

**Seow-Choen, F. (1997)** Stick Insects. *Malaysian Naturalist*, 51(2): 32-33.

Some general notes, and colour photographs, of *Phobaeticus serratipes*.

**Tilgner, E.H. & McHugh, J.V. (1997)** *Diapheromera carolina* Scudder (Phasmatodea: Heteronemiidae), First description of the female form and new range records. *Transactions of the American Entomological Society*, 123(3): 191-196.

This paper provides the first description of the female form of *Diapheromera carolina*, comments concerning the taxonomic placement of this species and new locality records expanding the known range to the states of Georgia and South Carolina.

**Vickery, V.R.** (1997) Two new species in the genus *Diapheromera* (Phasmatoptera: Necroscoioidea: Heteronemiidae: Heteronemiinae) from Baja California, Mexico. *Canadian Entomologist*, **129**(6): 1141-1149.

Two new species of *Diapheromera*, *D. kevani* and *D. petita*, are described from Mexico, the first record of these species and of the genus from Baja California. They were found while studying the stick insects (Phasmatoptera) of the Baja California Peninsula.

**Vickery, V.R. & Sandoval, C.P.** (1997) *Timema bartmani* (Phasmatoptera: Timematodea: Timematidae), A new species from Southern California. *Canadian Entomologist*, **129**(5): 933-936.

*Timema bartmani* sp.nov, is described from San Bernardino County, California. Both sexes are known. Males show relationship with *Timema podura* Strohecker. Females closely resemble *Timema tahoe* Vickery. *Timema bartmani* may be the sexual ancestor of the parthenogenetic *T. tahoe*.

**Zompro, O.** (1997) Über einige Phasmiden aus der Entomologischen Sammlung des Zoologischen Museums Hamburg. *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg*, **12**(156): 177-181.

Records of some phasmids in the collection of the Zoologisches Museum Hamburg are published; the male of *Anisomorpha lurida* Redtenbacher, 1906 is described. The abdominal ends of *A. lurida* male and female, and the egg of *Pterinoxylus difformipes* Serville, 1839 [sic] are figured.

**Zompro, O.** (1997) Beschreibung der Eier einiger Phasmatodea. *Arthropoda*, **5**(4): 1-3.

Eggs of eight species of the insect order Phasmatodea are described and figured for the first time. The species are: *Batycharax granulatus* Kirby, 1896, *Graeffea doederleini* Günther, 1929, *Hermachus muelleri* Redtenbacher, 1908, *H. oreithrepes* Günther, 1929, *Neopromachus gracilis* Günther, 1929, *N. vepres vepres* (Brunner, 1907), *Phasmataenionema australe* Günther, 1933, *Theramenes olivaceus* (Westwood, 1859).

**Zompro, O.** (1997) Bemerkungen über das Kopulationsverhalten von *Anisomorpha monstrosa* Hebard, 1932 (Phasmatodea). *Arthropoda*, **5**(4): 3.

A brief note on *Anisomorpha monstrosa*.

**Zompro, O.** (1997) Neue Nachweise mediterraner Bacilliden (Phasmatodea). *Arthropoda*, **5**(4): 10-12.

New data on the distribution of stick-insects (Phasmatodea: Bacillidae) in the mediterranean area are published. The species *Clonopsis gallica* (Charpentier, 1825) is new for Menorca. A male of *Bacillus rossius* (Rossi, 1788) produced a strange odour when disturbed. An unidentified species of *Clonopsis* is recorded from an altitude of 1000m from Morocco.

**Zompro, O.** (1998) Eine neue *Gratidia*-Art vom Mt. Elgon, Kenia (Phasmatodea). *Entomologische Zeitschrift*, **108**(1): 42-44.

A new species of the phasmatodean genus *Gratidia* Stål from Mt. Elgon, Kenya, is described and figured: *Gratidia parva* n.sp.

**Zompro, O.** (1998) Eine verkannte *Planispectrum*-Art aus Zentral-Borneo (Phasmatodea). *Entomologische Zeitschrift*, **108**(2): 83-84.

A new species of the phasmatodean genus *Planispectrum* Rehn & Rehn, 1938 (= *Platymorpha* Redtenbacher, 1906, nec Jacoby, 1888) is described from Central Borneo. The new species (*P. bakiensis* n.sp.) differs from *P. cochinchinensis* (Redtenbacher) in the smaller size and the less prominent lateral spines. Both species differ from *P. bengalensis* (Redtenbacher) in the meso- and metathorax, which is wider than the prothorax and abdomen, but parallel in the latter species.

# Phasmids in the National Museum, Prague, Czech Republic

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## Abstract

An outline of the phasmid collection in the Czech National Museum, Prague.

## Key words

Phasmida, National Museum Prague.

My latest book (in press) includes a section on museum collections, with details on highlights for the phasmid enthusiast and guidance on how to undertake research; it indicates that there are many poorly known collections world-wide. Having visited numerous collections for my own research work, I hope to occasionally publish contributions to improve our knowledge of lesser known phasmid collections, in order to assist future researchers who would otherwise be unaware of the scope of such collections. The National Museum, Prague is a good example of a neglected collection which is not mentioned in my book because I only visited the museum in July 1998; the museum boasts a phasmid collection of moderate size.

Starting with the Národní Muzeum (National Museum) in the centre of Praha (Prague): this spectacular building is a well known landmark in this beautiful city, in an area which attracts numerous tourists. The collection on display to the public includes several large, showy phasmids (some incorrectly identified). It is necessary for the researcher to make an appointment to view the entomology collection not on public display, which is housed in a 17th century chateau at Kunratice, a suburb of Prague. This is easily reached using the efficient public transport service (metro line C to Kačerov, then bus 114 to Kunratice, a total journey of 30-40 minutes from Prague).

The phasmid collection is housed in 63, mainly medium-sized, rather dusty store boxes; there is some pest damage to the specimens. Each store box contains a variable number of specimens, from 1-40 or so, which are mainly unidentified. Where identified the names are often suspect or incorrect but, nevertheless, the material, from various countries, should be of interest to the specialist. It is likely that these specimens were purchased on behalf of the museum by previous curators, possibly in the late 1800's-early 1900's. In particular, phasmids from the following countries are well represented: New Guinea (no further data, probably pre-1900); Madagascar, environs of Rogez; Borneo e.g. leg. Vráz. Other material, in some cases only one or very few specimens, is from (details refer to original data details, although some countries are spelt differently or known by modern names, for example Tonkin = Vietnam): Argentina: Misiones St. Anna, leg. Dr. Cernosviltov; Australia; Brazil: Espirito Santo and Sao Paulo; Ceylon, leg. Schilling; Costa Rica; Kamerun: Victoria; Key Is.: Toeal Is; Malaysia: Gap, leg. Dr. Baum (very faded); Is. Nias; Paraguay, 1893, leg. Dr. P. Jordan; Singapore, leg. Dr. Baum (very faded); Tonkin.

There are many duplicates included, particular of Madagascan material. I was unsuccessful in locating type material of three species reported by Paris (1994) as most likely to be in the Prague collection [*Pseudophasma auriculatum*, *Phasma kheili*, *Phasma urazi* - all described by Bolívar (1896); no material was traced from the type locality - Cuenca de río Atalapo, Amazonas]. There are a few possible type specimens from Nord-Borneo, leg. Frühstorfer, and Tonkin: Than-Moi, 2-3000ft., iv-v, via. H. Rolle, Berlin, although there is no indication that these were examined by Brunner von Wattenwyl or Redtenbacher when compiling their monograph (1906-08). However, they cannot be completely ruled out, as Brunner and

Redtenbacher occasionally stated that part of the type series was in "coll. Frühstorfer" [*sic*]. The entomologist Hans Frühstorfer sold material to several museums, mainly in Europe and his familiar labels are present on the specimens, which have the same data as the type series. A comparison with the entry for *Calvisia ferruginea* Redtenbacher, 1908, in Brock's 1998 catalogue of type material in Vienna, for example, indicates that the female in Prague has exactly the same data as syntypes in Vienna and Brussels (Nord-Borneo, leg. Frühstorfer); the Prague collection contains a printed label with the species name, beneath the specimen: could this have originated from Redtenbacher returning identified material to Frühstorfer? Without any evidence to support this, it is not appropriate to regard the Prague specimens as syntypes and therefore, a list of possible type species is not provided here.

To sum up, this collection would be particularly useful for specialists researching the main faunal regions specified above. If the enthusiast times his or her visit carefully, it could also be linked with one of two insect fairs each year; if not, there are plenty of tourist attractions in Prague and other nearby towns.

### Acknowledgements

I would like to thank Dr Svatopluk Bílý and Dr Ivo Kovář from the Entomology department for showing me the collection and commenting on the manuscript. If a researcher wishes to contact the museum please write to the Národní Muzeum, Entomologické odd. PM, Golčova 1 - zámek, 148 00 Praha-Kunratice, Czech Republic.

### References

- Bolívar, I. (1896) [Untitled note on Amazonian Orthoptera]. *Anales de la Sociedad Española de Historia Natural*, 25: 11-18.
- Brock, P.D. (1998) *Catalogue of type specimens of stick- and leaf-insects in the Naturhistorisches Museum Wien (Insecta: Phasmida)*. Kataloge der wissenschaftlichen-Sammlungen des Naturhistorischen Museums in Wien.
- Brock, P.D. (in press) *The Amazing World of Stick and Leaf-Insects*. The Amateur Entomologist 26, The Amateur Entomologists' Society, Orpington.
- Brunner von Wattenwyl, K. & Redtenbacher, J. (1906-08) *Die Insektenfamilie der Phasmiden*. Verlag Engelmann, Leipzig (published in three parts by Redtenbacher 1906 & 1908 and Brunner 1907 - usually bound in a single volume).
- Paris, M. (1994) Catalogue de tipos de Orthopteroides (Insecta) de Ignacio Bolívar, I. Blattaria, Mantodea, Phasmoptera y Orthoptera (Stenopelmatoidea, Rhaphidophoroidea, Tettigoniioidea, Grylloidea, Tetrigoidea). *Eos, Madrid*, 69: 143-264.



## New records of alien stick-insects

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### Abstract

*Bacillus whitei* Nascetti & Bullini from Sicily is reported as an accidental introduction to Britain, feeding on previously unreported food-plants. *Carausius morosus* (Sinéty) from India is listed as an established alien in the Cape Suburbs, South Africa.

### Key words

Phasmida, *Bacillus whitei*, *Carausius morosus*, alien.

### Introduction

Malcolm Lee's excellent update on stick-insects in Britain (1998), has prompted me to report further alien species established in Britain and South Africa.

### The Alien species

It is difficult to decide exactly when an alien species is regarded as established. Lee (1998) refers to a number of records of species, including *Carausius morosus* (Sinéty). Some specimens may survive for just one generation, in which case they cannot be treated as established; however, stocks may become hardy in suitable climates. Although I exercise care when cleaning out phasmids, I must have thrown away eggs or nymph(s) when rearing *Bacillus whitei* Nascetti & Bullini, which I brought back from Canicattini Bagni, Sicily (Italy) in October 1989. In summer 1991, a neighbour returned an adult female to me; apart from isolated instances, it is only in 1998 that I have noticed several specimens in two main locations in my garden (Slough, Berkshire), although another neighbour remarked on specimens seen in his garden in 1997. Having reared other *Bacillus* species from time to time, I carefully examined the eggs and adults to confirm the identification (using Brock, 1991). On 5th May 1999 I found a two legged *B. whitei* which had clearly over-wintered.

In the front garden, *B. whitei* favours *Leptospermum scoparium* (Myrtaceae) and, although the usual food-plant bramble *Rubus fruticosus* (Rosaceae) is available, in the back garden they are well established on *Rhamnus alaternus* (Rhamnaceae). I found third instar nymphs on *Leptospermum* as early as March 1998 (removed from the plant for rearing) which reached adult by May 1998. 70-100mm long adults have been seen in various colour forms ranging from plain green or brown to mottled grey; those on *Rhamnus* are still alive at the time of writing (October, 1998) and are remarkably well camouflaged amongst the foliage. As I have not reared *B. whitei* since 1991, they must have been established in gardens for at least 7 years.

Whilst collecting in the Cape Suburbs in September 1998, I discussed local stick-insects with Hamish Robertson, entomology curator at the South African Museum, Cape Town. He understood that an alien species had been established in the suburbs and occasionally received reports of stick insects from residents. One lady had telephoned him, distressed that pest control people had recently killed all the adults on ivy (often mentioned as a food-plant), but she now had lots of nymphs. This pointed towards a suspect known to many schoolchildren as the Indian or Laboratory Stick-insect, *C. morosus*, but the museum had no specimens to confirm this. However, a search of the literature revealed a sketch of a 'stick-insect' made on 14<sup>th</sup> September 1987 from the 'Cape Flats' resembling *C. morosus* (McMahon & Fraser, 1988). On 13<sup>th</sup> September 1998, when locating my third species of stick-insect in the grounds of our cottage accommodation at Constantia Nek, I was able to prove that it was *C. morosus*: a 78mm long adult female was resting on a wall near flowering plants of various species.

## Conclusion

The record of *B. whitei* is the first note of this species in Britain, or anywhere outside Sicily.

Although not previously reported from South Africa, *C. morosus* is probably very widespread on many food-plants in the Cape Suburbs, both in gardens and in the 'fynbos' areas (characteristic vegetation of the southern and southwestern Cape Province, South Africa). It is likely that the stock originated from specimens being reared by Le Feuvre (1936), who published a useful account of the two native species found in the Cape Suburbs (*Macynia labiata* (Thunberg) and *Phalces longiscaphus* (de Haan)). It is not known whether this was an accidental release or deliberate introduction. *C. morosus* has been found in the wild in various parts of Britain and California, USA (Brock, 1992).

## References



Brock, P. (1991) *Stick Insects of Britain, Europe and the Mediterranean*. Fitzgerald Publishing, London.

Brock, P.D. (1992) *Rearing and Studying Stick and Leaf-Insects*. The Amateur Entomologist Volume 22, The Amateur Entomologists' Society, Feltham.

Le Feuvre, W.P. (1936) The stick insects of the Cape Suburbs. *The Cape Naturalist* 1(3): 80-86.

Lee, M. (1998) An updated survey of the distribution of the stick insects of Britain. *Phasmid Studies*, 7(1): 18-25.

McMahon, L. & Fraser, M. (1988) *A Fynbos Year*. David Philip, Cape Town & Johannesburg.

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# Phasmids of Bangladesh

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Illustrations by Nahreen Farjana Shurobhi

## Abstract

This paper reports the results of phasmid collecting over two years in Bangladesh. Ten species have been collected, many of the records are new for Bangladesh, or new for the particular localities. Notes on foodplants are included, along with a brief guide to the appearance of the adults and eggs.

## Key words

Phasmida, Bangladesh, *Baculum* sp., *Carausius* sp., *Medaura brunneri*, *Lopaphus* sp., *Rhaphophasma spinicornis*, *Rhaphophasma* sp., *Sipyloidea casignatus*, *Sipyloidea meneptolemus*, *Sipyloidea* sp., *Sosibia pholidotus*, *Trachythorax maculicollis*.

## Introduction

In February 1996, I arrived for two years in Bangladesh in order to carry out my National Service in Co-operation. As I was already keen of phasmids, I was intending to take advantage of my sojourn in this country by searching for the local species. After a laborious start, as I was totally inexperienced, and as local people were ignorant about the presence of phasmids (they mistook the photos I was showing to them for grasshoppers, butterflies, dragonflies or cockroaches...) and giving me a lot of fanciful particulars, I found at last my first phasmid by a lucky chance. Later my searches proved to be a little more easier than I was thinking at first; the main difficulty was not to find the phasmids, but the forests!

The data is divided into two sections, each dealing with a particular area of Bangladesh.

## Section One : Chittagong area

### Previous work

To my knowledge, the region of Chittagong, contrary to that of Sylhet in north-east Bangladesh, had never been the object of a study about phasmids. So there was no documentation about the species present in this area. From February 1996 to January 1998, I found nine species there; six apterous and three winged. In order to make up a classification, I gave to these species the name of the country followed by the number corresponding to the order of their discovery.

### Geographical situation

Bangladesh, formerly East-Bengal, is located at the intersection of the Indian subcontinent and the Indo-Chinese Peninsula. The region of Chittagong, where I mainly prospected, forms the western part of the old Arakanese region. It is surrounded by Burma, by the Indian provinces of Tripura and of Mizoram, and is washed by the waters of the Bay of Bengal (See Figure 1). Geographically, it is a part of the Indo-Chinese peninsula. It contrasts with the rest of the country, a vast plain constituting the delta of Ganges and Brahmaputra rivers, by a relief composed of hills rising more and more to the east, the foothills of the Arakanese range.

Until recently all the hills were covered with dense forests; as it was impossible to cultivate rice on terraces because of the sandy soil, there was no need to destroy them. But the overpopulation problem lead to a massive deforestation: Bengalis over-exploiting the forest. Now the Forest Office has promoted reforestation in some few places, but most of the time with acacia which is not indigenous. Only the part situated beside the borders, the Chittagong Hill Tracts, populated with Tibeto-Burmese tribes, has more or less escaped for the moment from the massacre. Unhappily this area is the theatre of a guerrilla war lead by

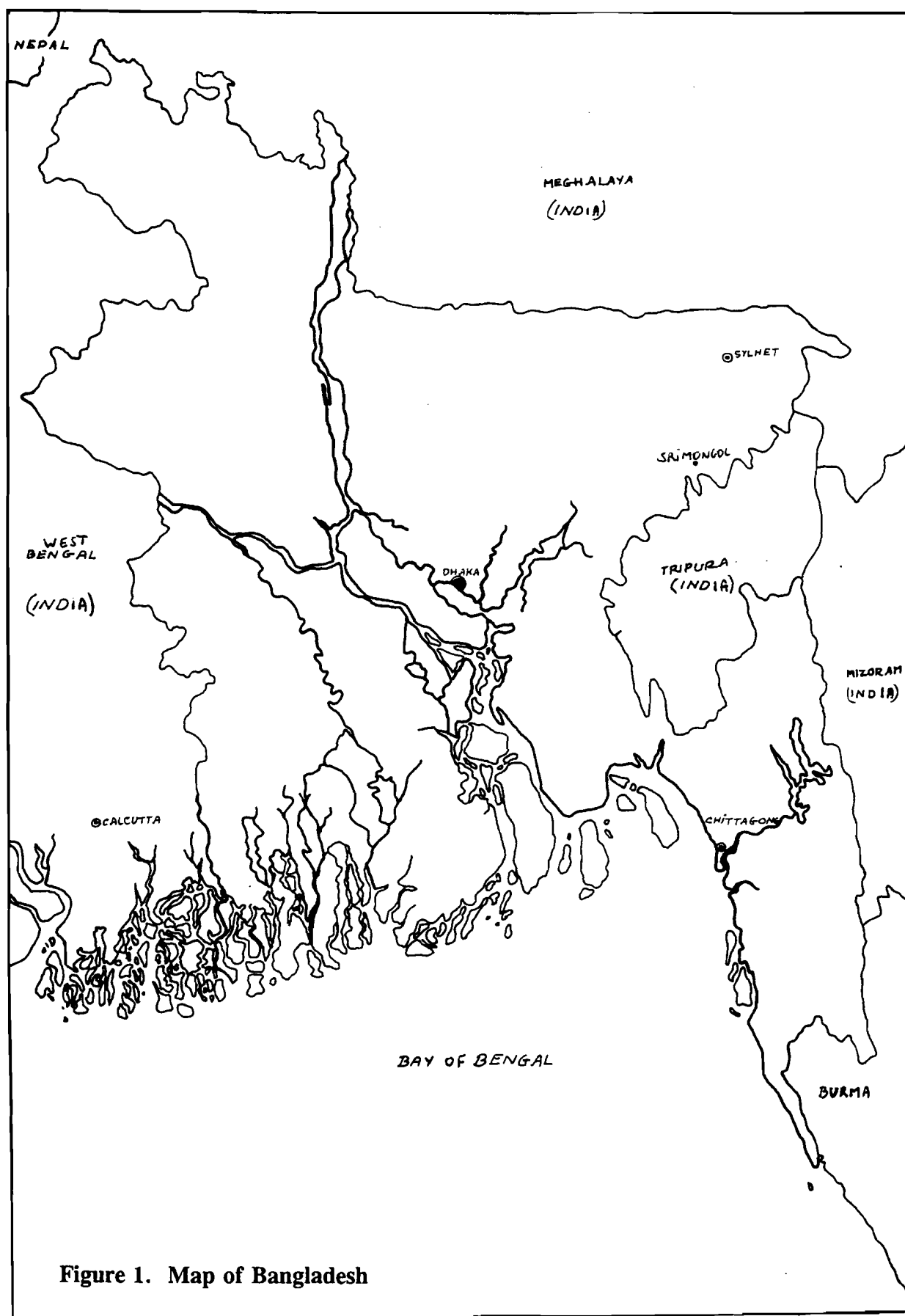
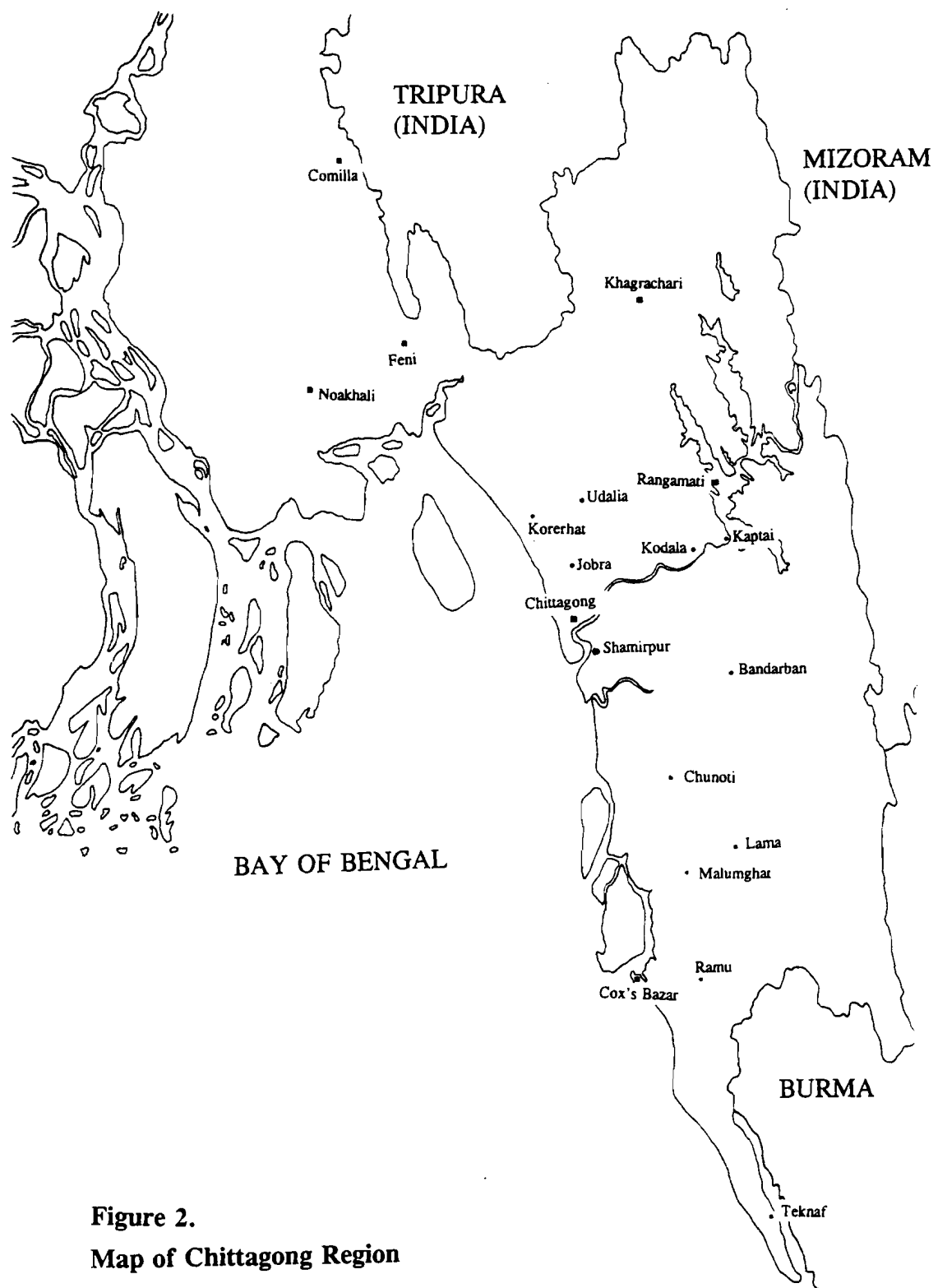


Figure 1. Map of Bangladesh



**Figure 2.**  
**Map of Chittagong Region**

the tribes against the government and is off limits to foreigners (a peace treaty was signed at the end of 1997 and there is a hope of it opening up soon).

The climate is tropical and is divided into three main seasons: winter (October-February) is genial and dry; hot season (March-June) is much more humid; monsoon (June-September) is characterised by very abundant rainfall (the most humid place in the world is situated nearby in Assam). There are about 2500-3000mm of water falling in a year in the area of Chittagong. The humidity remains high all year round and climaxes during the monsoon.

### Collection sites

All the insects I found come from ten localities: Chittagong, Kodala, Jobra, Chunoti, Malumghat, Ramu, Teknaf, Udalia, Shamirpur and Bandarban (see Figure 2). In Chittagong, they were from some small hills in the middle of the town which remained more or less wild; three species have been found there (*Bangladesh 1*, *Bangladesh 3* and *Bangladesh 8*). In Kodala, the site consists of a plantation of teaks which has quite recently succeeded the primary forest; I found four species there (*Bangladesh 2*, *Bangladesh 3*, *Bangladesh 5* and *Bangladesh 6*). In Jobra natural forest has been progressively replaced in the seventies by some new plantations, principally of acacias and eucalyptus; the presence of the university of Chittagong in this place is a little protection against the armies of woodcutters who destroy the little there is still to protect in this country; there, I found five species (*Bangladesh 1*, *Bangladesh 3*, *Bangladesh 4*, *Bangladesh 7* and *Bangladesh 8*). Chunoti is a primary forest very degraded, often invaded by bamboo: five species cohabit there (*Bangladesh 3*, *Bangladesh 4*, *Bangladesh 5*, *Bangladesh 6* and *Bangladesh 9*). Malumghat is also a primary forest, but it has lost its wild aspect; I found two species there with just one example of each (*Bangladesh 1* or *Bangladesh 4* and *Bangladesh 3*). Ramu is a secondary forest with a very thick low vegetation; I found just one phasmid there (*Bangladesh 3*). In Teknaf there is a quite well conserved primary forest (with wild elephants); I met two species there (*Bangladesh 2* and *Bangladesh 3*). Udalia is a tea plantation where I captured a phasmid in the nearby thickets (*Bangladesh 1*). Shamirpur is a village with a lot of trees where I found also just one phasmid (*Bangladesh 1*). Concerning Bandarban (one species: *Bangladesh 2*), I do not know the place of capture as it is situated in the tribal zone which is in trouble: to prospect in this area, I had to employ a Bengali (working in the entomological department of the Forestry Research Institute in Chittagong where there is a beautiful collection of insects, with some specimens of phasmids very poorly conserved) with very mediocre results. All these places are situated on low hills (I estimate no more than 250m) because all the plains are entirely occupied by rice fields.

### Collecting methods

I always collected in the daytime, because it is difficult to move in the countryside at night and impossible to lodge there. The first thing to do is to spot bushes with traces of eating characteristic of phasmids and to scrutinise all over: on or under the leaves, on the stems, in the interlace of bare branches in the heart of the clump, etc. When the host plant is determined and when the habits of diurnal camouflage of the wanted species are known, the search often becomes quite easy. For the winged species, it is much more simple because just by shaking the bush you usually flush out one or more specimens. I also used a beating tray which was sometimes fruitful. The main problem is to protect oneself against mosquitoes and, much more insidious, against leeches which swarm in some places. The bites of red ants are not really agreeable. Snakes are not abundant, and monitors were at least as scared by me as I was by them at first!

## Biology

The best places to find phasmids are forests of course, but I also found *Bangladesh 1* (just one example each time) in two cultivated areas (Udalia and Shamirpur). I met just two phasmids on the edge of high thickets, far from the trees (*Bangladesh 1* at Udalia and *Bangladesh 4* at Chunoti). Their favourite habitat appears to be the zones of secondary forests (as Kodala and Jobra) with fairly thick low vegetation. They look to be much more scarce in the primary forests where I never find them except at the fringe. One may also put forward the hypothesis that in the secondary forest where the replanted trees are generally not indigenous species, the phasmids do not climb them and stay exclusively at the level of the shrubs where the local species they eat are found, whereas in the primary forest they can find food above and thus slip out of the prospector's searches.

The host plants are little diversified: the one hosting the greater number of species of phasmids is assargach (*Microcos paniculata* (Tiliaceae)) which is very common; most of the time you find it in the shape of a bush but it is normally a tree, as is sheoragach (*Streblus asper* (Moraceae)) which you also find in the shape of small bushes. That last one, according to the Bengali belief, is supposed to be the abode of female ghosts!

In the middle of winter, phasmids are very scarce; then it is some old specimens which are going to die soon, or early nymphs which do not seem likely to survive. The coming of spring (at the end of February), characterised by a sudden rise of temperatures and the first rainfalls, marks the beginning of the massive hatching of eggs. The nymphs develop during the hot season and reach maturity at the monsoon time. This is the period in which the populations of adults are the most important, but it is possible to find some very scarce adults from March. The general pattern obviously varies according to the immediate environment (exposure, residual humidity, nature of the plantation, etc.) and much more according to the species. For example, there is just one generation of *Bangladesh 2* a year (slow incubation and development) against at least three generations of *Bangladesh 8* (very rapid incubation and development).

Another climatic factor is the cyclones. The region of Chittagong is very exposed to this kind of catastrophe which seems to have very little consequence for the phasmids: the big cyclone which damaged the region in May 1997 did not have any apparent impact on the populations.

## Species collected

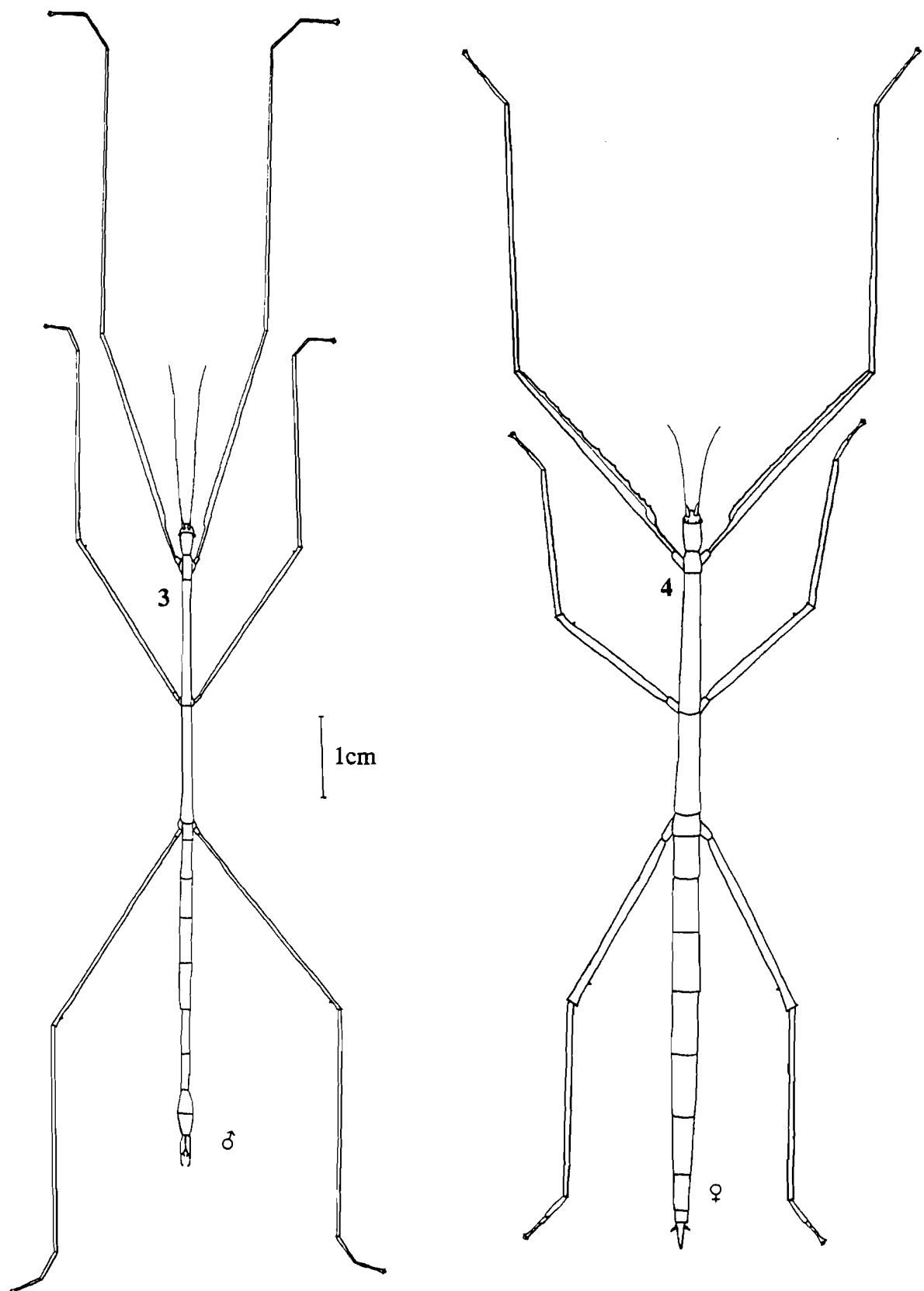
As previously mentioned, species were numbered in the order in which they were collected. Their identity has since been established by Paul Brock.

***Bangladesh 1: Rhamphophasma spinicornis* (Stål, 1875). PSG 194.**

It was found in Chittagong, Jobra, Chunoti, Udalia and Shamirpur (also reported in Korerhat by the Forest Research Institute).

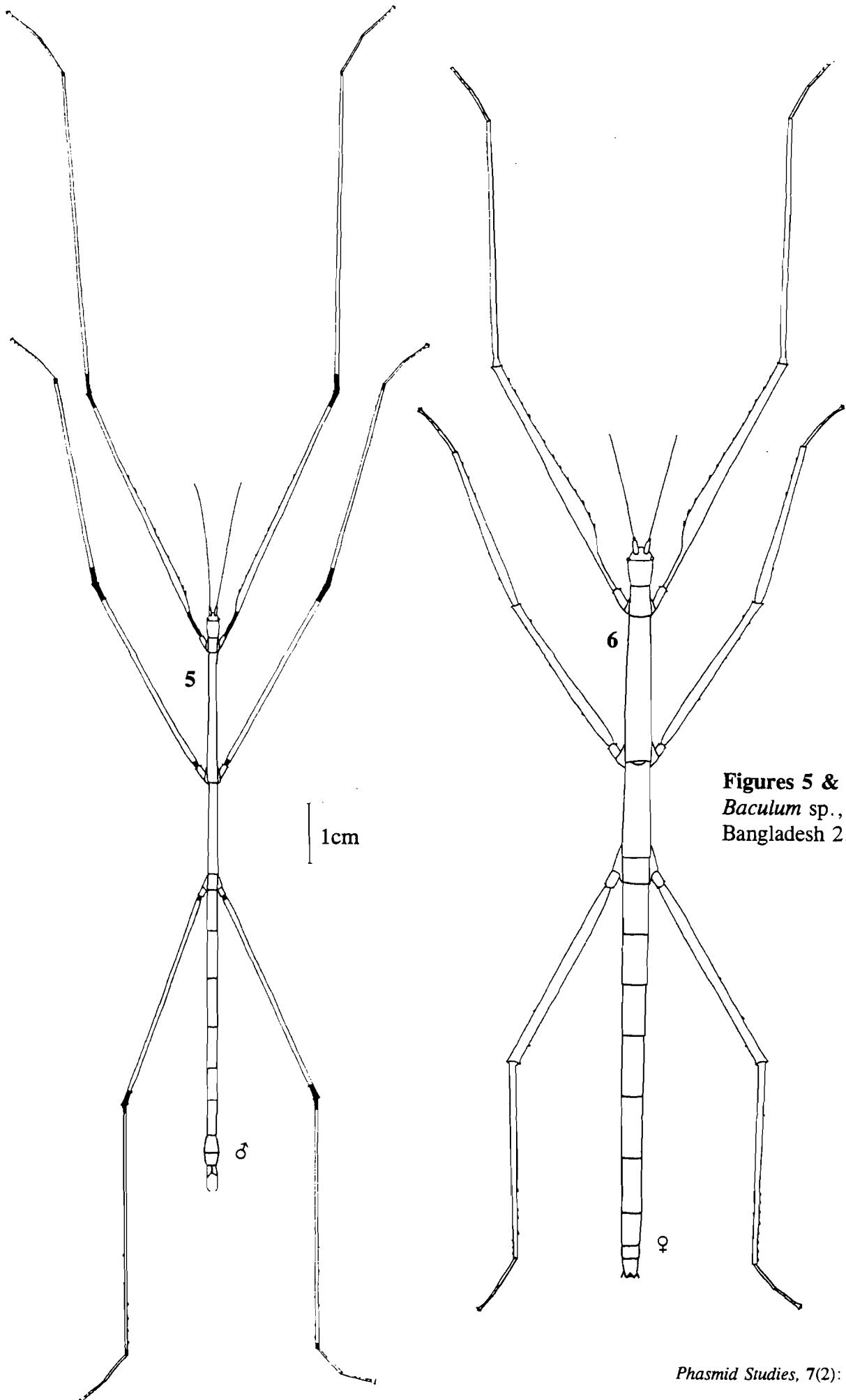
It is an apterous stick insect (Figures 3 & 4). The body length of the female is 90-100mm. The colour is generally a yellowish light green. The antennae are short (about 12mm). The abdomen ends in a light brown tapering point. The head presents two small black horns. The filiform male measures about 80mm with antennae of 21mm. Its body is brown with a lot of variations. The extremity of the abdomen is cleft. Eggs are in the shape of little sticks (Figure 20). Their size is 6mm by 1.5mm. They are beige and the operculum bears a crown of hairs.

This species feeds mainly on *Microcos paniculata*, but I sometimes found it on *Bridelia stipularis* (Euphorbiaceae). This species is in culture as PSG 194, feeding on bramble and hawthorn.



**Figures 3 & 4.** *Rhamphophasma spinicornis* (Stål), Bangladesh 1: male & female.





**Figures 5 & 6.**  
*Baculum* sp.,  
Bangladesh 2.

**Bangladesh 2: *Baculum* sp.**

It is present in Kodala, Bandarban and Teknaf.

This is a wingless stick insect (Figures 5 & 6). The female measures 120-125mm with a width of 4-5mm at the fourth and the fifth abdominal segments level. Its colour is a yellowish green more or less light according to the individuals (with some scarce light brown specimens). The antennae are 15-20mm long. The abdominal extremity is bilobate. The specimens from Teknaf have two minuscule horns on the head; on those from Kodala, it is just possible to see a vestige of these protuberances in the shape of a dark line.

The filiform male measures about 90mm. The main colour is brown, but the mesothorax and the metathorax are bright red on the two sides with bright green lateral strips (these colours became dim for an unknown reason). The abdominal extremity is cleft.

The eggs are round, flattened, with a very broad granular aspect (Figure 22). They are generally light brown but sometimes grey. They measure about 3mm in length.

This species feeds on *Microcos paniculata*.

**Bangladesh 3: *Sipyloidea* sp. (*S. meneptolemus* (Westwood, 1859) ?).**

It is found in Chittagong, Jobra, Kodala, Chunoti, Malumghat, Teknaf and Ramu.

This is a winged stick insect (Figures 7 & 8). The female is green or more scarcely brown; its length is more or less 88mm with antennae of about 62mm. The wings are 47mm long; they lightly overreach the fifth abdominal segment; unfolded, they present a blackish colour. The male is darker than the female. It is about 60mm long. The wings reach the extremity of the fifth abdominal segment; unfolded, they present a beautiful orange-colour. The eggs are small (3-3.5mm long), ovoid with a flat operculum, brown or grey and very distinctly wrinkled.

This species feeds on *Microcos paniculata*.

**Bangladesh 4: *Rhamphophasma* sp. (?)**

This phasmid is present in Jobra, Chunoti and Malumghat.

This species is very similar to *Bangladesh 1* (*Rhamphophasma spinicornis*) but stands out particularly with its size and the colour. The female is larger (about 110mm) and much darker, with bigger variations of colour from one specimen to another (from deep brown to deep green). The only thing that distinguishes the males of the two species is the size (about 90mm for *Bangladesh 4*). The nymphs seem to be quite different: *Rhamphophasma spinicornis* are usually uniformly light green when *Bangladesh 4* are brown or black with lighter coloured legs or with light coloured strips on the femur. The eggs appear to be wholly identical.

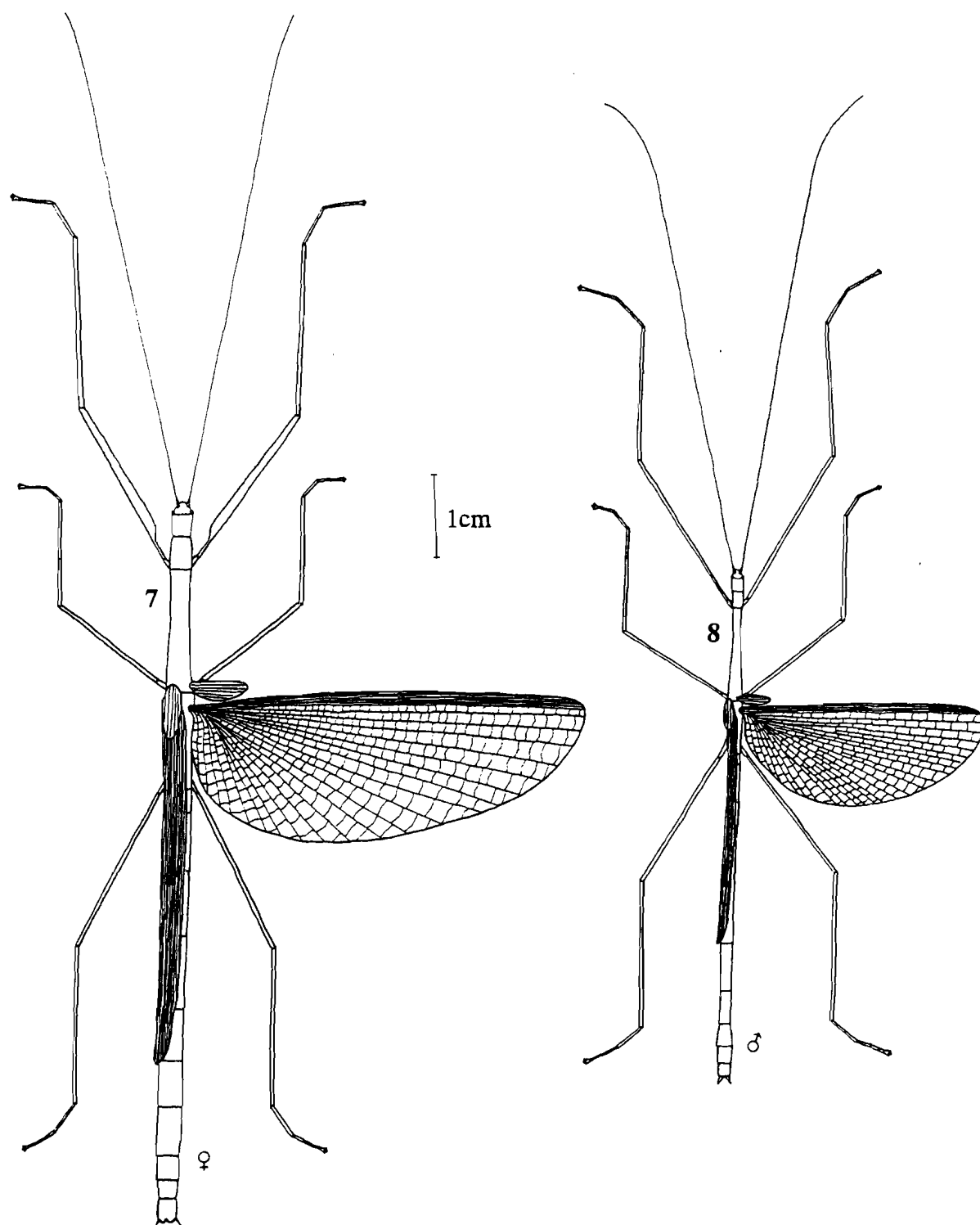
It feeds on *Microcos paniculata*.

**Bangladesh 5: *Sipyloidea* sp. (PSG 201)**

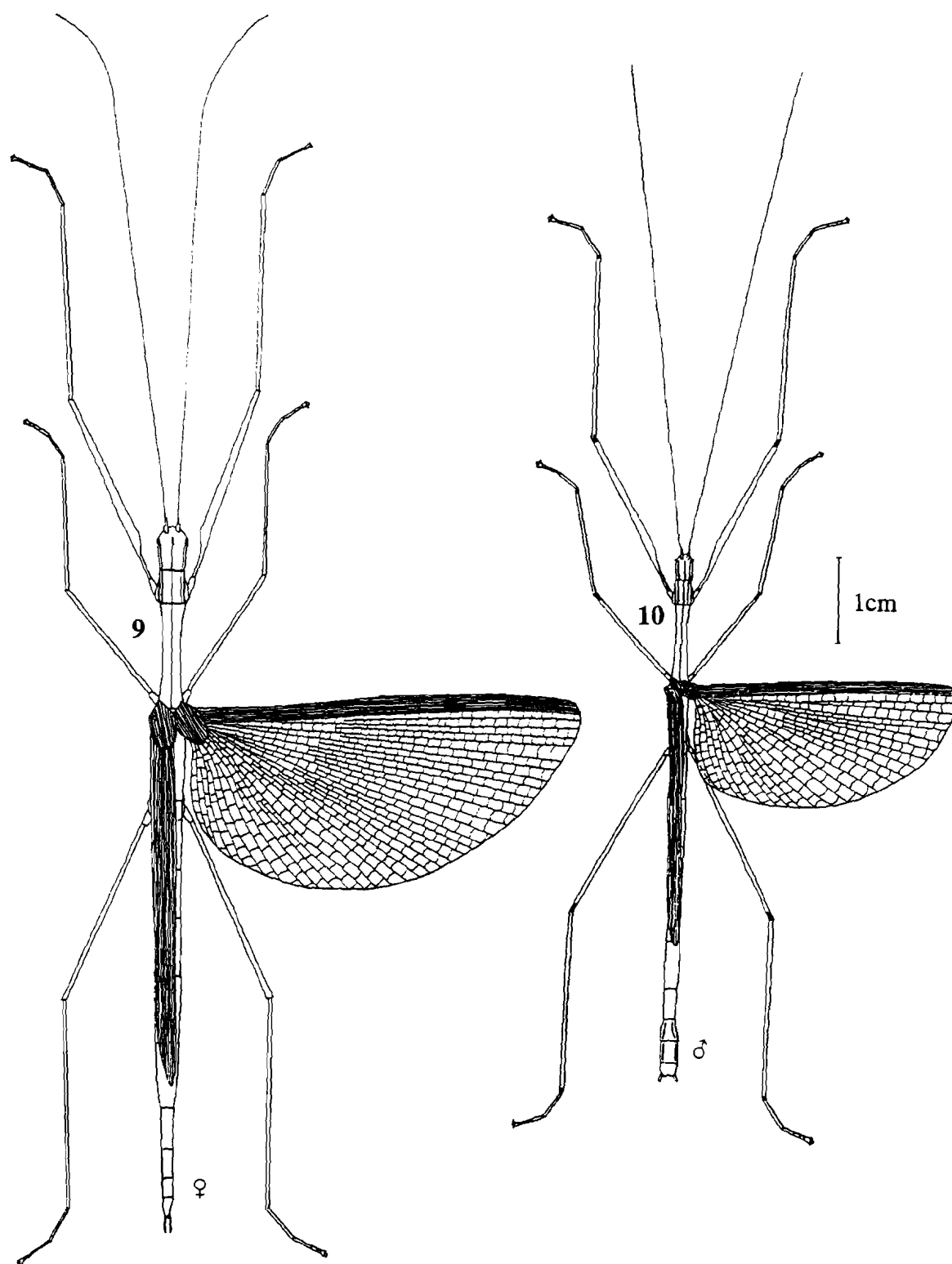
This is a brown or straw-yellow winged stick insect (Figures 9 & 10). In the manner of *Sipyloidea sipylus*, which it resembles a lot, it gives off a rank odour of crunched leaves when it is disturbed. The eggs are also very similar. It was found in Chunoti and in Kodala.

The female measures 86mm on average with a maximum breadth of 5mm at the metathorax level. The antennae are 65-70mm long. The wings measure about 45mm and reach the middle of the sixth abdominal segment. Unfolded, they present sometimes a pink-colour. The specimens from Chunoti were orange-colour brown with straw yellow wings when those of Kodala were entirely straw yellow. The male is a miniature version of the female; it is about 60mm long with an average breadth of 1.5mm; the wings measure around 30mm. The eggs are oblong, they measure 4mm by 1mm (Figure 21). They are black and white streaked. The female glues them in the nooks.

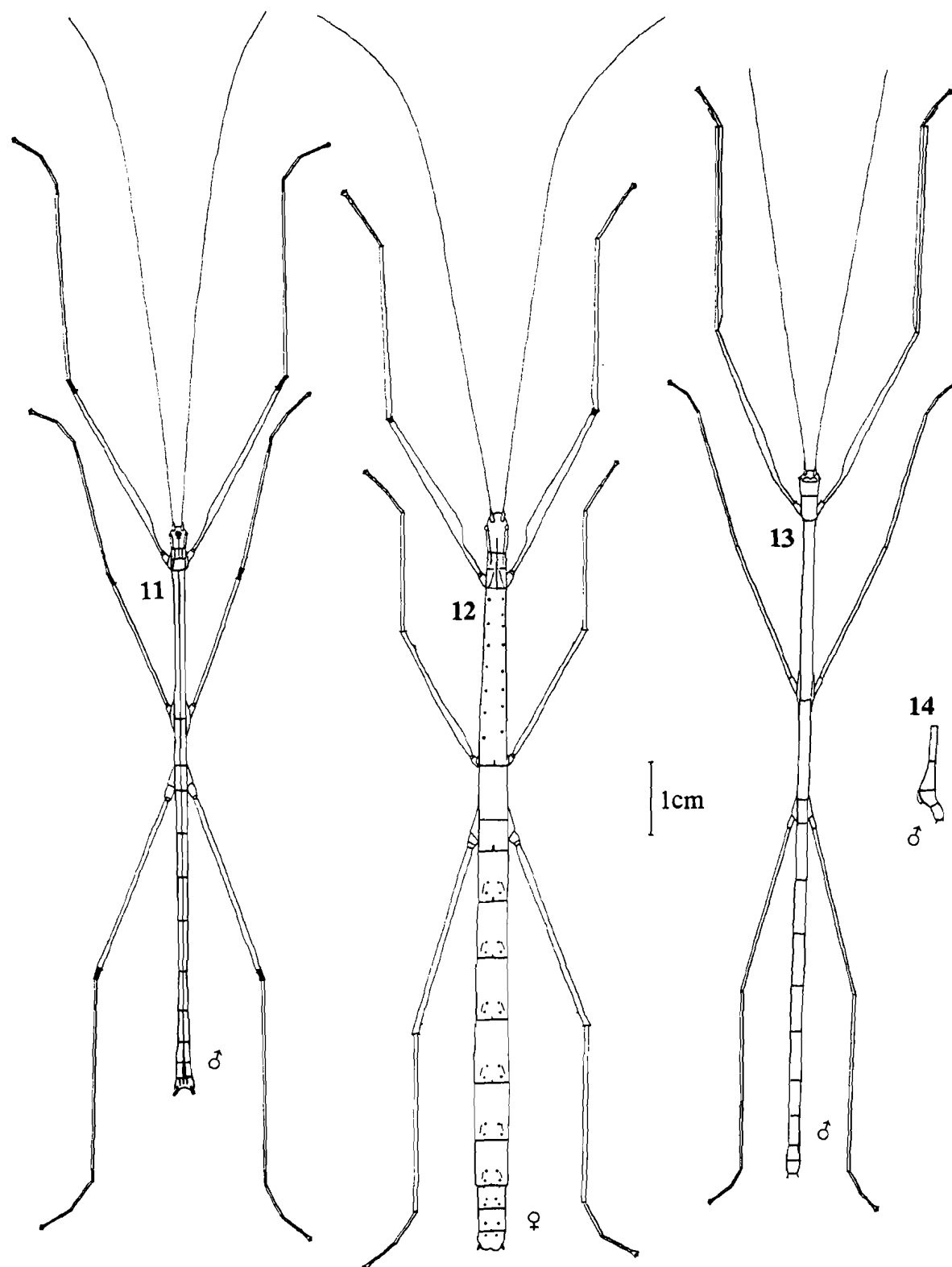
It feeds on *Microcos paniculata*. This species is in culture as PSG 201, feeding on bramble and hawthorn.



Figures 7 & 8. *Sipyloidea* sp., Bangladesh 3: female & male.



Figures 9 & 10. *Sipyloidea* sp., Bangladesh 5: female & male.



Figures 11-14.

11 & 12 *Lopaphus* sp.?, Bangladesh 6: male & female.

13 & 14 *Carausius* sp., Bangladesh 9: male.

**Bangladesh 6: *Lopaphus* sp.**

This is an apterous stick insect (Figures 11 & 12). It is present in Chunoti and in Kodala.

The female is generally greenish light brown, sometimes deep brown, with large whitish spots. It measures about 100mm with a maximum breadth of 5mm at the fourth abdominal segment. The antennae are about 80mm long. The male is filiform, mainly brown with a red mesothorax with blue lateral strips; it measures about 80mm with antennae as long as the body. The eggs are round and black, quite similar to those of *Carausius morosus*.

This species feeds on *Microcos paniculata*.

**Bangladesh 7: *Medaura* sp. (*M. brunneri* Stål, 1875 ?). PSG 202.**

It is present in Jobra.

It is an apterous stick insect (Figures 15-17). The female is generally light brown and is about 100mm long with a maximum width of 9mm at the metathorax. The antennae are short (about 17mm). It presents two pairs of horns on the head and the whole body is very granular. There are many outgrowths on the legs. The male varies from light brown to deep brown. The mesonotum and the metanotum have a long whitish strip surrounded with red or black. It measures a little over 70mm with a general width of 2.5mm. The antennae are about 18mm long. The eggs are round, dark grey and measure 3mm by 2mm.

This species feeds mainly on *Microcos paniculata* and on *Streblus asper* but appears to be very polyphagous. This species is in culture as PSG 202, feeding on bramble and hawthorn.

**Bangladesh 8: *Trachythorax maculicollis* (Westwood, 1848).**

I found this species in Jobra and also in Chittagong, but only one specimen and some hatched eggs (located in Lama too by Forestry Research Institute).

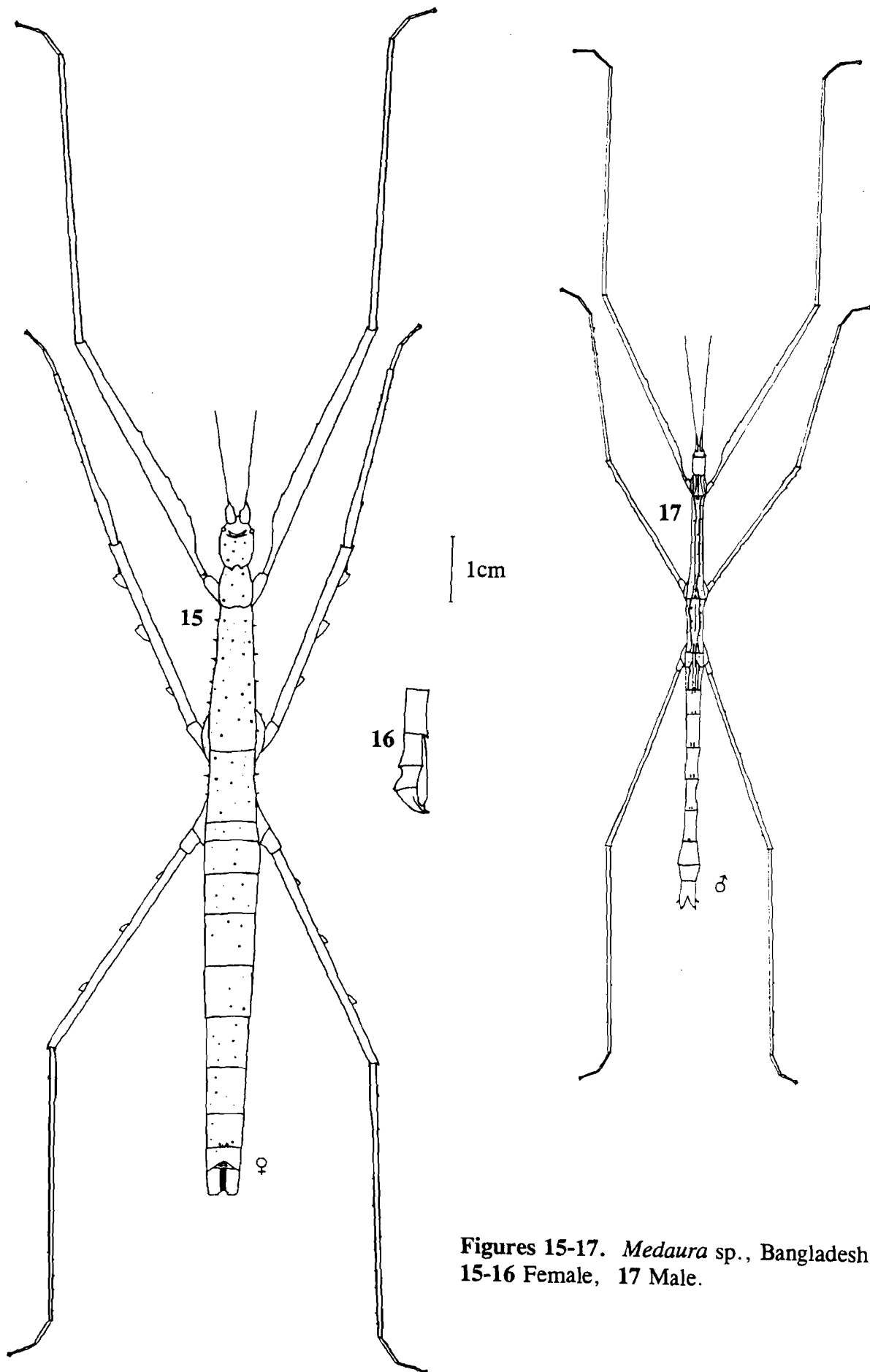
This is a winged stick insect; it is quite dumpy (Figures 18 & 19). The female is deep brown and grey; it measures about 75mm with a maximum breadth of 7mm at the metathorax. The antennae are long (around 53mm). The wings measure about 56mm and nearly reach the extremity of the abdomen. This phasmid has bright red coloration at the level of the pleurite joining the head and the thorax, on the prothorax and the mesothorax at the level of the indentation of the coxae and at the base of wings (coloration only visible when they are unfolded). The shape of the head looks like the one of *Extatosoma tiaratum*, but thornless. On the mesothorax, two protuberances are distinctly visible. The male has the same characteristics as the female but there are no protuberances on the mesothorax; it measures 43mm on average with a breadth of 2.5mm. The female attaches several eggs (one to thirty) on the leaves or on the branches. They are spheroidal, light beige, and present a crown of hairs around the operculum (Figure 23).

This species feeds on *Streblus asper*.

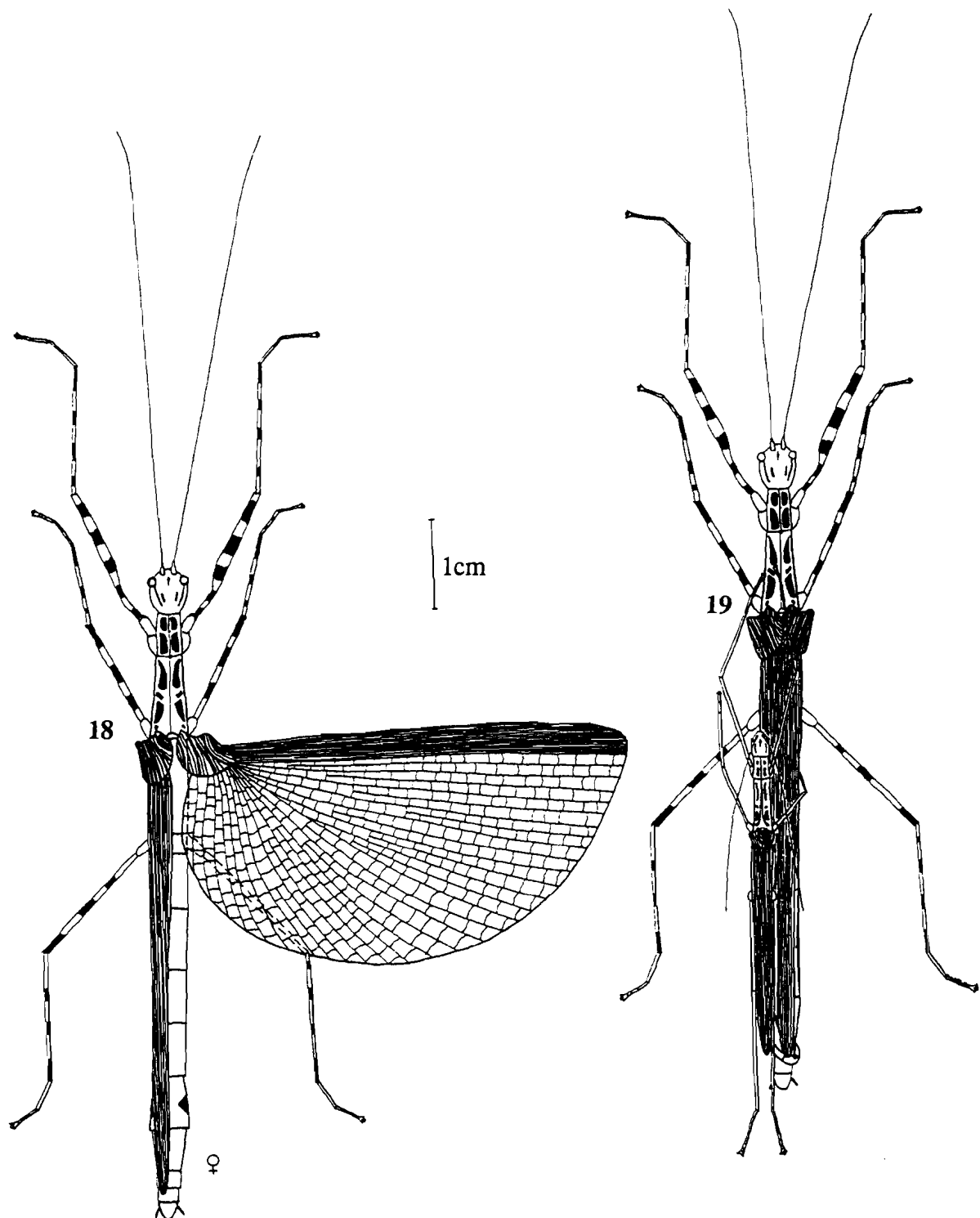
**Bangladesh 9: *Carausius* sp. (?).**

The female of this species, which was found in Chunoti, is unknown. The male is filiform; it measures more or less 100mm with an average breadth of 2mm. Its antennae are about 58mm long. Its head presents a crown-like protuberance, 1mm high. It is mainly brown with a bloody red mesosternum (Figures 13 & 14).

This species feeds on *Microcos paniculata*.



Figures 15-17. *Medaura* sp., Bangladesh 7.  
15-16 Female, 17 Male.



**Figures 18 & 19.**  
*Trachythorax maculicollis* (Westwood), Bangladesh 8.  
18 Female, 19 Mating pair.

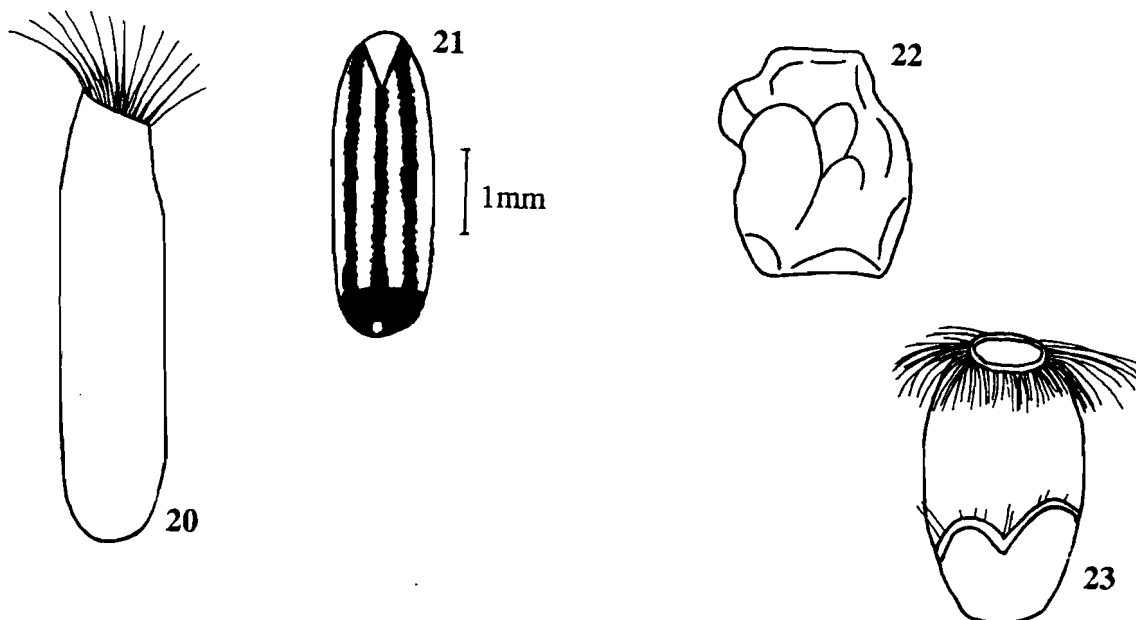


**Phyllium**

In spite of numerous searches and of numerous inquiries among zoologists or locals, I did not find *Phyllium* in Bangladesh. Nevertheless, the Forestry Research Institute of Chittagong has a specimen (a female in a very bad condition) collected in Kaptai; it is very likely a *Phyllium celebicum* for this female has complete wings under its elytra. Furthermore, botanists of University of Chittagong affirmed to me they saw (but on very few occasions) *Phyllium* on the site of the university (in Jobra). Lastly, in Kodala, locals I interrogated about this sometimes gave positive answers (but these people do not take the faintest interest in this matter: some of them even did not know of phasmids though they are very abundant on this site): those ones who told they knew *Phyllium* assured me they see them sometimes on the guava trees and on the lemon trees (they cultivate these trees at the bottom of the hills which are planted with teaks). A local told me he killed one because it was eating the leaves of a guava-tree; he added he then saw eggs inside the body of the insect. On the leaves of guava-trees I saw some traces of very round eating, quite typical of *Phyllium*, but nothing more.

**Addendum 1**

I was in Bangladesh from mid-August to mid-September 1998. I spent some time looking for phasmids. Now it is easier for a foreigner to enter the Chittagong Hill Tracks after the peace treaty. I just found a new locality for *Rhamphophasma spinicornis* at the south-east of Bandarban in Farukpara along the river Shoïlopropat: I collected three females on a plant called bherenda by locals, maybe castor-oil plant (*Ricinus communis* (Euphorbiaceae)). I found no male and I have to wait for the hatching of the eggs to know whether they were fertilised or not. These females have a thornless head.



**Figures 20-23** Eggs.

**20** *Rhamphophasma spinicornis* (Stål), Bangladesh 1.

**21** *Sipyloidea* sp., Bangladesh 5.

**22** *Baculum* sp., Bangladesh 2.

**23** *Trachythorax maculicollis* (Westwood), Bangladesh 8.

## Section Two: Srimongol area

### Introduction

During four days, from 26<sup>th</sup> to 29<sup>th</sup> of September 1997, I searched around Srimongol. This small town, the tea centre of Bangladesh, is situated in the north-east of the country, near the Indian border (Tripura), in the region of Sylhet. It is an undulating region with numerous, and immense, plantations of tea. It is surrounded by India: in the north by Meghalaya, in the east by Assam and in south by Tripura which present a relief much more important. This is the most humid region of Bangladesh with 5000mm of annual rainfall (Cherrapunji (Meghalaya), the most rainy place in the world, is situated just on the other side of the Indian border). Around Srimongol, there are some very beautiful plots of forest. The access to these forests is often difficult owing to their remoteness and to the poverty of the infrastructures, but mainly because of the overprotection of foreigners (the region of Tripura, where tribal people are in guerrilla war against the government of India, is nearby): the chief of the Forest Office in Sylhet even ventured to assure me that he did not know where the forests were(!), apparently in order to dissuade me from going there.

Searches have already been made in this region in the 19th, and at the beginning of the 20th century. At least ten species have been found there. I say "at least" since the information I have is incomplete: before the partition of 1947 that divided the Indian Empire into two countries (India and Pakistan. Pakistan split in 1971 with the former East Pakistan becoming Bangladesh), the region of Sylhet was a part of Assam. Numerous Indian species, all discovered before this event, are recorded as Assam, without other indication. These ten species are:

- Baculum magnum* (Brunner, 1907)
- Baculum stilpnus* (Westwood, 1859)
- Medaura brunneri* Stål, 1875
- Oxyartes despectus* (Westwood, 1848)
- Phasganistra virgea* (Westwood, 1848)
- Phyllium scythe* Gray, 1843
- Rhamphophasma spinicornis* (Stål, 1875)
- Sipyloidea sipylus* (Westwood, 1859)
- Sosibia pholidotus* (Westwood, 1859)
- Trachythorax maculicollis* (Westwood, 1848)

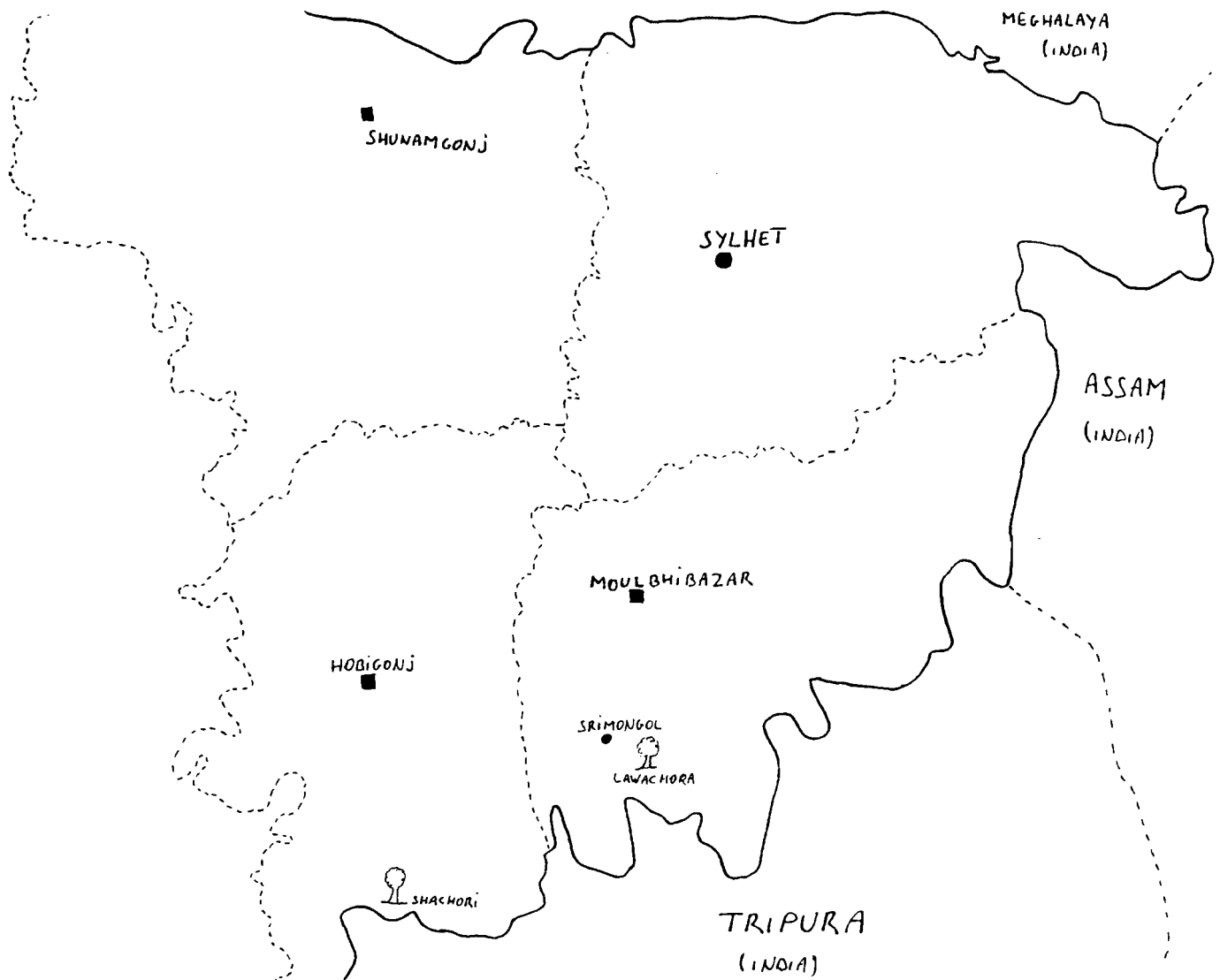
### Collection sites

I conducted my searches at two sites: the first two and the fourth day in Lawachora Forest, the third day in Shachori Forest. Lawachora Forest is a small primary forest situated on an undulating land, scored with numerous brooks which are used also as footpaths. The tree species there are mainly teaks and assargach. Shachori Forest is similar and surely much smaller although it seems to straddle India and Bangladesh (no detailed and reliable map is available). The relief is flatter than in Lawachora.

### Collecting methods

Here I had also to collect in the daytime, and this constitutes a real disadvantage when you have no time to discern habits of camouflage and recognise host plants. In order to spice up the whole, a lashing rain fell continually during the two first days, this made my searches very difficult; on top of this, hordes of leeches, reinvigorated by the rain, cheerfully assaulted my calves.

At the beginning I applied, with much less success because of my ignorance of host



**Figure 24.** Map of Srimongol area.

plants, the same method I used in the region of Chittagong which simply consists in scrutinising bushes by lifting up branches. Using a beating tray was more productive, especially along overhung paths where stick insects fall far from vegetation, which made them very easily locatable.

### Biology

In view of how little time I spent in this region, it was impossible for me to get many particulars. Phasmids were not very numerous compared to some sites near Chittagong. I can put forward two explanations based on my experience in the Chittagong region: the first one is that phasmids are generally more numerous (or easier to see) in secondary forests than in primary forests; the second one is that the period in which I prospected, after monsoon season, is not the most favourable to find phasmids.

**1st day:** 26<sup>th</sup> September 1997, Lawachora Forest.

As a post-monsoon cyclone approached the Chittagong coasts just after my departure, the rest of the country was covered with big clouds and was plunged under the rains. Considering

the little time I have at my disposal for my searches, I decided all the same to go and carry out my first search. After a fifteen minutes drive in baby-taxi, I arrived at last into the Lawachora forest which is the most beautiful I saw in Bangladesh.

During four hours in very difficult circumstances (leeches which you do not feel, and rain which you feel too much) I looked haphazardly among the low vegetation. Results: two small phasmids. The first one (individual A) measures 25-30mm, it is dark green with long antennae. The second (individual B) measures 33mm; it is yellowish light green with very long antennae (35mm).

**2<sup>nd</sup> day:** 27<sup>th</sup> September 1997, Lawachora Forest.

Conditions did not improve; I searched again for four hours and I found two new phasmids. The first one (individual C) is an adult male of *Bangladesh 5* (*Sipyloidea sp.*). The second one (individual D) is a adult male of a species which I had not seen before: it measures 89mm, with long antennae (61mm); it is winged, black with elytra yellowed-fringed on their extremity.

**3<sup>rd</sup> day:** 28<sup>th</sup> September 1997, Shachori Forest.

Rain finally stopped falling, but other problems emerged: Shachori is situated relatively far from Srimongol (60km), but, to spice up the travel, a bridge fell down, causing delay, a huge crowd, discouragement and yearning to turn back. At last, an obliging policeman discovers a place for me in a lorry and the travel resumes! Due to the time lost *en route*, I have to shorten my searches which last three hours, by following a large overhung path. It is in sunny glades, under a thick vegetation falling from the heights of the path, that I find six phasmids by practising the tree beating technique.

Individual E is a nymph of about 25mm, light green with long antennae.

Individual F is a nymph of 35-40mm, brown, very fine with very long legs and very short antennae.

Individual G is a nymph of about 20mm, dark green, with long antennae.

Individual H is a nymph of about 50mm, uniform green, with short antennae.

Individual I is a nymph of 55-60mm, green, with short antennae.

Individual J measures 36mm, it is light brown with short antennae and very long legs (34mm for the fore legs).

**4<sup>th</sup> day:** 29<sup>th</sup> September 1997, Lawachora Forest.

Fair weather, so my searches last more than six hours: much better conditions than the first two days at this site. As it was rather successful the day before, I pursue the tree beating method; it brings in nine phasmids.

Individual K is a adult male of *Bangladesh 7* (*Medaura sp.*)

Individual L is a nymph of about 25mm, brownish green, with long antennae.

Individual M is a adult male of *Bangladesh 2* (*Baculum sp.*).

Individual N is a adult male in a piteous condition (very damaged wings). It measures 72mm with antennae of 73mm. It is black.

Individual O is a nymph of 25-30mm, dark brown, with long antennae.

Individual P is a nymph measuring about 60mm, green, with long antennae and budding wings.

Individual Q is a very young nymph of about 15mm, with a lightly dumpy aspect. It is brown with small antennae.

Individual R is a nymph of 35-40mm. It is green with long antennae.

Individual S is a nymph of 20-25mm. It is green with long antennae.

## Outcome

Nineteen phasmids in four days and seventeen hours of searching: it is not opportune to say the outcome was fantastic. Moreover, from these nineteen phasmids, fourteen were nymphs often very young. As for the five adults, all were males which is frustrating, an adult female is obviously much more interesting because it provides the possibility of obtaining eggs which may have been fertilised if males do exist.

Added to this disappointing outcome was the fact I did not know host plants of these phasmids. I offered a sample of plants picked on the spot, hoping they would be suitable. Away from home, I could not make precise trials as I had just two small tanks at my disposal in which some individuals passed four nights, and then all of them spent the night in the bumpy return train. Circumstances were not really ideal.

On the 30<sup>th</sup> September, day of my return to Chittagong, individual D died; the day after (1<sup>st</sup> October) individuals J and M died, and then the following day (2<sup>nd</sup> October) individuals B and N. Then, as I had found for each one a suitable plant, deaths stopped. At the end of October, I lost two adults (individuals C and K) and the friend who took care of my insects during my holidays threw away individuals L and Q with the food plants.

Meanwhile, I had attempted to classify all these specimens and I was able to distinguish seven species, four of which I did not find in the Chittagong area.

The three species which also occurred in the region of Chittagong are:

**Bangladesh 2** (*Baculum* sp.): one adult male (individual M).

**Bangladesh 5** (*Sipyloidea* sp.): one adult male (individual C) and four nymphs which produced two adult males and two adult females (individuals E, P, R and S).

**Bangladesh 7** (*Medaura* sp.): one adult male (individual K) and one nymph (individual Q) which has been thrown away (see above). I think that the individual Q was a *Bangladesh 7* because of a general resemblance, reinforced by the habit it had of remaining on the ground during daytime.

The four new species are divided thus:

**Bangladesh 10:** *Sosibia pholidotus* (Westwood, 1848)

One adult male (individual D) and 4 nymphs (individuals A, G, L and O) from which one has been thrown away; as for three others, one became adult (a male) in December and died early March 1998, one died at the sub-adult stage (another male) in February and the last one (a female) died late March, apparently at the last but two stage.

**Bangladesh 11:** *Sipyloidea casignatus* (Westwood, 1859) (?)

One adult male (individual N) and one nymph (individual B). Both of them died quickly. I rank them in the same species, in spite of the difficulty there is to compare an adult phasmid with a young nymph, because of the remarkable length of the antennae (see above). Moreover the nymph has got a quite long median segment which indicates it belongs to a winged species.

**Bangladesh 12:** Unidentified.

Two nymphs (individuals F and J). The second one died rapidly, but the first one is still alive and is a female: it is adult now and it measures 156mm with an average breadth of 4-5mm; antennae are 22mm long and fore legs 112mm. It is uniformly light green on the thorax and the two first abdominal segments (including median segment), light brown on the rest of the abdomen. Its eggs are cream-coloured and are in the shape of little sticks: they are 12mm long by 1.5mm large; they present a cleft aspect at the bottom and are crowned with a hoof-shaped operculum measuring 3mm in height.

**Bangladesh 13: Unidentified.**

Two nymphs (individuals H and I), still alive at present. They are one male and one female which are adult now. The female measures 128mm with a breadth of 4mm at the thorax level; its antennae are 15mm long and its fore legs 104mm long. As to the male, it is 105mm long with a breadth of 2.5mm; its antennae measure 28mm and its fore legs 108mm. Both are dark brown. Eggs are very similar to those of *Bangladesh 12* but are brown and smaller (8.5mm long by 1.25mm large).

**Distribution summary**

**Lawachora Forest:**

*Baculum* sp. (= *Bangladesh 2*)  
*Sipyloidea* sp. (= *Bangladesh 5*)  
*Medaura* sp. (*M. brunneri* ?) (= *Bangladesh 7*)  
*Sosibia pholidotus* (= *Bangladesh 10*)  
*Sipyloidea casignatus* (?) (= *Bangladesh 11*)

**Shachori Forest:**

*Sipyloidea* sp. (= *Bangladesh 5*)  
*Sosibia pholidotus* (= *Bangladesh 10*)  
*Bangladesh 12*  
*Bangladesh 13*

**Addendum 2**

For four days in the summer of 1998 I was in the Srimongol area and I returned to Lawachora and Shachori Forests. I found many more phasmids than the first time I went there one year before (19 adults and 37 nymphs). I found no new species (I have to wait until the nymphs I am rearing now become adult to be sure of this) but I found some species where I did not find them before.

*Rhamphophasma spinicornis* (*Bangladesh 1*): I found both males and females in Lawachora and in Shachori (new records).

*Bangladesh 2* (*Baculum* sp.): one female and two males in Lawachora.

*Sipyloidea* sp. (*Bangladesh 5*): one adult male and some nymphs from Shachori and Lawachora.

*Medaura* sp. (*Bangladesh 7*): males and one female in Lawachora but this female was much smaller than those found in Chittagong area (76mm against 100mm). So this may be a different species of *Medaura* I just found one egg before she died after some days.

*Sosibia pholidotus* (*Bangladesh 10*): some nymphs in Lawachora of which two newly hatched ones which are very attractive (bright green with many little red spots). Back in Europe I was unhappy not to find a suitable food plant for them.

*Sipyloidea casignatus* (?) (*Bangladesh 11*): some nymphs of which one from Shachori (new record). They all died when I still was in Bangladesh.

*Bangladesh 12*: some nymphs of which two from Lawachora (new record).

*Bangladesh 13*: one male and one female adult plus some nymphs in Shachori.

These last two species were found in Shachori, living in sunny places most of the time under a curtain of vegetation (usually bamboo), among tufts of a grass (30-40cm in height) growing on the sides of an overhung trail. Sometimes they were very numerous in a very little space. This grass is their food plant: Dr. Matiur Rahman of Bangladesh National Herbarium in Dhaka identified it as *Brachiaria distachya* (Graminaea).

**Acknowledgements**

Mr Rafikul Islam, chief of the entomological department of the Bangladesh Forestry Research Institute in Chittagong for having helped me at the beginning of my searches. Dr M. Khairul Alam (and his assistant, Ms Shukla Basak), chief of the botanical department of Bangladesh Forestry Research Institute in Chittagong for the identification of the phasmids host plants. Paul D. Brock for the identification of these species. Alain Deschandol, Claude Lamorille and Jean Treutenaere for dealing with establishing the culture of these phasmids in our latitudes. Nahreen for having bravely proposed herself to draw my "creepy-crawlies". Moloy for having heroically faced the leeches in my company.

# Unravelling the species: *Graeffea erythroptera* (Olivier) versus *Marmessoidea rosea* (Fabricius).

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## Abstract

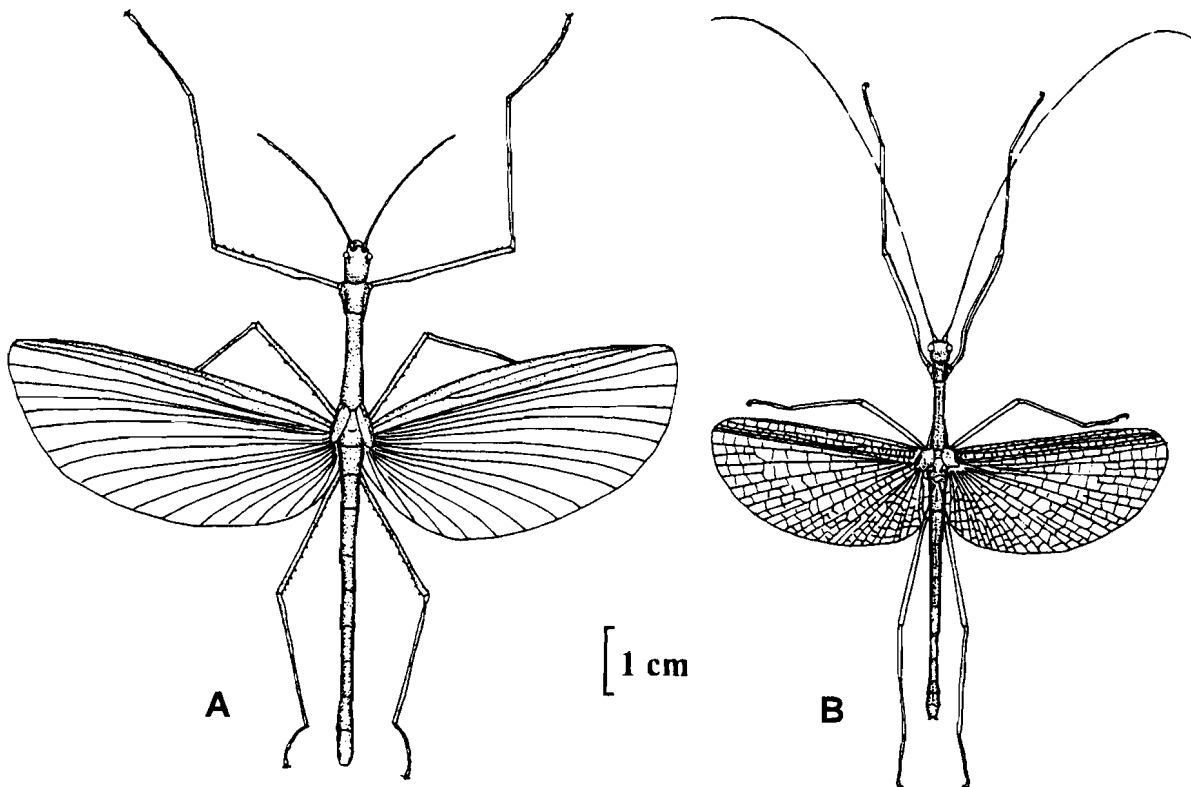
The synonymy of *Graeffea erythroptera* (Olivier) and *Marmessoidea rosea* (Fabricius) is examined. The two species are clearly distinct.

## Key words

Phasmida, *Graeffea erythroptera*, *Marmessoidea rosea*, *Phasma rosea*, *Platycrania rafflesii*, *Necroscia marmessus*.

Occasionally, completely different and valid species are confused in the literature. This article highlights one of these instances, namely the two rose-winged species *Graeffea erythroptera* (Olivier) and *Marmessoidea rosea* (Fabricius) which have been mixed up by most authors publishing on them.

In 1793 Fabricius described a species under the name *Mantis rosea* (Figure 1) which since has been transferred to the genus *Marmessoidea* Brunner von Wattenwyl by Kirby (1904). According to Fabricius, the type specimens (in Copenhagen see Zimsen (1964)) clearly showed that it concerned a species from "India Orientali" [East Indies] with rose hind wings, and with antennae which are longer than the total body length. In addition, this representative of the large tribe of Necrosiinae can be easily distinguished by its greenish head and thorax and the large yellow rounded spot between the eyes.



Schematic sketches of:

A. *Graeffea erythroptera* (Olivier) male, (after Stoll, 1813 plate 5 fig. 17).

B. *Marmessoidea rosea* (Fabricius) male, (after Westwood, 1859 plate 19 fig. 7).

Preceding Fabricius' description, Olivier (1792) described a different species from Ambon under the name *Mantis erythroptera* which is based on a description of "Spectre à ailes rouges" given by Stoll (1788) (location of type material unknown); Stoll omitted to include latinized binomial names (see also Bragg, 1996). Instead of referring to illustration 17 on plate 5, Oliver incorrectly quoted figure 16 on plate 5 which represents "Mantes raïée à etuis étroits". This mix up may have been the reason why so few authors have referred to this common, valid species. Currently, the valid name of this species is *Graeffea erythroptera* which is classified in the subfamily Platycraninae. The species somehow resembles *Marmessoidea rosea* but easily can be distinguished from it by its short antennae, which are typical of Platycraninae, and the spine formations on the ventral side of the femora.

Detailed studies show that the name *rosea* has been incorrectly used for *erythroptera* by a number of authors. In order to unravel the literature, a diagram (Table 1) was compiled to show the citation behaviour of different authors.

Table 1 shows a representation of the citation behaviour of a number of authors who have published on these species mentioned in this article. From the upper left to the bottom right corner species names and references of publications are given in chronological order. In the rows in front of these references space is used to mark whether a particular publication is citing a previous reference. In cases where a reference is cited a mark (Q or q) is given in the column under this reference. In the diagram a distinction is made between explicit and implicit citations. Explicit citations (Q) are references that are actually cited in a particular publication, while implicit (q) or indirect citations represent those references that are not cited in a particular publication but appear in references that are explicitly cited unless it is mentioned in the reference that the particular reference, species or specimens represent a different species. At spots where different species names are combined for the first time, for example as a new synonym, a square border is given around the marking. For ease of reading, references to the two different species have been given in different grey tones.

Probably because of the fact that the knowledge on the classification of Phasmatodea was initially poorly developed, and because Stoll's excellent illustrations were apparently more useful to identify species than the existing descriptions, a number of authors (see Table 1) have incorrectly quoted Stoll's figure in combination with *M. rosea* (Fabricius) after 1793. It is probably because of this that the name *P. rosea* was included the index of the 1813 reprint of Stoll's publication. The editor of the 1813 reprint (Stoll had died in 1795) failed to quote the original references and hence Stoll's description started to live a life on its own. As a result the name *rosea* has been inconsistently used by various authors in the years following (Table 1). Gray (1835) indiscriminately combined *rosea* Fabricius with *rosea* of Stoll in favour of the latter in his description and listing of synonyms. In addition, he went on to describe *Platycrania rafflesii* from Sumatra which was synonymised with *M. rosea* (Fabricius) by Kirby (1904). Westwood (1859) under *Necroscia rosea* follows Gray's example and includes a separate description of the male of *rosea* (Stoll). Furthermore, he described *Necroscia marmessus* which was selected as the type species of *Marmessoidea* and subsequently also has been synonymised to *M. rosea* (Fabricius) by Kirby (1904). Kirby in his "Synonymic Catalogue of Orthoptera" is the first author to unravel the species. Although his intentions are clear, he indirectly cites references to *Graeffea erythroptera* (Olivier) in *Marmessoidea rosea* (Fabricius) and vice versa as shown in Table 1. Unfortunately, recent authors such as Redtenbacher and Günther continued using *rosea* of Stoll instead of *erythroptera* and as a result a lot of specimens in many collections are labelled wrongly.



Table 1. Citation behaviour of authors with respect to *G. erythroptera* (Olivier) and *M. rosea* (Fabricius).

Species: <i>Ailes Rosea</i> Stoll, 1788: 113 pl. 3 fig. 17 [not 16]															INDEX	
Q <i>Mantis erythroptera</i> Olivier, 1792: 636 (n. sp).																= <i>Graeffea erythroptera</i> (Olivier)
- <i>Mantis rosea</i> Fabricius, 1793: 16 no: 15. (n.sp).																= <i>Marmessoidea rosea</i> (Fabricius)
Q	Q	- <i>Mantis rosea</i> of Lichtenstein, 1796: 78.													Q	= cited explicit
Q	Q	- <i>Phasma rosea</i> of Fabricius, 1798: 190.													q	= cited implicit
Q	Q	- <i>Phasma roseum</i> of Lichtenstein, 1802: 14.													-	= not quoted
q	Q	- <i>Phasma rosea</i> of Latreille, 1807: 87.													?	= no information available
-	-	- <i>Phasma rosea</i> of Stoll, 1813: 13 pl. 5. fig. 17.														= species first quoted as synonym
?	?	- <i>Phasma rosea</i> of Saint Fargeau & Audinet-Serville, 1825: 101.														
Q	Q	- <i>Phasma rosea</i> of Audinet-Serville, 1831: 58.														
-	-	- <i>Platycrana rafflesii</i> Gray, 1835: 37 (n. sp.).														
Q	Q	- <i>Platycrana rosea</i> of Gray, 1835: 37.														
-	-	- <i>Phasma (Necroscia) rafflesii</i> of Haan, 1842: 121.														
Q	Q	- <i>Necroscia rosea</i> of Westwood, 1859: 148.														
-	-	- <i>Necroscia rafflesii</i> of Westwood, 1859: 149.														
-	-	- <i>Necroscia marmessus</i> Westwood, 1859: 149 (n. sp.).														
-	-	- <i>Marmessoidea marmessus</i> of Brunner von Wattenwyl, 1893: 86.														
-	-	- <i>Arrhidaeus rosea</i> of Kirby, 1896: 472.														
-	-	- <i>Marmessoidea marmessus</i> of Rehn, 1904: 73.														
q	-	q	-	Q	Q	-	-	-	Q	-	-	-	-	-	Q	-
q	Q	q	-	q	q	q	Q	q	q	-	q	Q	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q	Q	q	-	Q	Q	Q	Q	Q	Q	-	Q	Q	-	Q	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q	q	q	-	q	q	q	Q	q	q	-	q	-	-	q	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
q	-	Q	-	-	Q	-	-	-	Q	-	-	-	-	Q	-	-
- <i>Arrhidaeus erythroptera</i> of Kirby, 1904: 384.																
- <i>Arrhidaeus roseus</i> of Brunner, 1906: 14.																
- <i>Graeffea rosea</i> of Redtenbacher, 1908: 372.																
- <i>Marmessoidea marmessus</i> of Redtenbacher, 1908: 511.																
- <i>Graeffea rosea</i> of Günther, 1929: 624.																
- <i>Graeffea rosea</i> of Günther, 1933: 155.																
- <i>Graeffea rosea</i> of Günther, 1936: 338.																
- <i>Marmessoidea rosea</i> of Brock, 1995: 90.																

With respect to the above, the key references of the two species should be cited as follows:

*Graeffea erythroptera* (Olivier), 1792: 636 (*Mantis*).

*Arrhidaeus erythroptera* (Olivier) Kirby, 1904: 384.

*Phasma rosea*; Stoll, 1813: 13 pl. 5, fig. 17. [not Fabricius]

*Marmessoidea rosea* (Fabricius), 1793: 16 no: 15 (*Mantis*).

*Phasma rosea* (Fabricius), 1798: 190.

*Marmessoidea rosea* (Fabricius) Kirby, 1904: 371.

*Platycrana rafflesii* Gray, 1835: 37.

*Phasma* (*Necroscia*) *rafflesii* de Haan, 1842: 121.

*Necroscia marmessus* Westwood, 1859: 149.

*Marmessoidea marmessus* of Rehn, 1904: 73.

## References

Bragg, P.E. (1996) Comments on the species of Phasmida described by Stoll in 1788 and named by Olivier in 1792. *Phasmid Studies*, 4(1): 24-25.

Fabricius, J.C. (1793) *Entomologia Systematica Emendata et Aucta. Secundum Classes, Ordines, Genera, Species adjectis Synonymis, Locis Observationibus, Descriptionibus*. 2: 1-519. Hafniae.

Gray, G.R. (1835) *Synopsis of the Species of Insects Belonging to the Family of Phasmidae*. London.

Kirby, W.F. (1904) *A Synonymic Catalogue of Orthoptera*. Volume 1. London.

Olivier, A.G. (1792) Histoire Naturelle. Insectes. *Encyclopédie Méthodique*, Volume 7. Paris.

Stoll, C. (1788-1813) *Natuurlijke en naar het leven nauwkeurige afbeeldingen en beschrijvingen der spoken, wandelende bladen, zabel-sprinkhanen, krekels, treksprinkhanen en kakkerlakken, in alle vier delen der wereld, Europa, Asia, Africa en America. Huishoudende, bij een verzameld en bechreven*. Amsterdam.

Westwood, J.O. (1859) *Catalogue of the Orthopterous Insects in the Collection of the British Museum, Part I. Phasmidae*. London.

Zimsem, E. (1964) *The type material of I.C. Fabricius*. Copenhagen.

# Reviews and Abstracts.

## 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.

**Asimakopoulos, S. & Orchard, I. (1998)** The aminergic control of salivary glands in the stick insect, *Carausius morosus*. *Biogenic Amines*, **14**(2): 143-162.

Immunohistochemistry in *Carausius morosus* reveals that the salivary glands are innervated by two paired neurons, the SN1 and SN2, located in the suboesophageal ganglion. The SN1 stain for tyrosine hydroxylase-like immunoreactivity, while the SN2 stain for serotonin-like immunoreactivity. Tyrosine hydroxylase is the rate limiting enzyme in the formation of catecholamines, and immunoreactivity to it is indicative of dopamine presence in insects (Evans 1980, and Ali and Orchard 1996). Both neurons project axons through the salivary nerve, and branch over the acini. Immunohistochemistry and biocytin filling shows that the salivary ducts are targets for branches from the salivary nerve. Dopamine and serotonin cause a dose-dependant increase in cyclic AMP levels in the salivary glands, indicating cyclic AMP may play a role as a second messenger. Increases in cyclic AMP induced by dopamine and serotonin, can be inhibited by vertebrate dopaminergic and serotonergic receptor antagonists respectively. The rank order of potency of dopaminergic antagonists (based on IC<sub>50</sub> values) of SCH-23390 > flupenthixol > chlorpromazine > butaclamol, suggests the presence of receptors similar to vertebrate D1-like receptor. The rank order of potency of serotonergic receptor antagonists of spiperone > ketanserin > mianserin > cyproheptadine, suggests the presence of receptors similar to vertebrate 5HT<sub>2</sub> receptors. Electrical stimulation of the salivary nerve also elevates cyclic AMP levels in the salivary glands, an elevation that can be partially inhibited by 0.1mM SCH-23390 and cyproheptadine.

**Brock, P.D. (1999)** *Stick and Leaf Insects of Peninsular Malaysia and Singapore*. Malaysian Nature Society, Kuala Lumpur. 222 pages, softback, ISBN 983 9681 16 8.

This book includes two new genera, 16 new species and new synonyms for eight species. 39 colour and 18 black-and-white photographs, and numerous line drawings. Keys are provided to all 103 species.

A full review of this book will be published in a subsequent issue of *Phasmid Studies*.

**Brunn, D.E. (1998)** Cooperative mechanisms between leg joints of *Carausius morosus*: I. Nonspiking interneurons that contribute to interjoint coordination. *Journal of Neurophysiology (Bethesda)*, **79**(6): 2964-2976.

Three nonspiking interneurons are described in this paper that influence the activity of the motor neurons of three muscles of the proximal leg joints of the stick insect. Interneurons were recorded and stained intracellularly by glass microelectrodes; motor neurons were recorded extracellularly with oil-hook electrodes. The motor neurons innervate the two subcoxal muscles, the protractor and retractor coxae, and the thoracic part of the depressor

trochanteris muscle. The latter spans the subcoxal joint before inserting the trochanter, thus coupling the two proximal joints mechanically. The three interneurons are briefly described here. First, interneuron NS 1 was known to become more excited during the swing phase of the rear and the stance phase of the middle leg. When depolarized it excited several motor neurons of the retractor coxae. This investigation revealed that it inhibits the activity of protractor and thoracic depressor motor neurons when depolarized as well. In a pilocarpine-activated animal, the membrane potential showed oscillations in phase with the activity of protractor motor neurons, suggesting that NS 1 might contribute to the transition from swing to stance movement. Second, interneuron NS 2 inhibits motor neurons of protractor and thoracic depressor when depolarized. In both a quiescent and a pilocarpine-activated animal, hyperpolarizing stimuli excite motor neurons of both muscles via disinhibition. In one active animal the disinhibiting stimuli were sufficient to generate swing-like movements of the leg. In pilocarpine-activated preparations the membrane potential oscillated in correlation with the motor neuronal activity of the protractor coxae and thoracic depressor muscle. Hyperpolarizing stimuli induced or reinforced the protractor and thoracic depressor bursts and inhibited the activity of the motor neurons of the retractor coxae muscle, the antagonistic muscle of the protractor. Therefore interneuron NS 2 can be regarded as an important premotor interneuron for the switching from stance to swing and from swing to stance. Finally, interneuron NS 3 inhibits the spontaneously active motor neurons of both motor neuron pools in the quiescent animal. During pilocarpine-induced protractor bursts, depolarizing stimuli applied to the interneuron excited several protractor motor neurons with large action potentials and one motor neuron of the thoracic depressor. No oscillations of the membrane potentials were observed. Therefore this interneuron might contribute to the generation of rapid leg movements. The results demonstrated that the two proximal joints are coupled not only mechanically but also neurally and that the thoracic part of the depressor appears to function as a part of the swing-generating system.

**Brunn, D.E. & Heuer, A. (1998)** Cooperative mechanisms between leg joints of *Carausius morosus*: II. Motor neuron activity and influence of conditional bursting interneuron. *Journal of Neurophysiology (Bethesda)*, **79**(6): 2977-2985.

The activity of the motor neuron pools of the protractor coxae muscle and of the thoracic part of the depressor trochanteris muscle during forward walking in the stick insect was investigated, and a spiking local interneuron, able to produce "endogenous bursting" and innervating both motor neuron pools, was identified. Extracellular recordings of the motor neurons innervating the protractor and the thoracic depressor of front, middle, and rear legs, respectively, were made with oil-hook electrodes from the peripheral nerves n12c and n14a while the animals were walking on a styrofoam treadmill. The corresponding leg movements were registered and phase histograms were created with the software Spike2. Intracellular recordings were made in the neuropile of the metathoracic ganglion with glass electrodes filled with the dye Lucifer yellow. In all three legs measured (front, middle, and rear), both motor neuron pools increased their activity during the swing movement. The increase in the activity of the protractor motor neurons started at the end of the stance approx 100ms before reaching the posterior extreme position (PEP), and the activity of the large-sized depressor motor neurons increased as soon as the tarsus was lifted at the PEP. A local spiking interneuron was identified that excited both motor neuron pools. In 4 of 23 recordings the interneuron started to burst in synchrony with protractor and thoracic depressor motor neurons. During bursting a depolarizing stimulus reinforced and a hyperpolarizing stimulus inhibited the activity of both motor neuron pools. Thus we conclude that the thoracic part of the depressor trochanteris muscle might be a component of the neuromuscular system that shapes the swing movement. The two proximal joints, subcoxal and coxa-trochanter, connected mechanically via the thoracic part of the depressor trochanteris muscle, are also

connected neurally by segmental and intersegmental spiking interneurons (this paper) and by nonspiking local interneurons (see companion paper).

**Cruse, H., Kindermann, T., Schumm, M., Dean, J. & Schmitz, J. (1998)** Walknet: A biologically inspired network to control six-legged walking. *Neural Networks*, **11**(7-8): 1435-1447.

To investigate walking we perform experimental studies on animals in parallel with software and hardware simulations of the control structures and the body to be controlled. Therefore, the primary goal of our simulation studies is not so much to develop a technical device, but to develop a system which can be used as a scientific tool to study insect walking. To this end, the animal should copy essential properties of the animals. In this review, we will first describe the basic behavioral properties of hexapod walking, as they are known from stick insects. Then we describe a simple neural network called Walknet which exemplifies these properties and also shows some interesting emergent properties. The latter arise mainly from the use of the physical properties to simplify explicit calculations. The model is simple too, because it uses only static neuronal units. Finally, we present some new behavioral results.

**Fausto, A.M., Fava, E., Mazzini, M., Cecchetti, A. & Giorgi, F. (1998)** Confocal scanning laser microscopy of the follicular epithelium in ovarioles of the stick insect *Carausius morosus*. *Cell & Tissue Research*, **293**(3): 551-561.

Ovarian follicles of the stick insect *Carausius morosus* were analyzed by confocal laser microscopy and immunocytochemistry with a view to studying cell polarity in the follicular epithelium. Such probes as anti- $\alpha$ -tubulin antibodies and Rh-phalloidin were employed to establish how the follicle cell cytoskeleton changes during ovarian development. Data show that  $\alpha$ -tubulin prevails over the basal end, while F-actin appears more abundant along the apical end of the follicle cells. This finding was further corroborated by immunogold cytochemistry, showing that label along the basal end is primarily associated with microtubules, while that along the apical end is due to follicle cell microvilli interdigitating with the oocyte plasma membrane. A monoclonal antibody specifically raised against a vitellin polypeptide was used to investigate the role the follicular epithelium might play in relation to vitellogenin (Vg) uptake by the oocyte. Data show that under these conditions label is restricted to the intercellular channels of the follicular epithelium, thus providing further support to the notion that Vg enters the oocyte through the extracellular pathway leading from the basement lamina to the oocyte surface. By contrast, the use of a monoclonal antibody raised against a fat-body-derived protein of 85 kDa that is specifically sulfated within the follicle cells provides evidence for the existence of an alternative way of gaining access to the oocyte surface, that is by transcytosis through the follicular cell epithelium. These findings confirm our earlier observations on stick insect ovarioles whereby polarization in the follicular epithelium is primarily addressed to sustain a transcytotic vesicular traffic between opposite poles of the follicle cell of Vg toward the oocyte surface.

**Flook, P.K. & Rowell, C.H.F. (1998)** Inferences about orthopteroid phylogeny and molecular evolution from small subunit nuclear ribosomal DNA sequences. *Insect Molecular Biology*, **7**(2): 163-178.

We determined DNA sequences of SSU rRNA genes in twenty-nine polyneopteran insect species and aligned these with homologues from eight other insects. In a phylogenetic analysis we recovered the classic divisions of Palaeoptera and Neoptera, with the latter divided into monophyletic Paraneoptera and Polyneoptera. The polyneopterans divided into

three lineages: one includes the Grylloblattodea, Dermaptera and Plecoptera, the second contains the Blattodea, and the third (Orthopteroidea sensu Hennig) contains the Embiina, Phasmida, and Orthoptera, in that order. The monophyly of the Orthoptera is supported by the analyses, as is the separation between taxa from its suborders Caelifera and Ensifera. The Caelifera are not always supported as a monophyletic group; the basal Tridactyloidea are separated from the rest of the Caelifera in some analyses. Inside of Tridactyloidea, the Acridoidea, Pamphagoidea, Pneumoroidea and Trigonopterygoidea are always recovered as a monophyletic group. We also examined the basal orthopteran relationships, with the specific aim of assessing the antiquity of the Ensifera. Character state reconstructions indicated that the ancestral ensiferan sequence is very similar to the ancestral orthopteran sequence. However, likelihood ratio tests rejected the null hypothesis of a molecular clock and we conclude that a change in substitution rate has occurred within the Orthoptera and several of the other polyneopteran orders. Similar observations have been made in holometabolous insects, suggesting that variation in substitution rate is a general feature of insect nuclear rRNA evolution.

**Giorgi, F., Falleni, A., Cecchettini, A. & Gremigni, V. (1998)** A fat body derived protein is selectively sulfated in the stick insect ovary by transcytosis through the follicular epithelium. *Biology of the Cell (Paris)*, **90**(2): 183-197.

With the onset of vitellogenesis, the follicular epithelium overlying the oocyte in stick insect ovarioles becomes highly polarized and patent by formation of wide intercellular spaces. The aim of the present study was to provide experimental support to the notion that the follicular epithelium in this insect species may be involved in transcytosis. Data demonstrate that the follicular epithelium carries out sulpho-conjugation of a 85 kDa fat body derived protein by allowing it to transit from one cell pole to another. Along the basal end, follicle cells branch into a number of cytoplasmic finger-like projections. At the opposite end facing the oocyte they taper off into lance-head shapes. Different vesicular elements are evident at both these extremities. In vivo exposure to horseradish peroxidase shows that the vesicular elements present along the apical end provide an endocytic entry. In contrast, those present along the basal end are labeled with sodium (35S)-sulphate, suggesting that they may be exocytic vesicles containing a sulpho-conjugated secretory product. In vivo exposure to sodium (35S)-sulphate caused radioactivity to appear over the Golgi apparatus and some nearby vesicles of the follicle cell cytoplasm, including the exocytic vesicles. The intracellular pathway of the follicle cells was also examined by immunogold labeling using a monoclonal antibody raised against a 85kDa fat body derived protein. Under these conditions, gold particles were consistently detected over the Golgi apparatus and the vesicular elements lying along both poles of the follicle cell membrane. Based on this evidence, it is concluded that follicular cells in stick insect ovarioles are endowed with the ability to undergo transcytosis by providing an endocytic entry along the apical end and by releasing exocytically a sulpho-conjugated 85kDa protein along the baso-lateral domain of the follicle cell membrane.

**Hennemann, F.H. (1998)** Ein Beitrag zur Kenntnis der Phasmidenfauna von Sulawesi. *Mitteilungen aus dem Museum Naturkunde Berlin, Zool. Reihe*, **74**(1): 95-128.

In this paper a collection of phasmids from Sulawesi (= Celebes) conducted by the author in August 1995 including material which has been sent to the author by native suppliers is studied. Three new species (*Phasma marosensis*, *Nescicroa albilateralis* & *N. nigra*) and three new subspecies (*Pseudostheneboea aberrans emiri*, *Nescicroa heinrichi rufescens* & *Hermagoras foliatus celebensis*) are described and illustrated. The male and egg of *Nescicroa tenella* (Günther, 1935), the female and egg of *Baculum globosicaput* (Brunner,

1907), the female of *Asceles rufescens* (Redtenbacher, 1908) and the eggs of *Nescicroa poeciloptera* (Rehn, 1904) and *Carausius insularis* (Kirby, 1896) as well as the male of *Hemiplasta styligera* (Bates, 1865) are described and illustrated for the first time. A type species is selected for *Pseudostheneboea* Carl. A catalogue is provided for all stick and leaf insects recorded or described from Sulawesi, including information on their synonymy and known localities on the island. *Eubias athlius* Günther, 1935 is listed as a junior synonym of *Moritasgus stresemanni* Günther, 1935, *Dagys balia* Günther, 1935 as a junior synonym of *Baculum globoscaput* (Brunner, 1907), the genus *Aruanoidea* Redtenbacher, 1908 as a synonym of *Necroscia* Audinet-Serville, 1838, *Datames* Stål, 1875, and *Hermagoras* Stål, 1875 is reinstated with *foliopeda* (Olivier, 1792) being selected as the type species. *Pylaemenes spinivestris* (Bates, 1865) and *P. occipitalis* (Kaup, 1871) are listed as junior synonyms of *P. coronatus* (de Haan, 1842) which remains with *P. oileus* (Westwood, 1859) and *P. pusillus* (Redtenbacher, 1908 [*sic*]) the only species in the genus.

[Editor's note: In the above paper, the selection of *foliopeda* as the type of *Hermagoras* is not valid since *Lonchodes personatus* Bates, 1865 was previously selected by Kirby (1904, *A Synonymic Catalogue of Orthoptera* 1: 322)]

**Hennemann, F.H. & Conle, O.V.** (1998) Das Männchen von *Parapachymorpha quadrispinosa* Hennemann, Gehler & Conle (Phasmatodea: Parapachymorphinae). *Entomologische Zeitung*, 108(6): 259-260.

The recently discovered male of *Parapachymorpha quadrispinosa* is described and illustrated.

**Herwaarden, H.M.C. van** (1998) A guide to the genera of stick- and leaf- insects (Insecta: Phasmida) of New Guinea and the surrounding islands. *Science in New Guinea*, 24(2): 55-114.

190 species of stick- and leaf- insects in 58 genera are known to occur in New Guinea and the surrounding islands. This paper, based on a literature study, provides keys to identify species up to their genus following the current accepted classification. For each genus a summarised description and where available a schematic reproduction of an existing illustration of a representative is given, as well as a list of species occurring in the subregion. For each species the reference to the original description including page number, sex of the type material, illustrations, and the locations of the type material are given. Where applicable, references to first descriptions of the opposite sex and synonyms followed by the reference containing the nomenclatural act are included. For each species a general geographic distribution is given. In addition, a gazetteer has been compiled including all known localities of type and non-type specimens reported in the literature from the New Guinea subregion. Technical terms used are described in the glossary.

**Kevan, D.K.M. & Vickery, V.R.** (1997) An annotated provisional list of non-saltatorial orthopteroid insects of Micronesia, compiled mainly from the literature. *Micronesica*, 30(2): 269-353.

The general literature relating to the non-saltatorial orthopteroid insects of Micronesia and certain nearby groups of smaller islands of Oceania is reviewed. The species known to occur in this region are listed according to order and family. Most of the information is based on literature records which have been updated, corrected and commented upon where appropriate. A few new records are included. The orders considered are Dictyoptera (including Blattodea, Mantodea and Termitodea (Isoptera)), Zoraptera (none recorded), Embioptera, Dermaptera and Cheleutoptera (Phasmatodea).

**Lelong, P. & Langlois, F.** (1998) *Lamponius lethargicus* n.sp., *Pseudobacteria donskoffi* n.sp. et *Paraclonistra nigromala* n.gen, n.sp.: trois nouveaux Phasmes de Guadeloupe (Orthoptera, Phasmatodea). [In French]

Description and illustration of three new Phasmatodea from Guadeloupe: *Lamponius lethargicus* n.sp., *Pseudobacteria donskoffi* n.sp. et *Paraclonistra nigromala* n.gen, n.sp. A new genus is established for this last. The descriptions of the eggs and the biology are also explained.

**Mantovani, B.** (1998) Satellite sequence turnover in parthenogenetic systems: The apomictic triploid hybrid *Bacillus lynceorum* (Insecta, Phasmatodea). *Molecular Biology and Evolution*, 15(10): 1288-1297.

In the genus *Bacillus* (Insecta, Phasmatodea) the Bag320 satellite DNA family is present in the bisexual *B. grandii* and in the related automictic nonhybrid *B. atticus*; it is lacking in the other bisexual taxon of the genus, *B. rossius*. This family of highly repeated sequences was analyzed for 11 populations of the apomictic triploid hybrid *B. lynceorum*. In the neighbour-joining dendrogram, *B. lynceorum* nucleotide sequences distribute, regardless of geographical origin, among two clusters, one also including all clones of the three *B. atticus* races, and the other including sequences of the *B. grandii grandii* subspecies. Thus, *B. lynceorum* is a trihybrid taxon: as the molecular approach definitively demonstrates, it embodies one haploid complement each of both *B. grandii grandii* and *B. atticus*, which must be added to that of *B. rossius*. The contribution of the latter species has already been assessed on karyological and allozymic grounds. A statistical analysis performed on p-distances shows that for the parental taxa, nucleotide substitution values are of comparable magnitudes at the population level but differ at the subspecific level, being higher for the bisexual taxon. In the apomictic hybrid, *atticus*- and *grandii grandii*-like sequences coexist with significantly different p-distance values. For three clones, the nucleotide compositions at the diagnostic loci suggest that gene conversion can occur between *atticus*- and *grandii grandii*-like monomers. On the whole, this supports bisexuality as a driving force in variant fixation and suggests that in *Bacillus*, different gametogenetic processes and different origins of the unisexuals are mirrored in genomic turnover rates of satellite DNA.

**Masetti, M., Cecchetti, A. & Giorgi, F.** (1998) Mono- and polyclonal antibodies as probes to study vitellin processing in embryos of the stick insect *Carausius morosus*. *Comparative Biochemistry and Physiology B* 120(4): 625-631.

During embryonic development, insect vitellins (Vt) are degraded by limited proteolysis to yield a number of lower-molecular weight polypeptides. The aim of the present study was to identify these polypeptides in the embryo and to verify how they relate to Vt polypeptides deposited in the oocyte during vitellogenesis. To this end a panel of poly- and monoclonal antibodies (Pab, Mab) was raised against Vt polypeptides and employed by immunoelectrophoresis and immunoblotting on embryos belonging to different developmental stages. Through this approach three major staining patterns were observed. First, Mab 4 reacts with both polypeptides B1 and E20, suggesting that polypeptide B1 is gradually trimmed to yield polypeptide E20 in late embryos. Second, Mab 12 is specific for polypeptide A3 which is retained unchanged throughout embryogenesis. Third, Pab anti-A2 and Mab 13 show that polypeptide A2 is processed to yield polypeptide E9 through limited proteolysis. In conclusion, the staining patterns reported in this study show that Vt polypeptides in developing embryos of the stick insect *Carausius morosus* undergo at least two major processing events concerning polypeptides B1 and A2.



**Moon, T.Y. & Yoon, I.B.** (1997) List of Blattaria, Mantodea and Phasmida deposited in the Korean Entomological Institute. *Entomological Research Bulletin*, **23**: 55-57.

Blattaria, Mantodea and Phasmida accumulated in Korean Entomological Institute were examined and classified. A small number of specimens in good condition were carefully chosen and registered as vouchers for future works, and preserved in separate boxes. Identified are 6 species belonging to 3 genera and 2 families in Blattaria, 4 species belonging to 3 genera and 1 family in Mantodea, and 3 species belonging to 3 genera and 3 families in Phasmida amongst the known fauna in Korea. Therefore, the species kept in the Korean Entomological Institute represent respectively 87.5% in Blattaria, 100% in Mantodea, and 60% in Phasmida of the species diversity recorded so far in Korea.

**Sandoval, C., Carmean, D.A. & Crespi, B.J.** (1998) Molecular phylogenetics of sexual and parthenogenetic *Timema* walking-sticks. *Proceedings of the Royal Society of London Series B Biological Sciences*, **265**(1396) 589-595.

We inferred a phylogeny for the walking-stick genus *Timema* (Insecta: Phasmatoptera) using mitochondrial DNA sequence, and we used the phylogeny to infer temporal patterns of speciation and the evolutionary history of parthenogenesis. Maximum parsimony, neighbour-joining and maximum-likelihood analyses of 660 base pairs (bp) of cytochrome oxidase I (COI) yielded phylogenies that were well resolved and topologically identical or very similar. Application of an insect molecular clock for COI suggests that the genus originated in southern California, northern Mexico or Arizona about 20 million years ago and underwent a burst of speciation 1.5-3 million years ago during the uplifts of the Sierra Nevada, Coast, and Transverse Ranges. The phylogeny indicates that the three parthenogenetic lineages of *Timema* have arisen independently and are each closely related to morphologically indistinguishable or similar sexual species. Each of the three lineages exhibits an allopatric or parapatric, and more northerly, distribution with regard to their closest sexual relative. COI divergence levels between each of the three parthenogens and their closest sexual relative suggest ancient origins of parthenogenesis, 1.5-3 million years ago, that may coincide with the extensive glaciation that formed the North American ice sheets.

**Scali, V.** (1996) Description of two incipient species of the stick insect complex *Leptynia attenuata* Pantel: *L. montana* n.sp. and *L. caprai* n.sp. *Redia*, **79**(2): 123-136. [In Italian]

Electrophoretic analysis on several gene-enzyme systems and chromosomal investigations have revealed the existence of three different population groups within the Iberian stick insect *Leptynia attenuata*. The sharp genetic distance values (ranging from 0.38 to 1.09) and the karyotype differentiations (with  $2n=36$ , XX/XY, 38/37, XX/XO and 40/39, XX/XO, respectively) are not paralleled by fully diagnostic morphological characters: SEM analyses on bodies of both sexes revealed some differentiation trends but failed to trace clear-cut characters for the three groups. Ootaxonomy gave only two quantitative discriminating characters. All this is thought to define a case of incipient speciation, with genetic and chromosomal features ahead of the morphological ones in the process. In view of the parapatric distribution, karyotype evolution and gene-flow interruption, it is anyhow maintained that the three groups reached the species level through a stasipatric mechanism of cladogenesis. Their formal description is then provided: *L. attenuata*, sensu stricto includes the Portuguese populations, *L. montana* n.sp. those of the Sistema Central mountains and *L. caprai* n.sp. those collected on the hills south of Toledo. By comparing karyotypic composition of the three taxa it is speculated that *L. caprai* is the ancestral taxon and that Robertsonian fusions, together with inversions, played a major role in the microevolution of Iberian *Leptynia*, as it occurred in the Australian genus *Didymuria*.

Sellick, J.T.C. (1998) The micropylar plate of the eggs of Phasmida, with a survey of the range of plate form within the order. *Systematic Entomology*, **23**(3): 203-228.

Eggs of Phasmida are characterized by the presence of a micropylar plate system. The nature of this plate is discussed and the relevance of differences in plate structure to the taxonomy of the order is considered. A survey is made of the range of plate structure throughout the order, covering the external plate structure of 384 species and the internal plate structure of 179 species in forty of the forty-four subgroups of the order.

Seow-Choen, F. (1998) *Pharnacia chiniensis* n.sp., A new species of stick-insect from Peninsular Malaysia (Phasmida: Phasmatidae). *Serangga*, **3**(2): 183-189.

*Pharnacia chiniensis*, a new species of stick-insect from Tasek Chini, Pahang, Peninsular Malaysia is described along with foodplants and aspects of its natural history.

Stein, W. & Sauer, A.E. (1998) Modulation of sensorimotor pathways associated with gain changes in a posture-control network of an insect. *Journal of Comparative Physiology, A. Sensory Neural and Behavioral Physiology*, **183**(4): 489-501.

The resistance reflex in the femur-tibia joint of stick insects shows a great variability in its strength which allows the animal to adapt to different environmental requirements. This paper presents the modulations in the neural reflex pathways which occur during an increase of the gain of the resistance reflex after tactile stimulation. The gain increase was associated with a short-term, reversible increase of slow extensor tibiae depolarization. Because membrane properties like resting potential and input resistance of this motoneuron remained unchanged during the gain changes, the increase of depolarization appeared to result from an increase of stimulus-related inputs and thus was due to modulations of the premotor neuronal network containing afferents of the femoral chordotonal organ and interneurons. However, no changes of spike activity of sensory neurons and amount of their presynaptic inhibition was found during gain changes. In contrast, recordings from different types of identified premotor non-spiking interneurons demonstrated a correlation between the amplitude of stimulus-related inputs to particular nonspiking interneurons and gain changes, while other nonspiking interneurons appeared unaffected. Thus, an increase in gain of the resistance reflex must be due to a specific weighting of synapses between sense organ and particular non-spiking interneurons.

Tilgner, E.H. & McHugh, J.V. (1997) *Diaphemora carolina* Scudder (Phasmatodea: Heteronemiidae), First description of the female form and new range records. *Transactions of the American Entomological Society*, **123**(3): 191-196.

This paper provides the first description of the female of *Diapheromera carolina*, comments concerning the taxonomic placement of this species and new locality records expanding the known range to the states of Georgia and South Carolina.

### Erratum

The captions to figures 1 & 2 on page 27 of *Phasmid Studies*, 7(1) were incorrect. The correct captions should read:

**Figures 1 & 2.** (Life-size reproduction of Westwood, 1843, plate 61)

1. Female *Cranidium gibbosum* (Burmeister).
2. Female *Paracranidium pumilio* (Westwood).