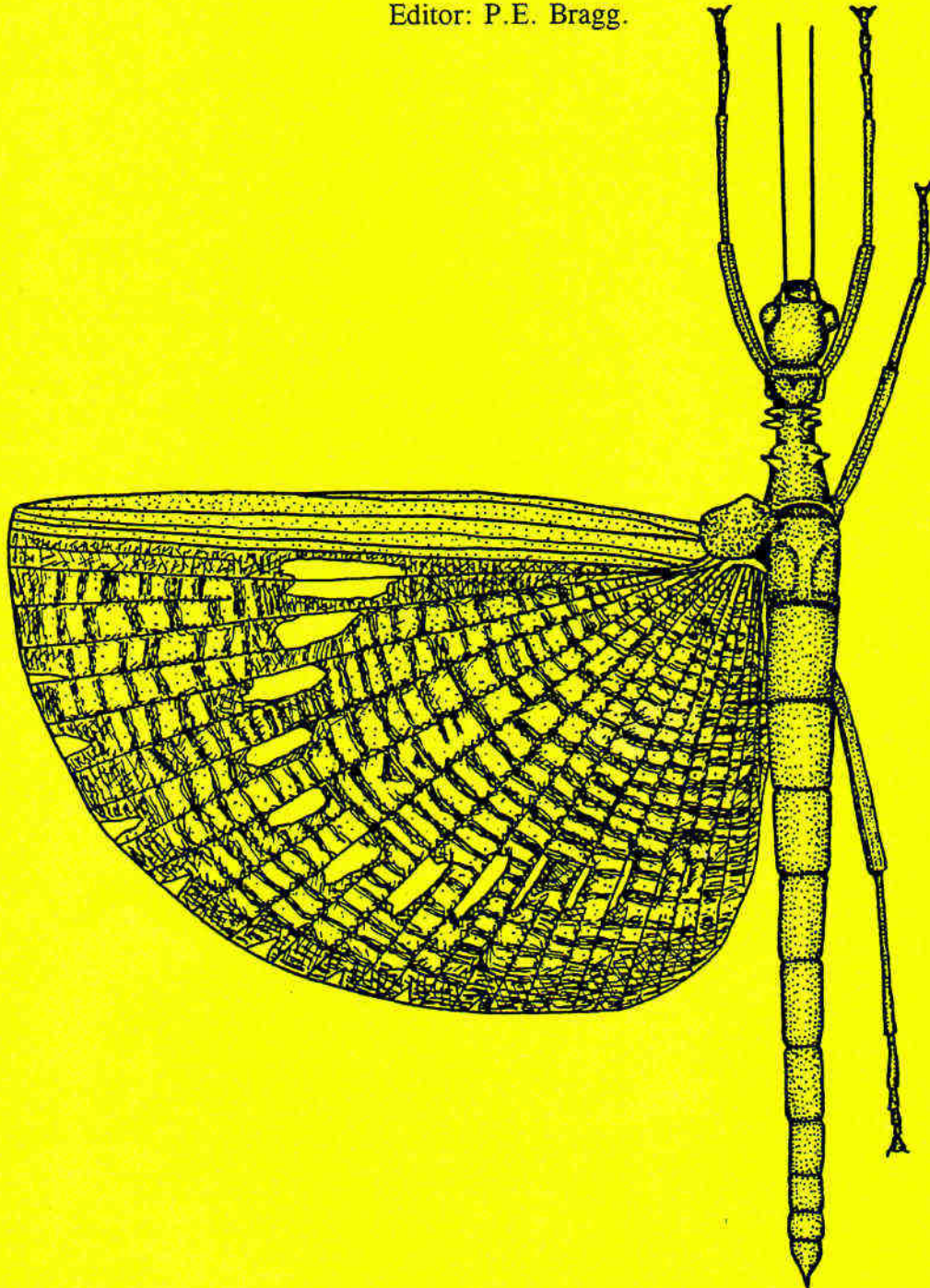


# PHASMID STUDIES.

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The Phasmid Study Group (PSG) was formed in 1980 to foster the study of phasmids. The group currently has several hundred members worldwide. The membership ranges from young children to professional entomologists. The PSG holds regular meetings and presents displays at all the major entomological exhibitions in the U.K. The PSG places emphasis on study by rearing and captive breeding and has a panel of breeders who distribute livestock to other members. The PSG produces two publications which are issued free to members.

*The Phasmid Study Group Newsletter* is issued quarterly and contains news items, livestock information, details of exhibitions and meetings, and a variety of short articles on all aspects of phasmids.

*Phasmid Studies* is issued biannually, in June and December. It contains longer articles on all aspects of phasmids, with an emphasis on natural history, captive breeding, taxonomy, and behavioural studies. Each issue contains abstracts of papers from other recent publications.

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Details of *Phasma* may be obtained from **J. van Gorkom, Stadhouderslaan 32, 1213AH Hilversum, Netherlands.**

### Publication date

*Phasmid Studies*, 6(2) was published on 13th March 1998. Due to unanticipated delays it was not published in January despite this date being given on the front cover and on pages 42 and 45.

# 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°. 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.

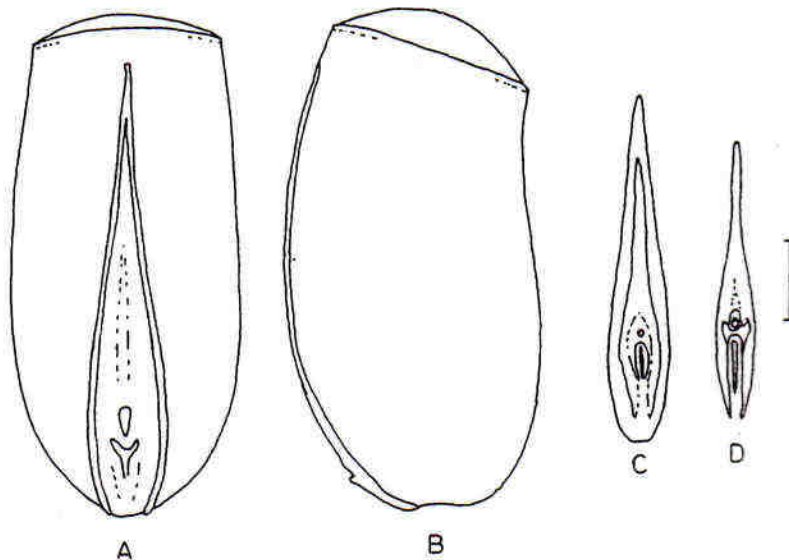


Figure 1. *Agathemera crassa*. A. dorsal, B. Lateral, C. Full internal plate, D. Internal plate with outer area obscure, giving false "open" appearance.

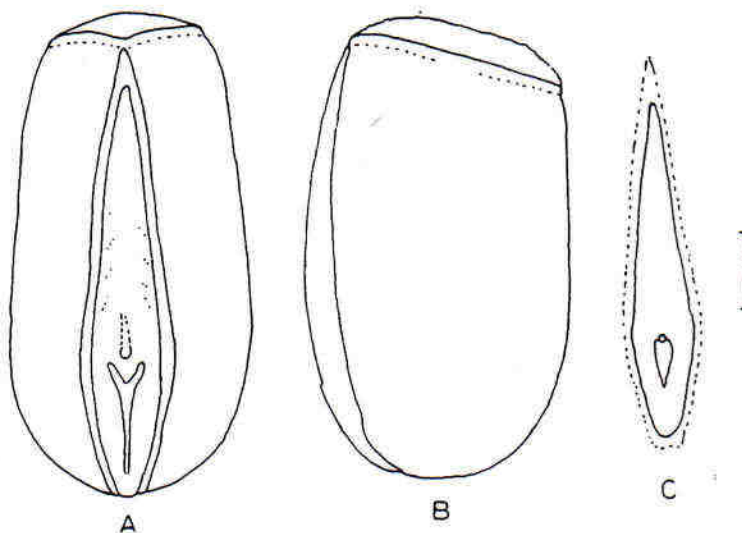


Figure 2. *Agathemera elegans*. A. Dorsal, B. Lateral, C. Internal plate.

***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.  $-20^{\circ}$ .

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.

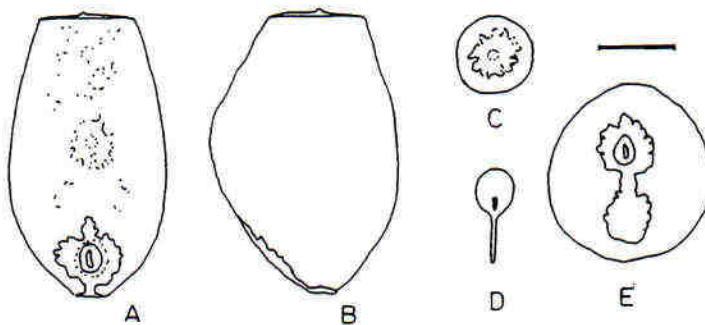
***Bacunculus* Burmeister (tribe Bacunculini)**

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 *largo/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.  $0^{\circ}$ .

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.

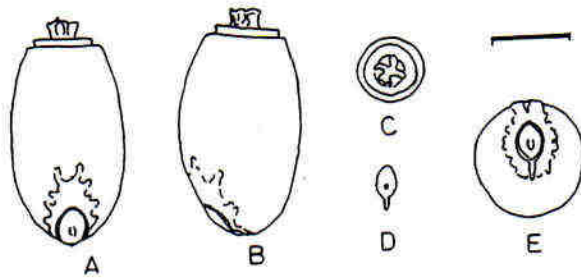


Figure 4. *Bacunculus granulicollis*. A. Dorsal, B. Lateral, C. Operculum, D. Internal plate, E. Posterior.

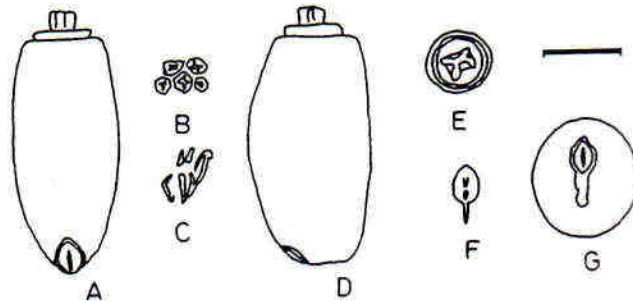


Figure 5. *Bacunculus phyllopus*. A. Dorsal, B. & C. Types of surface sculpturing, D. Lateral, E. Operculum, F. Internal plate, G. Posterior.

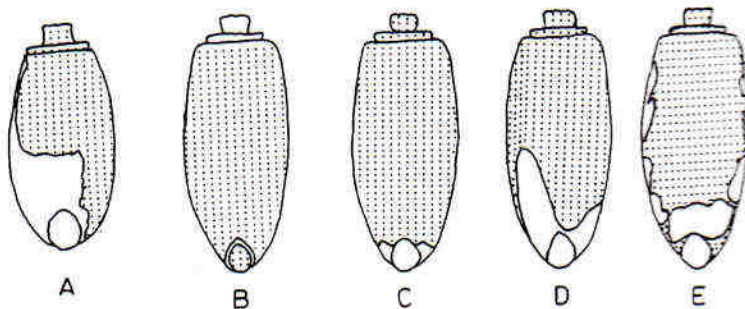


Figure 6. Colour patterning in *Bacunculus*: A. *B. granulicollis*, B-E. *B. phyllopus*.

***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.  $-3^{\circ}$ .

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.

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# 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: *Neoclydes 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.
- Pseudodiactynis obscura* Redtenbacher, 1908: 552. Holotype ♂, Java: Tjibodas, i.[18]94, Siboga exp[edition]. Valid name: *Orxines macklottii* (de Haan, 1842: 126) New synonym. As *P. obscura* is the type species of the genus *Pseudodiactynis* Redtenbacher (by monotypy), this genus becomes a new synonym of the genus *Orxines* 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; RMT0: 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 Gebiet", 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.

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# *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.

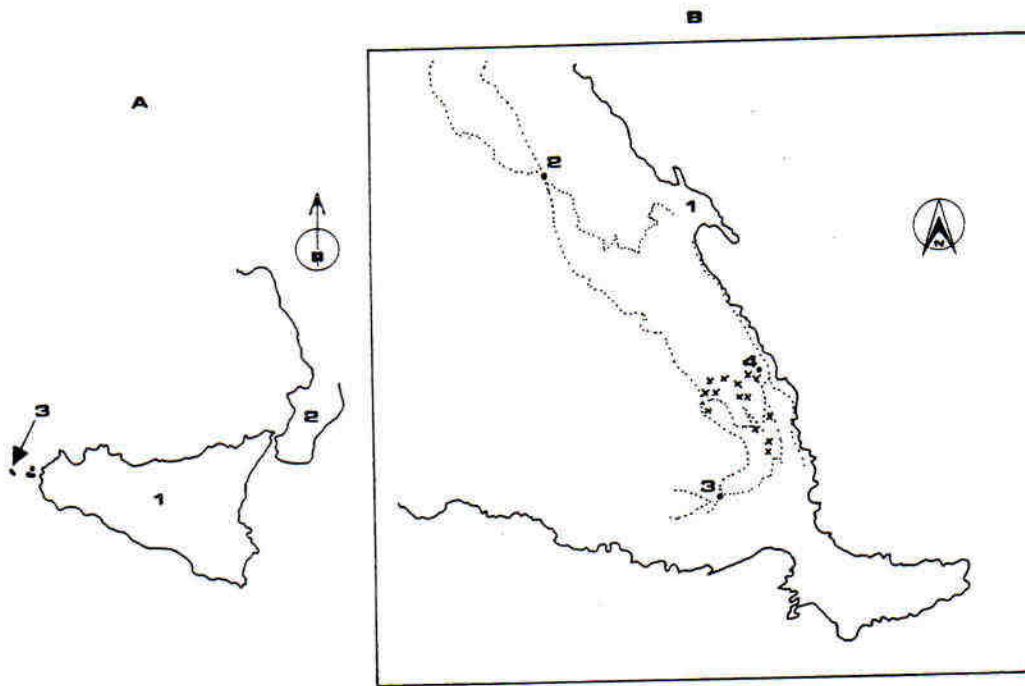


Figure 1. a) Location of Marettimo Island: 1 = Sicily, 2 = Calabria, 3 = Marettimo.  
b) South-eastern Marettimo. 1 = Inhabited resort, 2 = Case Romane, 3 = Carcaredda,  
4 = Electricity Station, X = Findings of *Bacillus grandii maretimi*.

## *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).

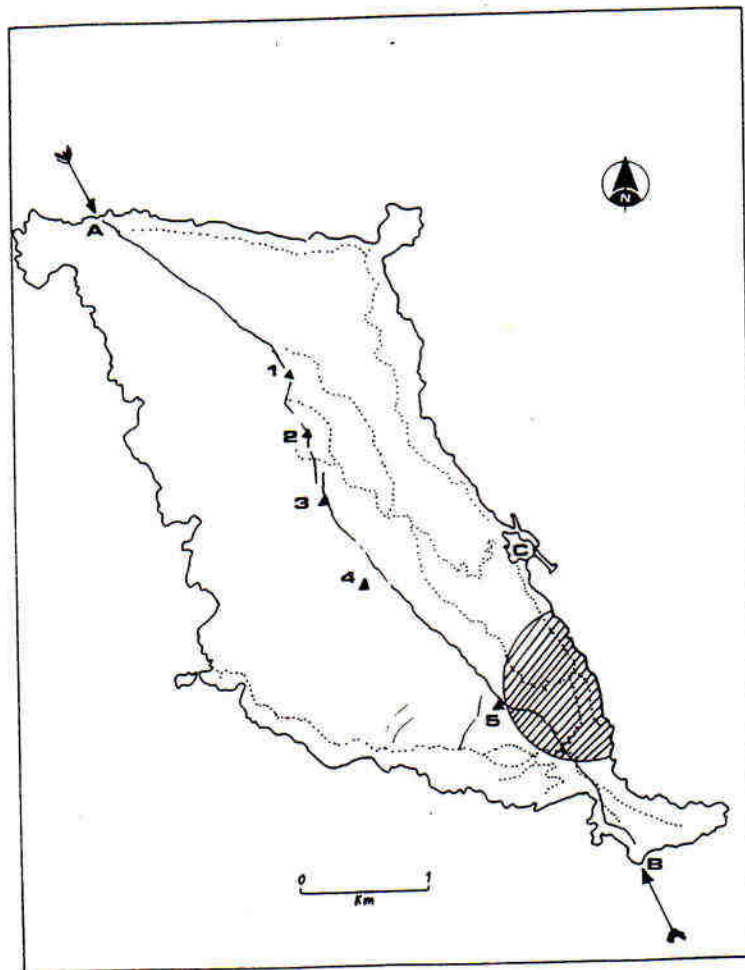
Several characteristics were noted that distinguished these new populations from the original one in south-eastern Sicily. Such characteristics led up to the description of the subspecies *B. grandii benazzii* (along the Trapanese coast and on the island of Levanzo) and *B. grandii maretimi* only on 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).

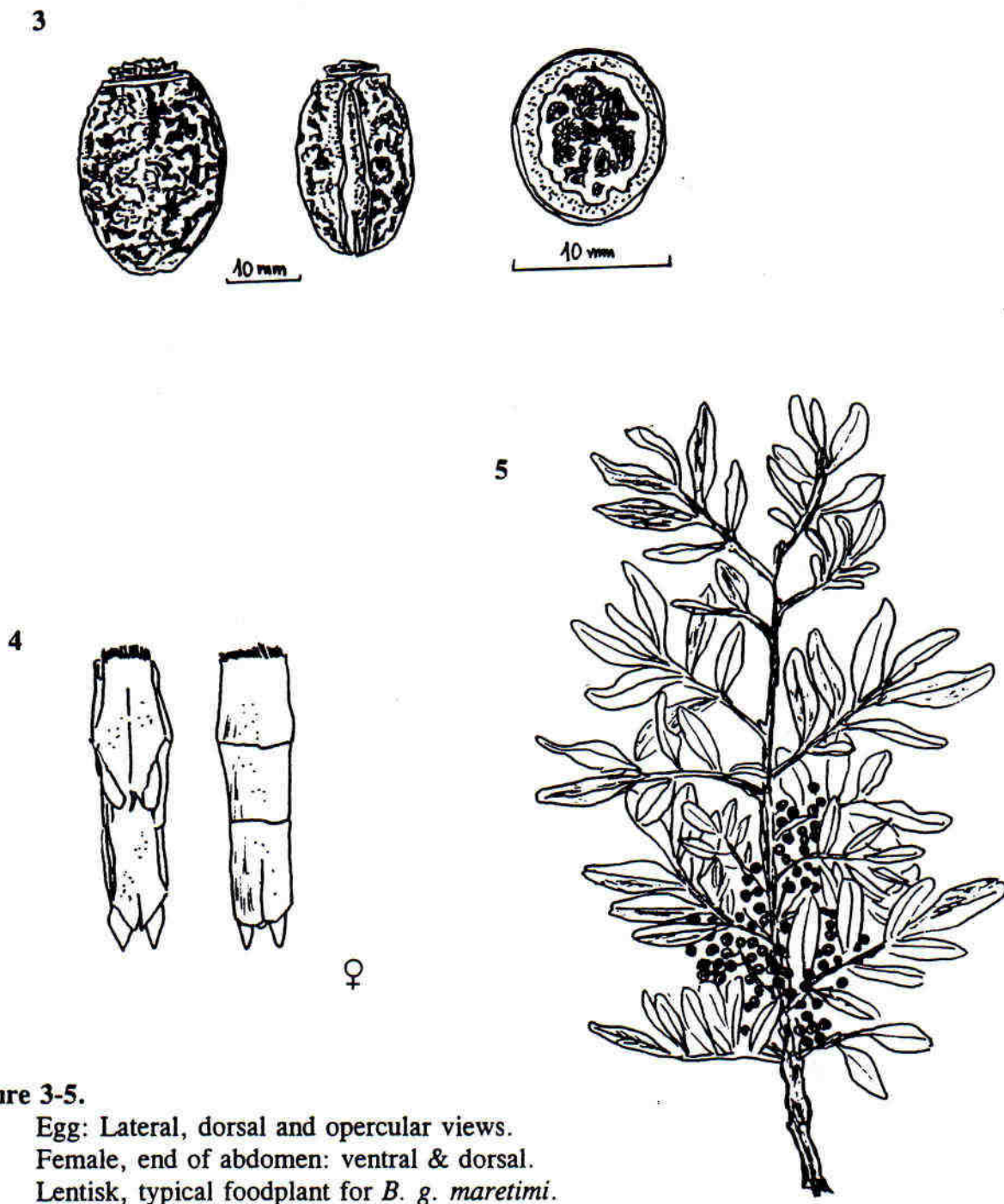


Figure 3-5.

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.

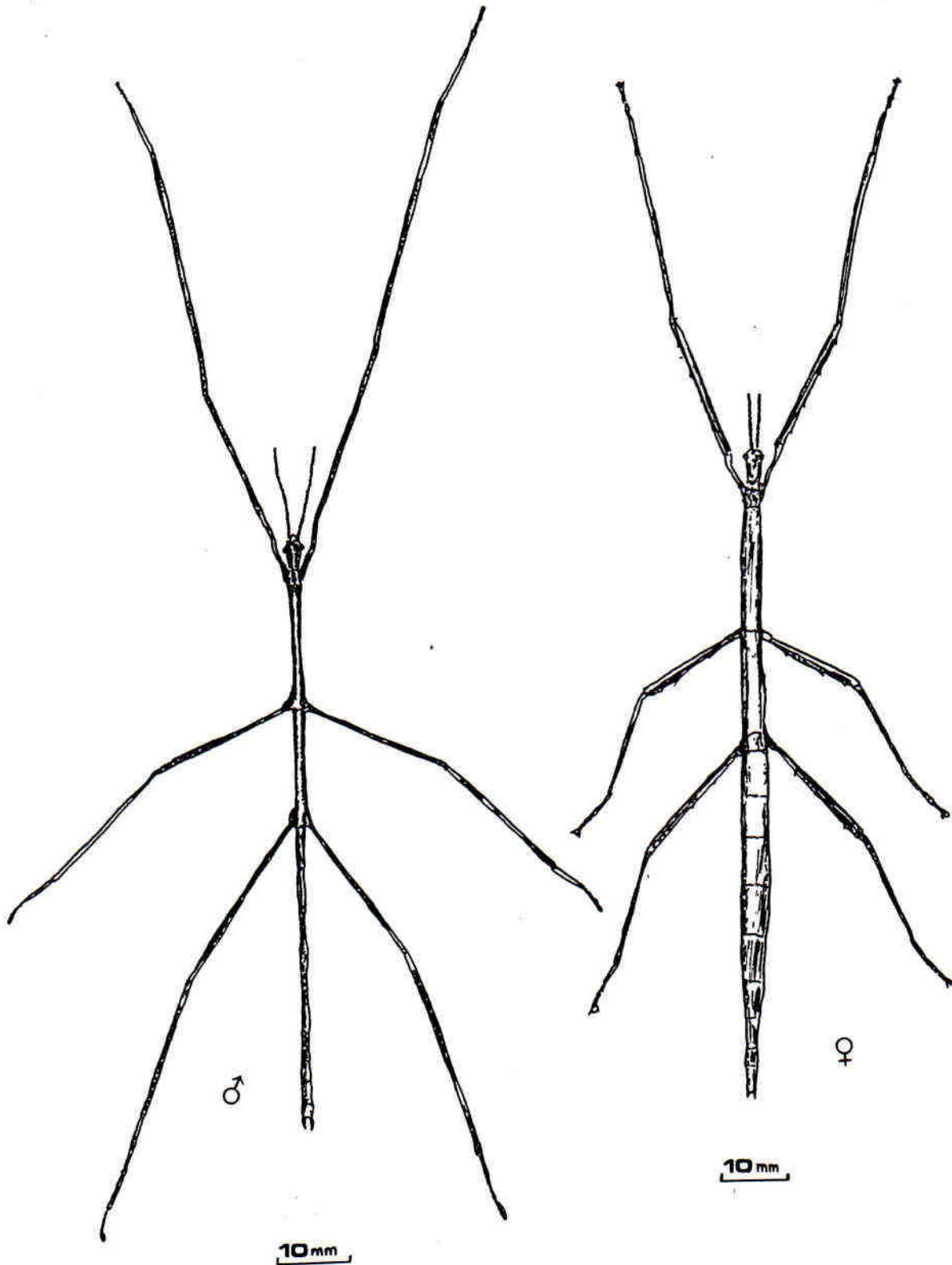


Figure 6. Adult male and female *Bacillus grandii maretimi*.



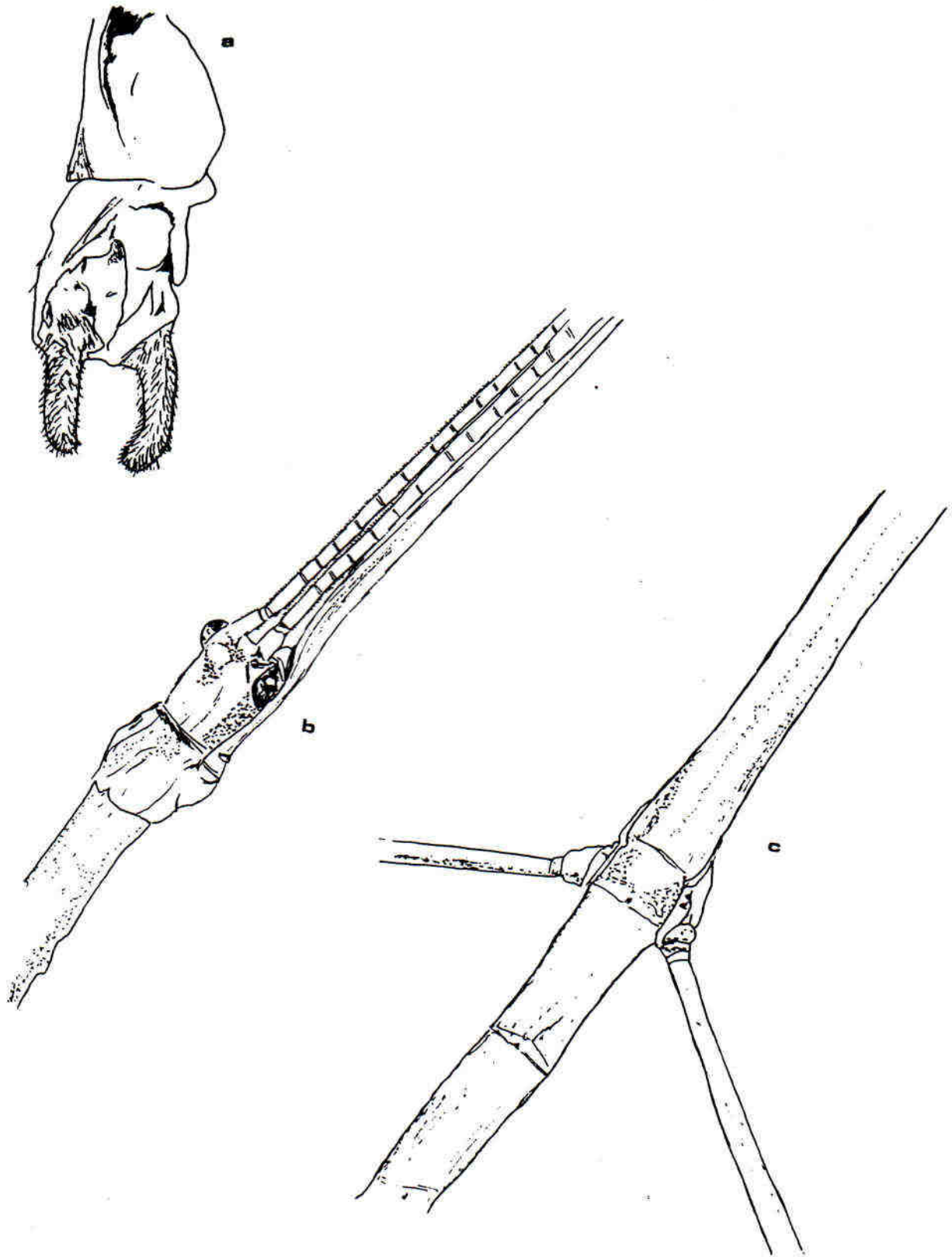


Figure 7. Male.  
a) Ventral view of abdomen; b) Head; c) Mid legs.

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.

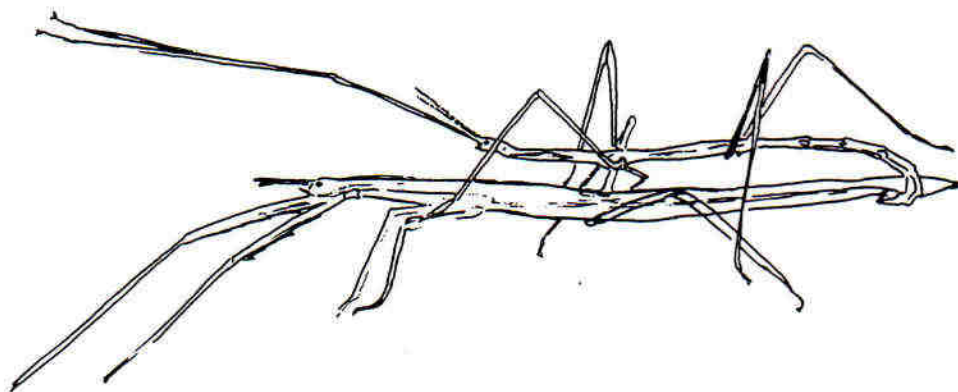


Figure 8. Mating pair of *Bacillus grandii maretimi*.

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.

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

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## 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

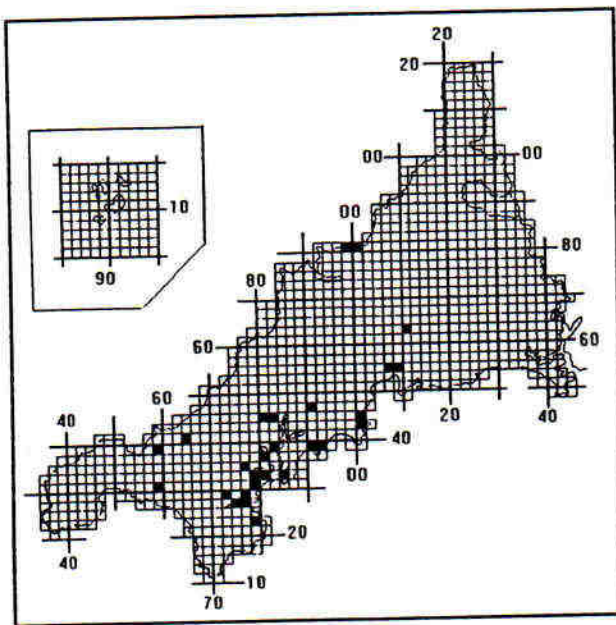
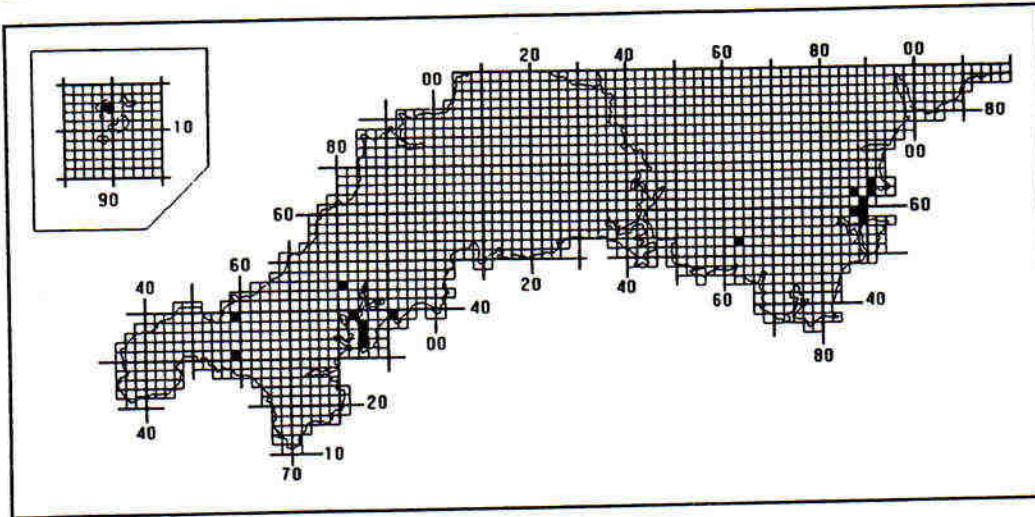
There have been a considerable variety of garden plants mentioned, and it seems likely that these insects are widely polyphagous here. Since eggs are simply dropped below the plant on which the parent is feeding, next year's nymphs are most likely to climb onto that same plant when they hatch out. Were 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 Treviso, 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.
- HELDFORD 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 adaptation). 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: Claddananure 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.

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- 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.

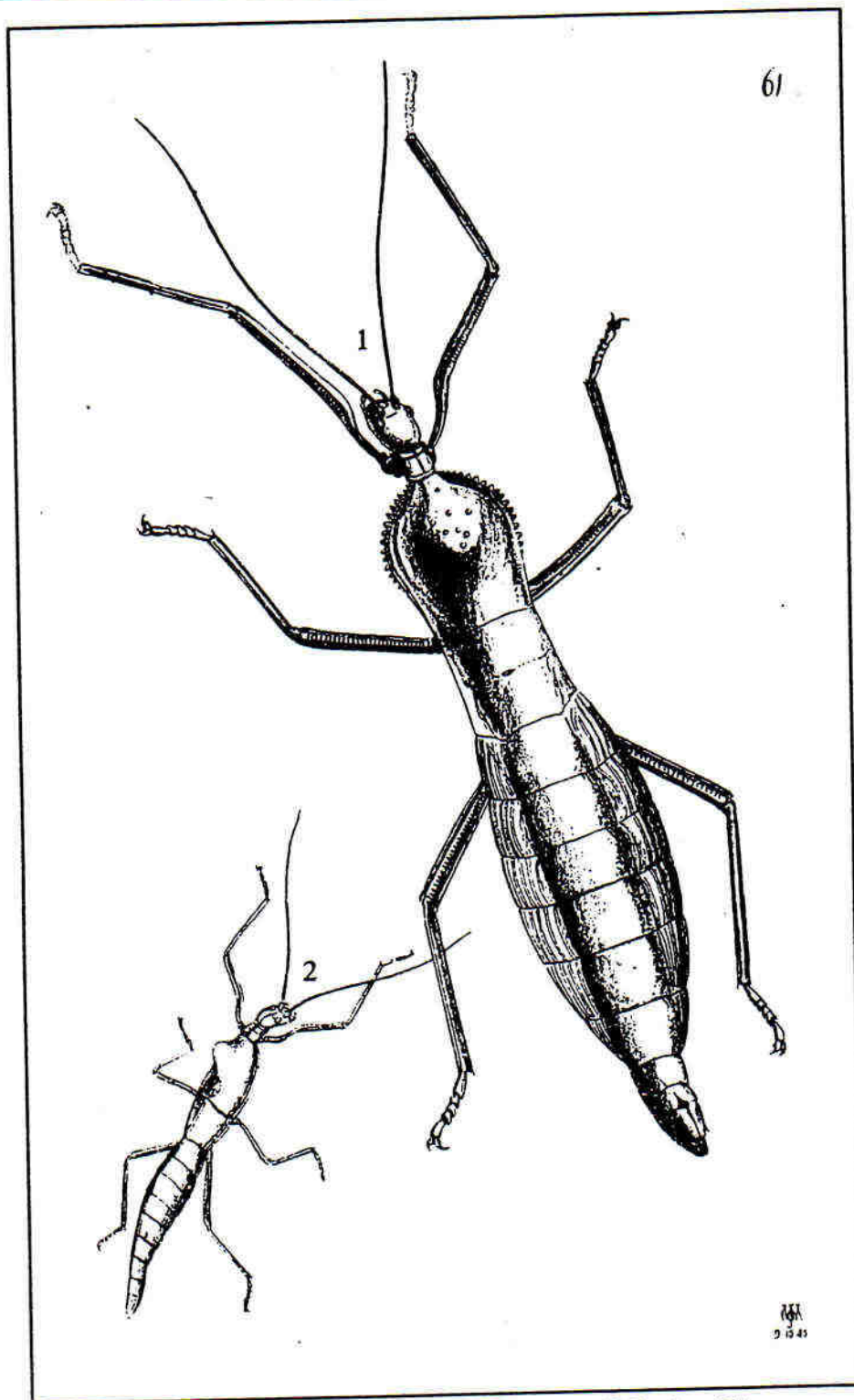
The Registration information for 1847-62 includes 26 Orthoptera, 'Purchased of Mr Gosse'. Other entries indicate that this is a Mr P.H. Gosse.

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

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.

*Monandroptera 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.

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# 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 borneeensis*, *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 (Phasmatodea: 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 (Phasmatodea: 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. oreithrepe* 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.

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