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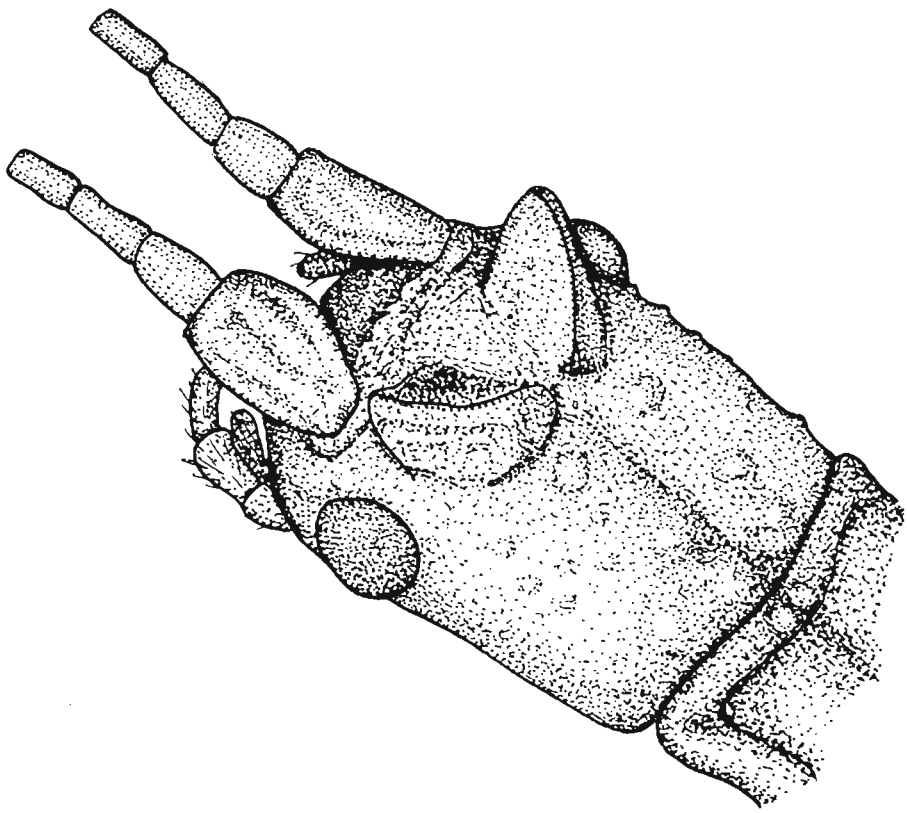

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Contents

Cover illustration: Female *Phenacephorus spinulosus* (Hausleithner) by P.E. Bragg.

The World of Stick and Leaf-Insects in Books, some general remarks.

Paul D. Brock, "Papillon, 40, Thorndike Road, Slough, SL2 1SR. UK.

Key words
Stick and Leaf Insects, Books.

Book hunting can be a very enjoyable pursuit, particularly when the unexpected turns up. In recent years the increased interest in keeping stick and leaf-insects as pets has helped to increase printed matter on these insects, and these books are generally easy to track down. However, the pursuit becomes more interesting when a book is located which is not widely known for its content on phasmids. The book is even more fascinating if the content includes an exciting tale or two about the insects!

The serious book collector, including myself, will search for volumes such as Westwood's excellent book published in 1859. The black and white plates are magnificent and one can easily track down the type specimens in the Natural History Museum and Oxford University Museum collections. Some years ago I paid a lot of money for a mint condition Westwood and have since purchased a bound volume containing just the plates. So far, an original of Brunner and Redtenbacher's monograph (1906-08) has eluded me, despite searches all over Europe. However, there is always hope for the true book collector that one day he will come across a dust covered volume in a bookshop. Gray's 1835 Synopsis (48 pages, no illustrations) is just too easy to find; I know a source with several copies in virtually mint condition!

Before I deal with some of the tales in a few of the books tracked down, let's firstly look at some recent books, which have followed Brunner and Redtenbacher's monograph. Most serious phasmid enthusiasts will possess most of these:

Anon. (1970) *Rearing Stick Insects.* AES Leaflet No. 30. PB, 20 pages. A basic breeders' guide; replaced by Brock (1985), although a slightly enlarged reprint was sold in between.
Clark, J.T. (1974) *Stick and Leaf Insects.* B. Shurlock & Co., Winchester. 65 pages. A useful introduction to phasmids (including rearing 11 species) which has long been out of print. Originally published in hardback, a paperback followed before copies were on sale in some remainder bookshops. It sometimes turns up in bookdealers' lists, with inflated prices due to the demand.
Brock, P.D. (1985) *The Phasmid Rearer's Handbook (Stick Insects and Leaf Insects).* AES volume 20, PB 41 pages. A popular breeder's guide, out of print and replaced by my 1992 updated version. Odd copies are still around, I saw one recently at Dillon's Bookshop in Watford.
Floyd, D. (1987) *Keeping Stick Insects.* Deanprint Ltd, Cheadle Heath. PB, 60 pages. A basic beginner's guide, covering seven species. Self published book by a trader, it includes colour photographs.
Mazzini, M. & Scali, V. (eds) (1987) *Stick Insects: Phylogeny and Reproduction. Proceedings of the 1st International Symposium on Stick Insects, Siena, Italy, September 30th - October 2nd 1986.* University of Siena and University of Bologna, Italy. 224 pages. It includes a wide variety of papers, two by PSG members: Clark Sellick (eggs) and Brock (British stick insects).
Byron, M. (1988) *How to keep Stick Insects.* Fitzgerald Publishing, London. PB 21 pages. A basic beginner's guide which discusses eight species. The text is too preoccupied with elaborate descriptions of each species. Out of print, but a few copies are still around.
Peltier, M. & others. (1989) *Gespenstschrecken.* Naturmuseum Olten. 25 pages (in German). I only have a photocopy of this well illustrated booklet.
Brock, P.D. (1991) *Stick-Insects of Britain, Europe and the Mediterranean.* Fitzgerald Publishing, London. 50 pages. A comprehensive, illustrated account, including keys to species, maps, habitat

and foodplant drawings. Attractive colour cover.
Salmon, J.T. (1991) *The Stick Insects of New Zealand.* Reed Books, New Zealand. 124 pages. A magnificent study, with beautiful watercolours of adults.
Alderton, D. (1992) A Step-by-Step Book about Stick Insects. TFH Publications, worldwide. PB 64 pages. A basic beginner's book with a lot of colour photographs which vary in quality. Part of the TFH series widely available in pet shops.
Brock, P.D. (1992) *Rearing and Studying Stick and Leaf Insects.* AES volume 22. Amateur Entomologists' Society, Feltham. PB 73 pages. A comprehensive introduction to the subject, dealing with many species in culture. Also includes details on the structure of these insects, breeding, collecting and preserving them. Illustrated by line drawings and black and white plates.

Other modern books including colour illustrations of phasmids are wide ranging. Well worth obtaining for their content on British species are: Ragge (1965), now very expensive, but watch out for ex-library copies, and Marshall and Haes (1988). General guide books to insects of particular regions or countries sometimes include stick-insects, although the information given is sometimes very inaccurate. A good guide to breeding exotic insects is Löser (1991); published in German, it includes fine colour photographs of nearly all of the 21 species of phasmids included. Stone (1992) follows on from the well known *Butterfly Culture* by Stone and Midwinter (1975). The author is not always accurate with the information given, but he has a good track record with leaf-insects and there is a useful section in his 1992 work. Sharrell (1971) includes an interesting chapter on New Zealand stick-insects, and Hughes (1975) an excellent account of *Didymuria violescens* from Australia. Unno (1989) is an excellent photographic account of certain Malaysian insects. The brief text is in Japanese with an English summary. For an enjoyable read about Australian garden insects, I can thoroughly recommend Clyne (1979). Preston-Mafham (1990, 1991) is well known for his excellent photography.

I recently obtained a copy of *Praying Mantids and Stick Insects* by Schoeman (1985). This 47 page book is published as part of the De Jager-Haum *Insight* series, and provides a lively account, pages 26-42 dealing with stick-insects. I was hoping for a stick-insect on the front cover, but instead found mantids on the front and inside covers! There are several good colour photographs of South African stick-insects, although two are posed set specimens. The text is fairly general, including notes on morphology, colour change, aggression, chemical defence, etc. Some comments are inaccurate e.g. *Prisopus flabelliformis* of Brazil "spends the whole of the day under water, in a stream or rivulet..."; this has long been disproved. The author has a habit of describing some stick-insect species as leaf-insects, following on from his attempts at describing the classification of the order. Very much a general study, the book is by no means technical and only briefly mentions specific South African species and their habits. The series is therefore perfectly suitable for the general public, who may well collect the series of books. A few of the sketches included in the book may also be found in the author's brief notes on pages 96-98 of *Insects of Southern Africa* (Scholtz & Holm, 1985). Unfortunately I cannot offer much practical advice to people seeking a copy of *Praying Mantids and Stick Insects*, the publishers did not respond to my letter and my own copy was eventually obtained following its purchase at a South African shop by a third party for a UK bookdealer. I have since found a UK distributor who can obtain a supply from South Africa. I am prepared to collect bulk orders for these and if interested please forward a cheque for £8.00 payable to "The Phasmid Study Group" . Add £1.00 if you live outside the UK. **N.B. Deadline: 31st July 1993.** Books have to be ordered from S. Africa and should be supplied in about three months. The first few orders should however be supplied from stock on a first come, first served basis.

Figure 1.

On trips abroad, foreign language books can be interesting. This includes a Japanese colour plate book on insects, obtained in Malaysia. Fortunately the text is short! Even unexpected sources can include stick-insects. Braack's 1983 travel guide to the Kruger National Park in South Africa (only 50p from a "bargain" bookshop in 1992) includes a fine colour photograph of a male *Palophus* sp., with tips on where to locate stick-insects. The author comments that "stick insects are more common than is often thought". Text books on insects provide an interesting insight into phasmids, with excellent coverage in the revised CSIRO *Australian Insects* volumes (1992). Another much

older example is Sharp (1910). Modern encyclopedias on insects are also useful, good examples including Stanek (1969) and Linsenmaier (1972). For fine colour plates on the African *Palophus reyi* see Skaife (1979).

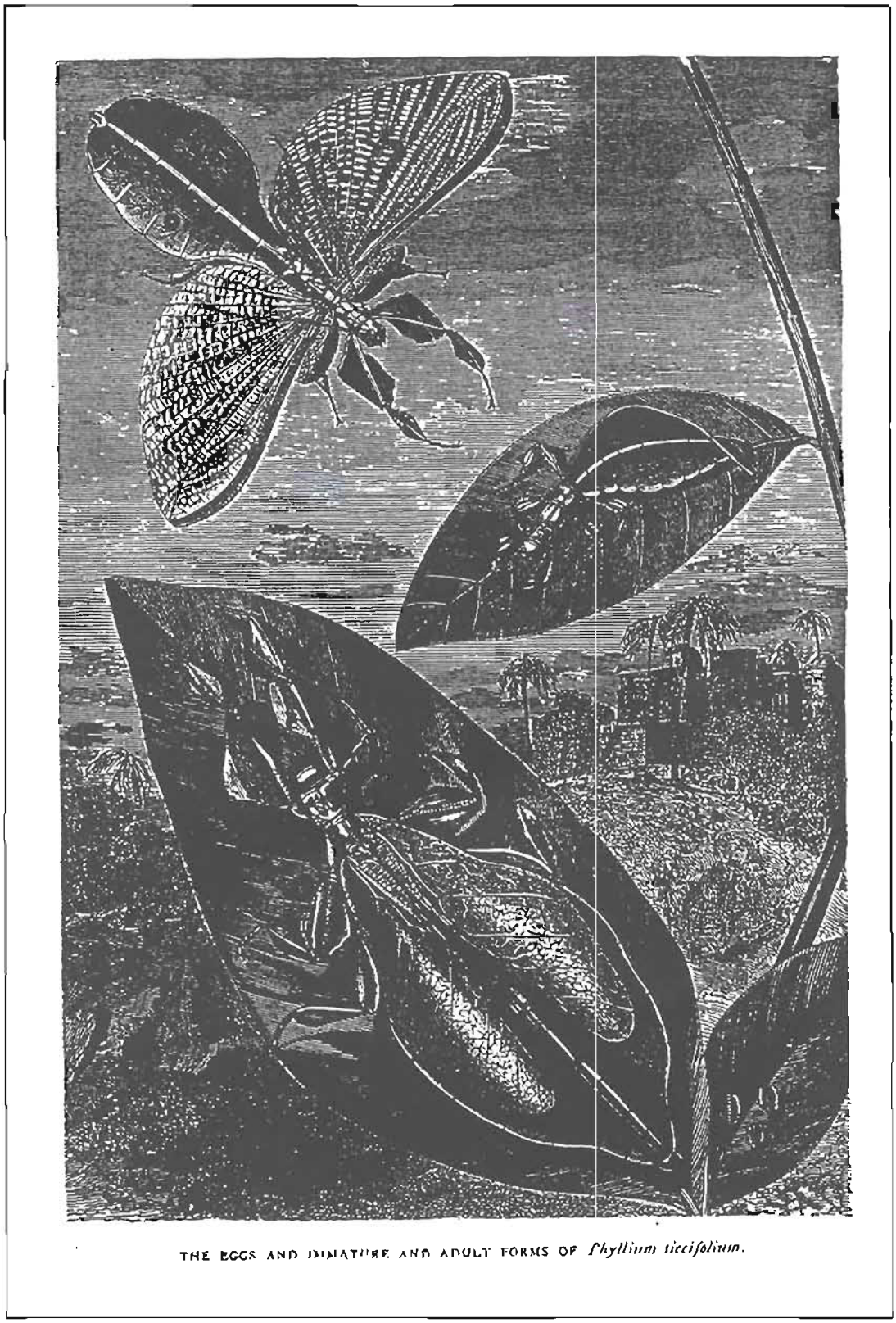

Figure 2. Black and white plate from *The Transformations (or Metamorphoses) of Insects* by P. Martin Duncan.

Now for the "tales"! Many insect books contain sections on phasmids and below are a few of the more exciting finds.

Whilst hunting for insect books on a holiday in Wales a few years ago, I came across a rare beetles volume, subsequently on-sold to a foreign bookdealer. For a mere £2.50 I also found *True Tales of the Insects* by Baedenoch (1899). The Orthoptera are very well covered in the first 159 pages of this 255 page book. Phasmids are dealt with in chapters three and four, pages 41-80. On page 45 one learns "They devour the leaves, and especially the young glutinous or gummy shoots of the plants on which they reside, and with a voracity so excessive that a single pair will destroy a great quantity of foliage, so that in some parts of the world where they abound they become very injurious. This occurs in the South Sea Isles, in the case of *Graeffea coccophagus*, a brown slender species, which sometimes commits dreadful devastation in the plantations of coconut trees, occasioning scarcity of food, and orders have been issued by the chiefs for their destruction. One writer goes so far as to ascribe the cannibalism in some of these islands to want of food caused by the ravages of this insect.....". Other tales include reference to a well known story about a Brazilian *Prisopus* species living submerged in mountain streams (also mentioned in Schoeman (1985), see above). This was later dismissed in scientific papers. There are lots of stories on various stick and leaf-insects, combined with good illustrations.

Whilst book hunting in 1992, I located *Insect intruders in Indian Homes* by Stebbing (not dated), which has a fine frontispiece (Figure 1). The stick-insect, almost certainly a *Carausius* sp., described as originating from Assam, is eight inches in length. There is a story about leaf-insects on page 118: "By the way, while on district work in Eastern Bengal some years ago a native brought me one of these insects. On instituting a few inquiries as to where I might procure some more, I was told that the trees were fairly common in those parts, and that this particular one was only one of the leaves *which had taken to walking*! I fancy most of us in Eastern Assam have been told this simple yarn at one time or another - there is little doubt that the native believes it." At the same bookshop I also obtained a nicely bound 164 page thesis, in French, by de Sinéty (1901), entirely on stick-insects.

The Naturalist's Library is a very collectable series of books published in the late 1800's and Duncan's *Entomology, Volume 28* (not dated) includes three fine handcoloured plates on phasmids; well worth hunting for. I could digress further with more stories, but these are just a small selection of examples one can come across when book collecting. Warning: if you decide to become a bibliophile, beware of the urge to constantly add more to your collection. Not only will your pets take over the house, but you will need more and more bookcases. Beware again! If you are like me, you will also collect scientific papers on phasmids which again multiply rapidly and contain even more fascinating stories in some instances.

Note - I stress again that this is by no means an exhaustive account of books which include reference to stick and leaf-insects, but merely a personal selection of some of my favoured titles.

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THE 6TH INTERNATIONAL EXHIBITION OF INSECTS - PARIS 12th-14th NOV. 1993
Organised by Groupe D'Etude des Phasmes. Details from Peter Classey 0367820 399.

A very pretty phasmid: *Parectatosoma hystrix.*

J. Roget, 11, Rue Louis Aragon, 59290 Roost Warendin, France.
Translated by Margaret Day from *Le Monde des Phasmes, 19: 13-15.*

Key words
Phasmida, *Parectatosoma hystrix*, Madagascar, Rearing, Breeding.

Classification

This species was first described from Madagascar in 1879 by Wood-Mason who placed it in his new genus *Parectatosoma*. The genus is similar to the related *Haaniella* Kirby. This species only appears to have been mentioned a few times since the original description (Kirby, 1904: 398; Redtenbacher, 1906: 164, pl. 6.8 & 6.9).

Eggs

The eggs are black in colour and oval in shape. They resemble, but are slightly smaller than, the eggs of *Acrophylla wuelfingi* (Redtenbacher). They are laid on or in the earth like *Heteropteryx dilatata* (Parkinson) or *Eurycantha calcarata* Lucas. Incubation lasts a minimum of five months at ambient temperature.

1st Instar

On hatching, the body measures 21mm. The antennae are quite long and make a total length of 29mm. The body is green and grey and is smooth. The insect is not very mobile.

2nd Instar

From the second instar it is possible to distinguish the sexes: the male has a pronounced, bulging subgenital plate. The body is still smooth and looks shiny. The female has two pairs of white projections on the top of the thorax between the anterior and median pairs of legs. From this stage onwards the body has little spines. It is less shiny than that of the male. The dimensions of the insects are still identical in both sexes. The body measures 27mm long (36mm with the antennae) and 2.5mm thick.

3rd Instar

The body of the male measures 33mm (46mm overall), the female 38mm (51mm). The white projections are replaced by white bands with spines on. The body is 3mm thick.

4th Instar

Spines are now visible on the male, in particular on the head. The body measures 40mm with a total length of 55mm, the thickness is 4mm. The female has lots of spines. The total length is 60mm, and the body measures 45mm with a thickness of 5mm.

5th Instar

The white bands on the thorax of the female are more important. In the male, the body measures 47mm, total length 70mm and thickness 5mm. In the female, 50mm, 75mm and 7mm respectively.

6th Instar

The wings are visible in both sexes but are very small. The insect is very spiny, the male having the bigger spines. The dimensions of the male are: body 60mm, total length 84mm, thickness 6mm. In the female: body 63mm, total length 88mm, thickness 9mm.

7th Instar

The insects of both sexes are now adult. They are very handsome, the spines are white at the base

and red at the tips.

The male

The body is shiny black, the insect is very fine, the thickest part of the body (7mm) being at wing level. He has four toothed spines, 3mm long, on his head and also six smaller ones. The thorax is also very spiny. The abdomen has smaller spines between all segments. The wings are very small (4mm) and white with black veins in the visible parts. The folded away parts are bright red with black veins. The body measures 65mm and the total length is 110mm. The antennae are black and white.

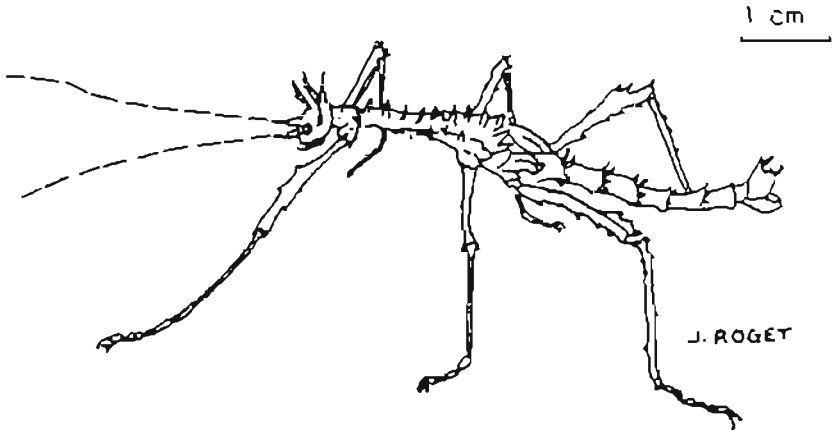

Figure 1. Male *Parectatosoma hystrix*.

The female

She is much more thickset. The body measures 75mm with a thickness of 10mm; the total length is 120mm. The spines are thicker and more numerous than in the male, the head bears a dozen spines. The effect of the body is not shiny like that of the male. The wings are very small (about 10mm), the colouring being the same as those of the males'. The 50mm antennae are black and white.

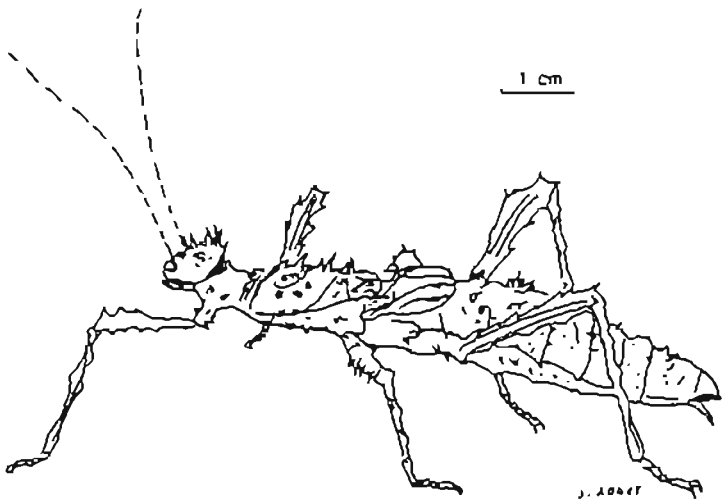

Figure 2. Female *Parectatosoma hystrix*.

The end of the abdomen resembles that of *Heteropteryx dilatata* with a "gutter" which facilitates laying eggs on or in the ground. About a month after the final skin-shed, the abdomen becomes very fat (diameter about 15mm) and laying begins. Coupling can last a long time (several hours) and the female can often be seen carrying the male on her back.

Behaviour

Both sexes, when disturbed, show the distinctive mannerism of unfolding their wings several times very violently and rapidly. This has the effect of producing a rustling or hissing sound (with a frequency of up to seven beats per second) and showing the bright red colour of the folded part of the wings. A similar phenomenon can be seen in *H. dilatata* and *Haaniella* spp.

Development

Development takes about three months and the adults live in excess of three months.

INSTAR	DURATION (days)
1st	20
2nd	15
3rd	13
4th	13
5th	16
6th	18

Culturing

This phasmid feeds on bramble at all stages. Little space is needed. Small boxes suffice for early stages. Adults can be put into a large cage. Nymphal mortality is not significant. The eggs are best kept in compost which is kept damp, at a temperature of about 23°C. The success rate of hatching is more or less 80%. For the hatchlings the temperature should be about the same with a relative humidity of 60-80%.

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Looking at *Baculum* eggs.

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Key words
Phasmida, *Baculum* spp., Eggs.

Whilst examining a sample of unidentified *Baculum* eggs (PSG 144) I had occasion to look through the various published figures and descriptions (Table 1). The first thing to notice is the paucity of detailed information and inconsistency in the way the information is presented. Very rarely are two views shown of the egg, or dimensions given for all three major dimensions. Often dimensions are given to the nearest millimetre; even so the figures can vary wildly - partly because authors do not follow the standard system of measuring "length" as capsule length not including the size of growths rising from the operculum. These growths, incidentally, have been called "capitula" though to the best of my knowledge no *Baculum* species carries a capitulum. On one occasion an egg was even shown in two views which were mutually inverted. Where egg drawings are shown they sometimes differ significantly from what can be seen when you look at the egg itself under modest magnification. In the table I have given the dimensions as length, height, width, according to the standard system, though in the literature length has been called "height", height "breadth" or "width", and width "thickness". The species are grouped into Hausleithner's types and then arranged roughly in order of size within any one type.

Baculum consists of a large number of species most of which were described by Brunner (1907) in the genera *Clitumnus* Stål and *Cuniculina* Brunner. Sadly, the egg types do not match up with these two generic concepts. Eight *Clitumnus* and 19 *Cuniculina* are included in Table 1, with each "genus" appearing with each egg type. The type species of *Baculum* is Westwood's *Bacillus cuniculus* which Brunner placed in *Cuniculina* and which has the egg type III of Hausleithner.

Baculum is a taxonomic hotch-potch if its eggs are anything to judge by. I recognised two types (Clark, 1979): type i based on *B. extradentatum* and type ii based on what was later to be named *Baculum thaii*. Carlberg (1983) called the two types *extradentatus*-group and *artemis*-group. Hausleithner, who has published many phasmid egg descriptions, for some reason referred to my paper but made my type i his type II and my type ii his type I (a source of confusion for future workers) and added a type III based on *B. hypereon*. His types I and III were both included by Carlberg in the *artemis*-group. Hausleithner briefly defined his types as follows:

I - Flat, oblong and more or less narrow (Flach, länglich und mehr oder weniger schmal).

II - Cask-shaped; surface textured. (Tönnchenförmig; Oberflache struktiert).

III - Oblong-cylinder shaped; characteristic operculum rim and indented posterior end (Länglich-zylinderförmig; characteristischer Eideckelrand und eingekerbte Eibasis).

These three types are listed separately in Table 1, although I am not convinced that *B. trilineatum* is my type i, since it does not appear to have the pseudocapitulum of the other two species of this type. Another possibility for Hausleithner's II is PSG 24, originally said to be *B. impigrum* and whose egg is slightly, but distinctly different from that of *B. extradentatum* with which it is now equated. Hausleithner's *B. impigrum* is clearly a type ii egg.

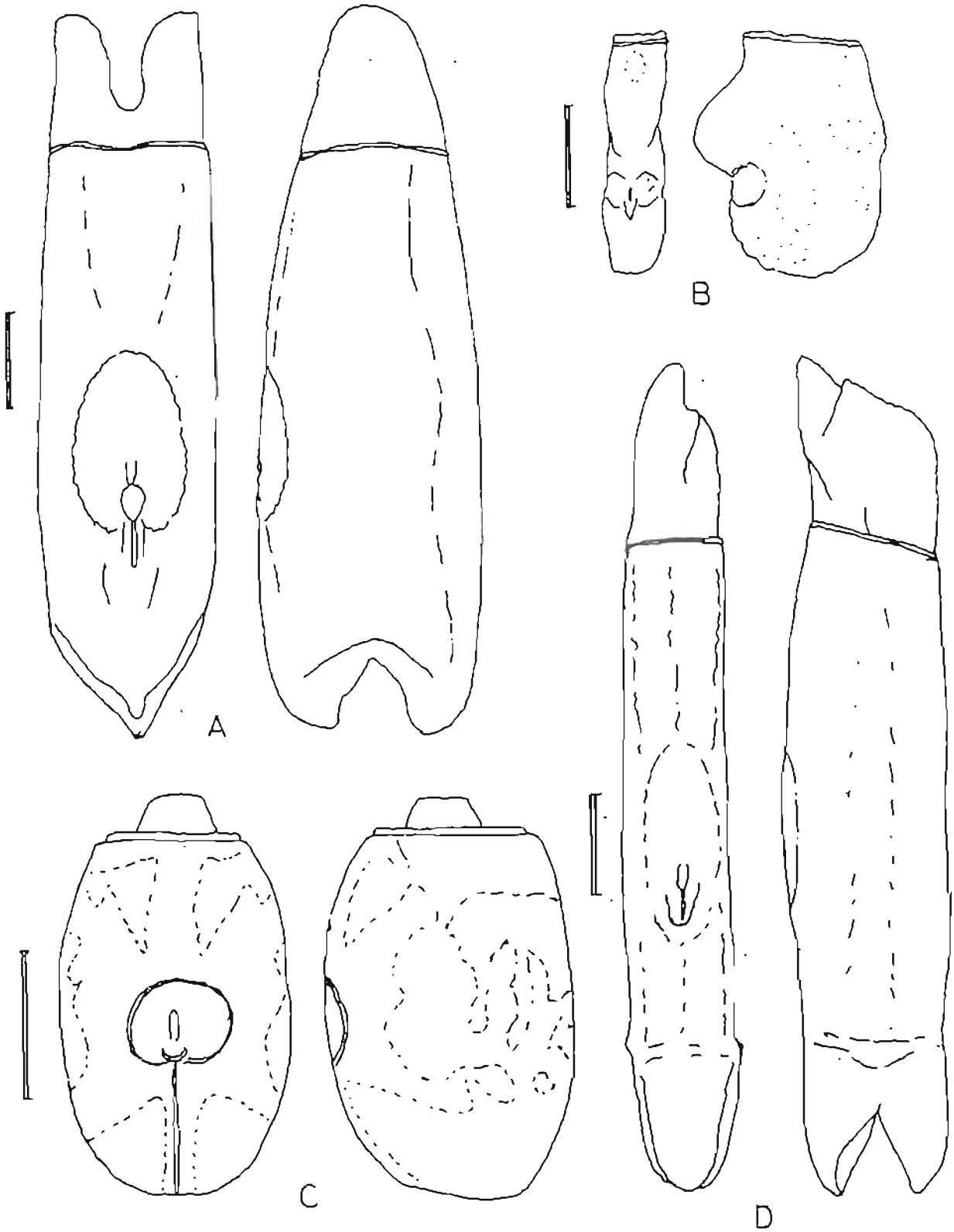
Key to Table 1.

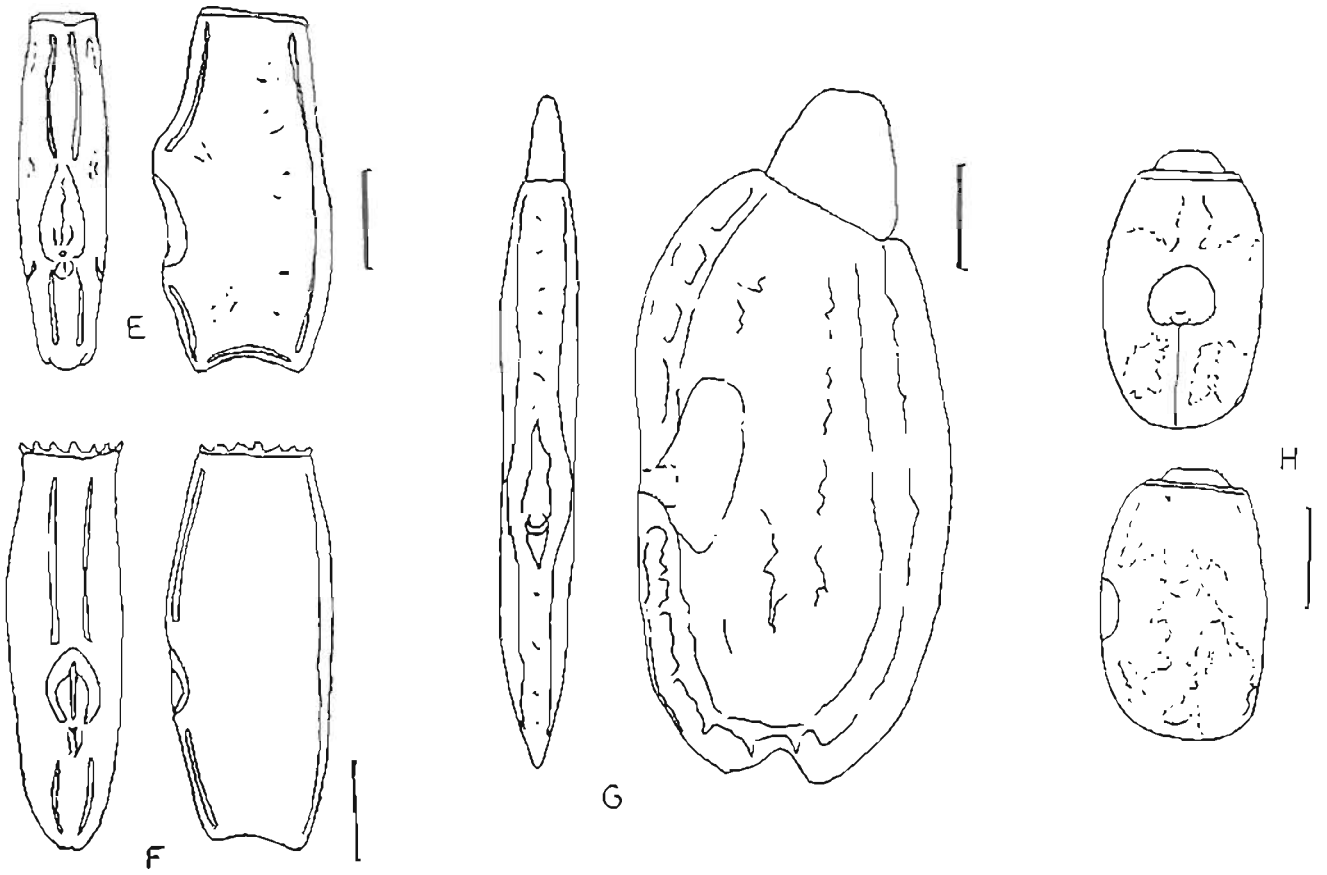
Dimensions of length, height and width are in mm.
The genera used by Brunner are indicated in column 2: Cu. = Cuniculina, Cl. = Clitumnus.
Views: D = dorsal, L = left, R = right, O = opercular, P = posterior, I = inverted.
** = not PSG 24.
* = the type species for Hausleithner's type I, II, and III.

Type	Br.	species name	source	view	length	height	width	authority
I	Cu.	bidentatum (Brunner)	Java	L	7	2	1	Hausleithner 1988
	Cu.	malaccense (Brunner)	Perak etc.	R	7	2	0.7	Hausleithner 1988
	Cu.	nematodes (de Haan)	Java etc.	R	6	2	-	Hausleithner 1986
	Cu.	insuetum (Brunner)	Perak etc.	L	6	2.3	0.8	Hausleithner 1988
				DR	5.6	3.0	0.6	new data
	Cu.	eminens (Brunner)	Java	L	5	2	1	Hausleithner 1988
	Cu.	arrogans (Brunner)	India	R	5	1.3	-	Hausleithner 1986
	Cu.	decolyti (Brunner)	?	R	5	1.3	-	Hausleithner 1986
	Cl.	artemis (Brunner)	Bhutan	D	4.4	-	1.3	Cappe de Baillon *et al* 1934
	Cu.	mediocre (Brunner)	Java	L	4	2	-	Hausleithner 1986
	Cu.	verecundum (Brunner)	Java etc.	L	3-4	1.3	1	Hausleithner 1988
	-	PSG 144	Vietnam	DR	3.8-4.0	1.5-1.6	1.1	new data
	-	thaii (Hausleithner)*	Thailand	DR	3-3.5	-	-	Hausleithner 1986
				DR	3.6	1.6	0.8-1.0	Sellick 1980
				LPO	4	2	-	Allington 1981
				R	3.3	1.6	1.1	Deschandol 1991
				L	4	-	-	Floyd 1987
	Cu.	anceps (Brunner)	Vietnam	R	3.5	2	-	Hausleithner 1986
	Cu.	receasum (Brunner)	New Guinea	R	3.5	2	-	Hausleithner 1986
	Cl.	serratulum (Brunner)	Java etc.	R	3.5	2	-	Hausleithner 1986
	Cu.	impigrum (Brunner)**	Tonkin etc.	L	3.2	2.2	1	Hausleithner 1986
	Cu.	warnbergi (Brunner)	Java	R	3	1.7	1	Hausleithner 1988
	Cu.	irregulariterdentatum (Br.)	Japan?	DR	2.5	2	1	Yasumatsu 1942
	Cu.	frustrans (Brunner)	India	DB	2.3-2.4	1.9-2.0	0.5-0.6	new data
	-	PSG 114	Thailand	DL	2.6	1.6	0.7	van Herwaarden 1989
	Cl.	emendatum (Brunner)	India	R	2	1.2	-	Hausleithner 1986
II	Cl.	trilineatum (Brunner)	Sri Lanka	R	2.5	1.5	-	Hausleithner 1986
	Cu.	annamense (Brunner)	Annam	DL	2.8	1.8	-	Hausleithner 1988
	Cl.	extradentatum (Brunner)*	Vietnam	R	2.5	1.5	-	Hausleithner 1986
				DR	2.2-2.4	1.5-1.6	1.4-1.6	Clark 1976
III	Cu.	inversecornutum (Brunner)	Sri Lanka	DR	8	2	-	Hausleithner 1986
	Cu.	regina (Brunner)	Tonkin etc.	R	8	1.2	-	Hausleithner 1988
	Cl.	hypereon (Westwood)*	Sri Lanka	R	7-8	1.5	-	Hausleithner 1986
	Cl.	attigens (Brunner)	?	-	7-8	1.5	-	Hausleithner 1986
	Cl.	rivale (Brunner)	?	-	7-8	1.5	-	Hausleithner 1986
	Cu.	insignis (Wood-Mason)	India	DR	6.6	1.5-1.6	1.0	new data
				R	8-9	2	1	Kocubuhler 1989
				DLI	7.3-9	1-1.8	0.8-1	Hausleithner 1990
	Cu.	cuniculum (Westwood)	?	DR	5.6-6.2	2.0-2.1	1.8	Sellick 1980

Table 1. Dimensions of *Baculum* eggs.

I illustrate the eight species of *Baculum* eggs in my reference collection in the standard views as an illustration of how diverse this apparent genus actually is. In each case the scale line represents 1mm.





Legends to Figures A-H.

A. *B. cuniculum* (type III)
B. *B. frustrans* PSG 95 (type I)
C. *B. impigrum*? PSG 24 (type II)
D. *B. insignis* PSG 94 (type III)
E. *B. thaii* PSG 22 (type I)
F. *B.* sp. PSG 144 (type I)
G. *B. insueta* PSG 55 (type I)
H. *B. extradentatum* PSG 5 (type II)

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Keeping and breeding *Haaniella* species successfully.

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Key words
Phasmida, *Haaniella* spp., Breeding, Rearing.

Over the last few years there has been a great deal of interest shown by members of the PSG in the genus *Haaniella*, with many members asking for eggs or nymphs, usually to be disappointed when told there are none available.

Now, at last, they are becoming more common in captivity, thanks to our intrepid collectors such as Phil Bragg, Allan Harman, Ulrich Ziegler etc. The eggs of several species are slowly being distributed to those who want them. The following species are being bred in captivity: *H. grayi grayi*, *H. echinata*, *H. dehaani*, *H. muelleri*, with a tentative culture of *H. echinata scabra*.

Most of the *Haaniella* are large, robust species with the females rather like brown *Heteropteryx dilatata* (PSG 18). The males though are quite different from male *dilatata*, although winged, the wings are small and not capable of flight, appearing to be only for stridulating for defence and perhaps during competition for females. The females have a good array of defensive spines and are capable of drawing blood from the incautious finger. The males are some of the spikiest insects that we keep and are extremely handsome in appearance.

To keep the insects in good condition we must first take into account where they come from. The species which we have in culture at present are all from Borneo, with the exception of *H. muelleri* which comes from the Malay Peninsula. The sort of habitat in which we found them was warm, humid rainforest, and almost always within 100m of running water. We found them on the forest floor and up to 6m high in small trees. They could of course go much higher, but considering the obstructed view in the rain forest we wouldn't have been able to see them.

In the wild they eat a wide range of native plants and we often found adults after finding very large leaves half eaten. Female *Haaniella* spp. will stay in the vicinity of favourite food plants for a considerable amount of time. A female *H. grayi grayi*, feeding on *Rubus* sp. on Mt Serapi, was still there when we returned four weeks later.

Taking this information into account, this is the method I use to keep and breed *H. grayi grayi*, *H. dehaani* and *H. muelleri*. I use a large wooden cage, approximately 100cm long, 60cm wide and 75cm high. The temperature is maintained at around 20°C in winter and 25°C in summer by means of a flat 28W heater mat taped to the inside back of the cage. This never gets too hot and indeed the manufacturers claim that reptiles can sit safely on them for long periods. This I can bear out by often seeing *Haaniella* hanging from it, and since I've been using it I've had no deaths. In the cage is a very large hollow "log" of cork bark. This is very much appreciated by the *Haaniella* which creep inside and behind it in the daytime. Adults will occasionally stay aloft if the vegetation is very thick and nymphs will stay in the vegetation if they can crawl into withered brown leaves. Also in the cage is a standard (375mm x 130mm x 60mm) seed tray full of moist peat for the insects to lay their eggs in; I find about 90% of all eggs in the peat. The rest are on the newspaper-lined floor, often in the corners. I remove the eggs and incubate them in damp "Vermiculite", buried with just the operculum showing. I check the eggs every day for hatching and throw out any eggs which are infected with fungus.

The food plants are kept in milk bottles and in winter this is usually bramble about 1.5m long and quite thick stemmed. This gives the *Haaniella* plenty of room to climb about. They spend most

of the hours of darkness climbing and feeding, only descending when I put on their light in the morning. The light is a small 15W fluorescent tube shining from 7am to 10pm. I took great care to obtain a tube that gives out light similar to natural daylight as I thought the insects might benefit from it, but so far as I can't say with any conviction that they have.

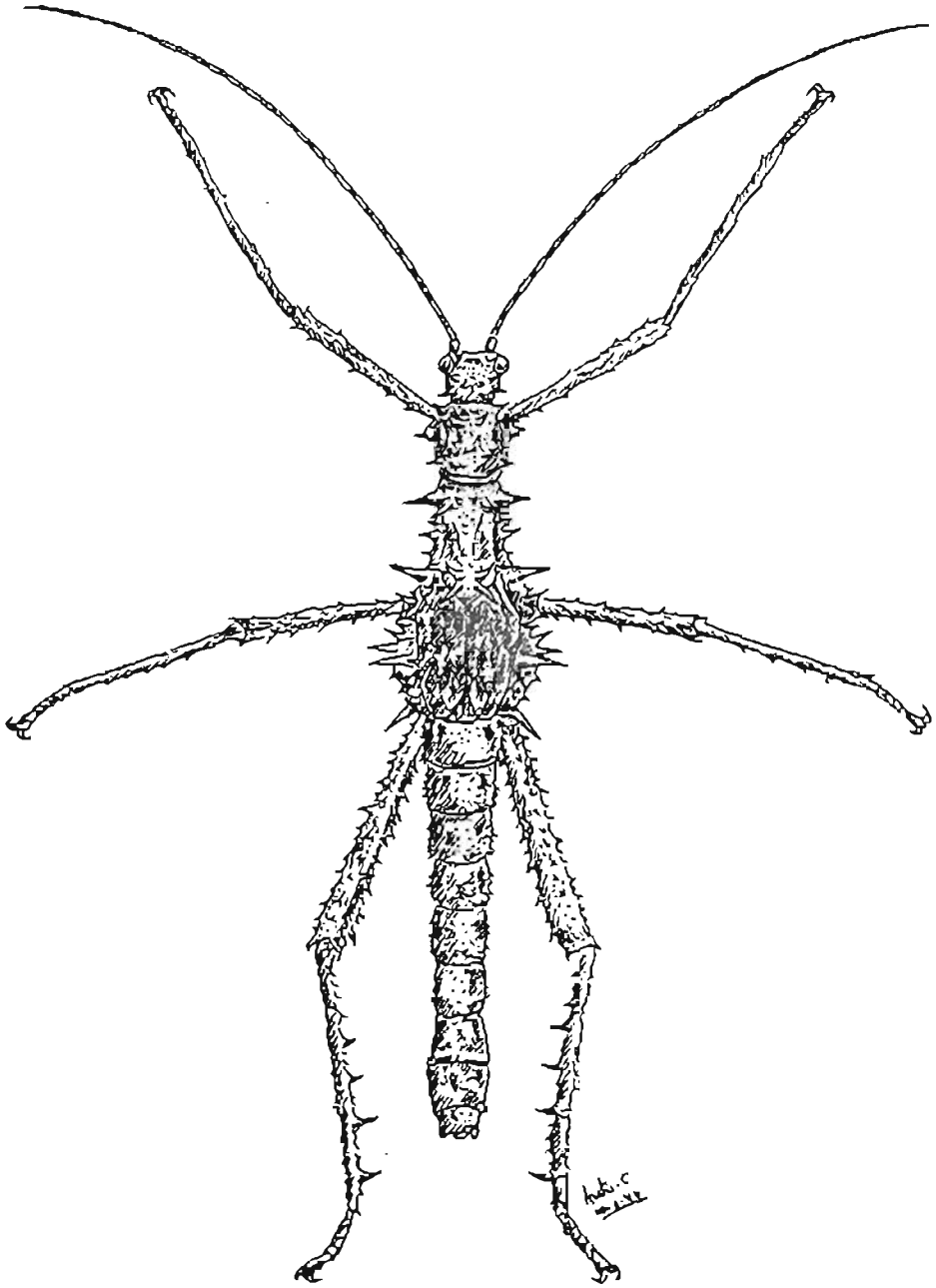

Figure 1. Male *Haaniella echinata*, drawing by Austin Crompton.

Also in the cage is a plastic plant pot saucer, about 150mm diameter and 20mm deep, full of water. This I feel is essential to the well being of my *Haaniella*. The adult females drink every day, often leaving their daytime hiding places to have a drink and a good soak. The adult males often drink when they descend from the foodplant in the morning. They put their front legs in the water and often submerge their whole head and remain in that position for at least an hour. It's a good job

that they don't need their heads for breathing! Small nymphs don't seem to need the drinking pot and I assume they get enough liquid from the foodplant. The females need to drink every day when they are fully mature and laying their huge eggs. I believe the liquid content of the eggs would soon dehydrate her and result in the cessation of egg laying or in extreme cases, the death of the female.

The main reason why the *Haaniella* spp. have been so long in coming into general distribution is the extremely long life cycle. The eggs can take over 18 months to hatch and as many as 60% can fail to hatch due to fungus infections or just because they are infertile. Once the nymphs are feeding they appear to be very robust with very few losses. The few losses which do occur are mainly caused by bad skin sheds. *Haaniella grayi grayi* and *H. echinata* take about 16-18 months to become adult, and females about three more to become sexually mature and capable of laying eggs. One of the interesting things observed by myself and others is the males often try to mate with the females as soon as she completes her last moult, even when she is still hanging onto her old skin. Whether this mating could be successful I am in some doubt.

The females can live at least two years as egg laying adults and at about two eggs per week should lay about 200 eggs in her lifetime. Considering the mortality rate of the eggs, I like to hatch the eggs myself and give away pairs of nymphs at various meetings of the PSG. In this way the recipients, who in some cases have waited upwards of two years, are likely to be reasonably experienced with other species. As mentioned earlier, *Haaniella* spp. are becoming more widespread in the PSG and my waiting list is going down. If any members would like to be added to the list, please write but I warn you that it may be a very long time before you actually get your *Haaniella*.

The methods outlined above are the way I keep and breed my *Haaniella grayi grayi*, *H. dehaani*, and *H. muelleri*; I am at least moderately successful. Others approach the problems of *Haaniella* spp. in different ways and are just as successful or even more so.

List of stick and leaf-insect (Phasmatodea = Phasmida) type material in the Natural History Museum, published since Kirby's 1904 Catalogue.

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Key words
Natural History Museum, Type specimens, Kirby.

Summary
A listing is given of all Phasmatodea type material (64 species and 1 subspecies) deposited in the Natural History Museum, London, following publication of Kirby's 1904 Catalogue of all species. Details of the number of specimens and data are also provided, along with general taxonomic and relevant comments for this understudied order. References are included at the end of this work.

Introduction
Anyone seriously interested in studying the taxonomy of Stick and Leaf-insects (Phasmatodea) needs to examine type material in museums. Kirby's 1904 Catalogue of species includes reference to type specimens lodged in the BM(NH). These are mainly species described by such well known authors as Westwood, Gray and Kirby himself. Unfortunately the Catalogue was not referred to at all by Brunner von Wattenwyland▼.p1020XRedtenbachers of a huge monograph on the Phasmatodea published in three parts between 1906-1908. Kirby's Catalogue is valuable in that it includes details of synonyms ignored by Brunner and Redtenbacher, although these need to be carefully checked against original descriptions in the literature and type specimens, if available.

In Kirby's Catalogue BM(NH) type material is marked **. An examination of the collection revealed that there is type material in the collection described before 1904, but not marked ** in Kirby. This type material is as follows, referring to Kirby's page reference: *Diapheromera femorata* (Say) 346, *Heteronemia striata* (Burmeister) 348, *Bactrododema aculiferum* Kirby 366, *Ophicrania phlyctaenoides* (Rehn) 384, *Graeffea crouanii* (Le Guillou) 386, *Cotylosoma dipneusticum* Wood-Mason 407 (note - *C. carlottae* Macgillivray: specimens are not types as stated by Kirby), *Prexaspes ambiguus* (Stoll) 414, *Presbistus nebulosus* (Westwood) 419. Whilst some of the above relate to omissions in the Catalogue, I believe some type material may have come to light after 1904.

The BM(NH) collection is one of the major reference points to study of Phasmatodea and since 1904, type material consisting of 64 new species and 1 new subspecies has been added to the collection. The list provided, which includes details of data and number of specimens, should be very useful to researchers. Many of the specimens are the Central and South American material from the Godman-Salvin collection. These are listed in Brunner and Redtenbacher's monograph as "coll. Godman", on occasions referring to the wrong Country e.g. Mexico instead of Guatemala.

The majority of Brunner and Redtenbacher's type material is deposited in the Naturhistorisches Museum, Vienna, Austria and only a very few species have been added to that collection since publication of the monograph. Likewise, the Oxford University Museum collection includes very little material obtained after Westwood's spell as curator. Westwood's 1859 book describes many of the insects housed in the BM(NH) and OUM. The three museums mentioned include the vast majority of Phasmatodea type material, which generally include little data, specimens dating from the 1800's to early 1900's. It is worth pointing out that the BM(NH) collection contains a significant number of specimens collected after 1908 and much is yet to be classified.

The Listings

I have used a similar format to Kirby's work, but included, in addition, details of the number of type specimens and data. The list has been ascertained by identifying labelled type material in the BM(NH) collection described after 1904. A cross-check has been made by referring to the species card index at the museum and consulting Brunner & Redtenbacher's work for details of Godman's material. On page 336 Brunner states that the type of *Heteronemia foliata* (Brunner) is in the Godman collection, but the Holotype is housed in the Vienna museum collection.

Species are listed alphabetically within a genus in the order of Bradley and Galil (1977), mentioning relevant Families and Subfamilies.

Localities are as listed on data labels. Comparing these with modern maps, for instance, certain localities in the Vera Paz region of Guatemala are spelt slightly differently, as follows: Purula = Purulha, Geronimo = Jeronimo.

The Natural History Museum was formerly known as the British Museum (Natural History) and to confuse matters the collection may still be referred to as the BM(NH) collection. The current BM(NH) cabinet drawer number is given, in square brackets, before details of the type(s) and localities; all drawers are in series 3 of the Museum's Orthoptera section (where there is no number in the brackets the specimens have not yet been moved into the main collection). If known, the collector's name follows e.g. (Champion). I have also indicated where I consider specimens are nymphs.

Definitions of terms used:
holotype - The single specimen designated as "The Type" by the original author at the time of publication of the original description, or the only specimen known at the time of the original description.
paratype - A specimen other than the holotype which is before the author at the time of the original description and which is designated as such, or is clearly indicated as being a specimen upon which the original description was based.
syntype - One of several specimens on which an author bases an original description when no single specimen is designated as the holotype.
lectotype - One of a series of syntypes which is selected subsequent to the original description and thenceforth serves as the definitive "Type" of the series. In order to be effective such selection must be made known through publication.

SUBORDER ANAREOLATAE
FAMILY HETERONEMIIDAE
SUBFAMILY HETERONEMIINAE

CALYNDA Stål

C. quadrilobulata Brunner, 1907: 329
[47a] ♀ holotype COSTA RICA (van Patten).

DIAPHEROMERA Gray

D. furcata Brunner, 1907: 336.
[37] 2♂♂ & 1♀ syntypes MEXICO: Venta de Zopiloto, Guerrero (H.H. Smith) [note - the second, much smaller ♂ marked syntype is clearly a different species - but Brunner has included it in the type description i.e. 2 ranging in size "56-106mm".]

HETERONEMIA Gray [=**BACUNCULUS** Burmeister]

H. carinulata (Brunner, 1907): 334 (*Bacunculus carinulatus*).
[38a] 2♂♂ syntypes MEXICO: Ciudad; Sierra de las Aguas Escondidas, Guerrero
H. elongata (Brunner, 1907): 335 (*Bacunculus elongatus*).
[38a] ♂ holotype MEXICO: Dos Arroyos, Guerrero (H.H. Smith)
H. godmani (Brunner, 1907): 334 (*Bacunculus godmani*).
[38a] 2♂♂ syntypes MEXICO: Amula, Guerrero (H.H. Smith)
H. incongruens (Brunner, 1907): 336 (*Bacunculus incongruens*).
[38b] 8♂♂ syntypes GUATEMALA: Senahu, Vera Paz (x6); Teapa, Tabasco (x1); Purula, Vera Paz (x1) (all = Champion)
H. picta (Brunner, 1907): 333 (*Bacunculus pictus*).
[38a] 2♂♂ syntypes GUATEMALA: Senahu, Vera Paz (Champion); MEXICO: Atoyac, Vera Cruz (Schumann) [note - the ♂ from Atoyac appears to be a distinct species]
H. praetermissa (Brunner, 1907): 333 (*Bacunculus praetermissus*).
[38a] 2♂♂ syntypes GUATEMALA: Geronimo (Champion); COSTA RICA (van Patten)
H. unidentata (Brunner, 1907): 334 (*Bacunculus unidentatus*).
[38a] 2♀♀ syntypes (nymphs) MEXICO: Atoyac, Vera Cruz (Schumann); Jalisco (Schumann) [note - Brunner describes a ♂ adult and ♀ nymph - locality given Vera Cruz]

OCNOPHYLLA Brunner

O. ciliata Brunner, 1907: 313.
[35] ♀ holotype MEXICO: Amula, Guerrero (H.H. Smith)
O. godmani Brunner, 1907: 314.
[35] 1♂ & 1♀ syntypes GUATEMALA: ♂ Senahu; ♀ Purula, Vera Paz (Champion)
O. meditans Brunner, 1907: 313.
[35] ♀ holotype GUATEMALA: Purula, Vera Paz (Champion)
O. ornatissima Brunner, 1907: 312.
[35] 1♀ syntype (nymph?) GUATEMALA: San Juan, Vera Paz (Champion)

PARADIAPHEROMERA Brunner

P. armata Brunner, 1907: 317.
[35] ♂ holotype PANAMA: V. de Chiriqui (Champion)

LIBETHRA Stål

L. elegantior Brunner, 1907: 308.
[34] ♀ holotype MEXICO: Omilteme, Guerrero (H.H. Smith)

PSEUDOBACTERIA Saussure (=**DYME** Stål)

P. depressa (Brunner, 1907): 327 (*Dyme depressa*).
[39a] 3♀♀ syntypes (nymphs) GUATEMALA: Las Mercedes (x1); Purula, Vera Paz (x1); Cerro Zunil (x1) (all - Champion)
P. discors (Brunner, 1907): 324 (*Dyme discors*).
[39] 4♂♂ syntypes PANAMA: V. de Chiriqui (Champion)
P. incolumis (Brunner, 1907): 326 (*Dyme incolumis*).
[39a] ♂ holotype GUATEMALA: Parzos, Vera Paz (Champion)
P. irregulariterspinosa (Brunner, 1907): 328 (*Dyme irregulariterspinosa*).
[39a] ♀ holotype GUATEMALA: Purula, Vera Paz (Champion)
P. modesta (Brunner, 1907): 324 (*Dyme modesta*).
[39a] ♂ holotype PANAMA: V. de Chiriqui (Champion)

SUBFAMILY LONCHODINAE

CARAUSIUS Stål

C. gardineri Bolivar (in Bolivar and Ferrière), 1912: 296.
[3] 1♂ & 1♀ syntypes SEYCHELLES: Mahé V-XII 1905 (J.S. Gardiner - Percy Sladen Trust Expedition)
C. scotti Ferrière (in Bolivar and Ferrière), 1912: 297.
[3] ♂ holotype SEYCHELLES: Silhouette, near Mont Pot-à-eau VIII 1908 (Percy Sladen Trust Expedition)

PERICENTRUS Redtenbacher

P. multilobatus Redtenbacher, 1908: 352.
[148a] 2♂♂ syntypes COSTA RICA: R. Susio (H. Rogers) [not "Chiriqui" as mentioned by Redtenbacher]

SUBFAMILY NECROSCIINAE

APORA Brunner

A. laetior monticola Günther, 1944: 78.
[106] 1♂ paratype BORNEO: Sarawak, Mt. Kalulong 3 XI 1932 (Hobby & Moore, Oxford University Expedition)

CENTEMA Redtenbacher

C. longipennis Günther, 1944: 78.
[89a] ♂ holotype BORNEO: Sarawak, R. Kapah, Trib. of R. Tinjar 24 IX 1932 (Hobby & Moore, Oxford University Expedition)

SUBFAMILY PACHYMORPHINAE

BURRIA Brunner

B. brachyxipha Uvarov, 1939: 556.
[26] ♀ holotype, 2♀♀ paratypes YEMEN: Aden (Major Yerbury) =holotype; Ktubu (nymph?) (G.W. Bury); Talha 2 XII 1936 (H.St.J. Philby)

RAMULUS Saussure

R. dicranurus (Uvarov, 1939): 558 (*Gratidia dicranura*).
[22b] ♂ holotype, 21♂♂, 12♀♀ paratypes [although paper states 19♂ and 9♀, Uvarov may have excluded nymphs] SAUDI ARABIA: Desert East of Sheikh Othman IV-X 1932 (Mrs M.C. Rant)
R. hebraicus (Uvarov, 1939): 226 (*Gratidia hebraica*).
[22] ♀ holotype ISRAEL: Mt. Carmel, 1938 (J. Palmoni) [a synonym of *Ramulus libanicus* (Uvarov) - Brock 1991: 39]
R. kurdus (Uvarov, 1944): 64 (*Gratidia kurda*).
[22] ♂ holotype, 1♀ paratype IRAQ: Zakho Gorgo, N. of Mosul 7 X 1942 (F. Bodenheimer)
R. longefurcatus (Chopard, 1954): 113 (*Gratidia longefurcata*).
[22a] ♂ holotype KENYA: Isiolo III 1944 (Mrs J. Adamson)
R. manderensis (Chopard, 1954): 114 (*Gratidia manderensis*).
[22] ♂ holotype KENYA: Damassa, Mandera district 9 XII 1944 (D.K. Kevan)
R. schizurus (Uvarov, 1939): 559 (*Gratidia schizura*).
[22] ♂ holotype SAUDI ARABIA: Hadramaut (Mr Bent's Expedition)

R. turcus (Karabag, 1955): 98 (*Gratidia turca*).
[22b] ♀ holotype TURKEY: Hatay 25 VII 1952 (O.N. Gülen) [a synonym of *Ramulus libanicus* (Uvarov) - Scali, Mantovani & Marescalchi 1990: 65]

SUBFAMILY PALOPHINAE

PALOPHUS Westwood

P. alldridgei Kirby, 1905: 279.
[75] ♂ holotype SIERRA LEONE: Bonthe, Sherbro 1904 (T.J. Alldridge)

FAMILY PHASMATIDAE
SUBFAMILY BACTERIINAE

BOSTRA Stål

B. amplectans Redtenbacher, 1908: 409.
[39b] ♂ holotype COSTA RICA: Cache (H. Rogers)
B. championi Redtenbacher, 1908: 410.
[39b] ♂ holotype GUATEMALA: Cahabon, Vera Paz (Champion)
B. godmani Redtenbacher, 1908: 411.
[39b] 1♀ syntype GUATEMALA: Zapote (Champion)
B. lobata Redtenbacher, 1908: 408.
[39b] ♀ holotype PANAMA: V. de Chiriqui (Champion)
B. magistralis Redtenbacher, 1908: 410.
[39b] ♀ holotype GUATEMALA: Panzos, Vera Paz (Champion)
B. similis Redtenbacher, 1908: 412.
[39b] ♀ holotype MEXICO: Jalisco (Schumann)
B. tridenticulata Redtenbacher, 1908: 411.
[39b] ♀ holotype MEXICO: Acaguizolta, Guerrero (H.H. Smith)

BACTERIA Latreille

B. subvolans Redtenbacher, 1908: 416.
[46] ♂ holotype PANAMA: V. de Chiriqui (Champion)
B. zehntneri Redtenbacher, 1908: 421.
[47aa 1♀ syntype MEXICO: Atoyac, Vera Cruz (Schumann)

HESPEROPHASMA Rehn

H. lobata (Redtenbacher, 1908): 355 (*Phantasis lobata*).
[148a] ♀ holotype PANAMA: V. de Chiriqui (Champion)

PTERINOXYLUS Audinet-Serville

P. spinulosus Redtenbacher, 1908: 428.
[68] 1♂ syntype PANAMA: V. de Chiriqui (Champion)

RHYNCHACRIS Redtenbacher

R. ornata Redtenbacher, 1908: 354.
[148a] ♀ holotype COSTA RICA: R. Susio (H. Rogers)

SUBFAMILY PLATYCRANINAE

GRAEFFEA Brunner

G. seychellensis Ferrière, (in Bolivar and Ferrière) 1912: 299.
[11a] ♀ holotype, 1♀ paratype (nymph) SEYCHELLES: Morne Blanc, Mahé (Scott - Percy Sladen Trust Expedition)

HYPOCYRTUS Redtenbacher

H. substrumosus Redtenbacher, 1908: 357.
[148a] 1♀ syntype MEXICO: Rinconada (Shaus)

SUBORDER AREOLATAE
FAMILY BACILLIDAE
SUBFAMILY BACILLINAE

BACILLUS Latreille

B. cyprius Uvarov, 1936: 505.
[25] ♀ holotype CYPRUS: Halefga 31 V 1931 (H.M. Morris) [Scali (personal correspondence 1992) considers this is almost certainly a subspecies of *Bacillus atticus* Brunner, which it closely resembles in all stages. Research by Italian workers is on-going]

FAMILY PSEUDOPHASMATIDAE
SUBFAMILY ASCHIPHASMATINAE

PRESBISTUS Kirby

P. inexpectatus Klante [marked "1967" but apparently unpublished, and therefore excluded from the total number of types already given. Bragg believes the museum specimen is a synonym of another *Presbistus* species].
[165] 1♂ marked "paratype" BORNEO: Sarawak 1909 (C.J.Brooks)

SUBFAMILY PSEUDOPHASMATINAE

DAJACA Brunner

D. filiformis Bragg, 1992.
[ ] ♀ holotype SARAWAK: Bako N.P., 50m. 20 VIII 1989 (P.E. Bragg)

DAMASIPPUS Stål

D. fuscipes Redtenbacher, 1906: 147.
[156] 1♂ syntype PANAMA: Bugaba (Champion)

PRISOPUS Latreille

P. fisheri Gahan, 1912: 54.
[155] ♀ holotype BRAZIL: Xapury, Amazon Valley (F.G. Fisher)

ISAGORAS Stål

I. dentipes Redtenbacher, 1906: 134.
[162] 2♂♂ syntypes PANAMA: Bugaba; V. de Chiriqui (Champion)
I. plagiatus Redtenbacher, 1906: 135.
[162] 1♂ syntype PANAMA: V. de Chiriqui (Champion)

METRIOPHASMA Uvarov

M. iphicles (Redtenbacher, 1906): 140 (*Metriotes iphicles*).
[163] 1♂ syntype PANAMA: Bugaba (Champion)

AGROSTIA Redtenbacher

A. amoena Redtenbacher, 1906: 110.
[159] 3♂♂ syntypes PANAMA: Bugaba (x2); V. de Chiriqui (x1) (all - Champion)

BRIZOIDES Redtenbacher

B. graminea Redtenbacher, 1906: 113.
[159a] ♀ holotype PANAMA: Bugaba (Champion)
B. lacteipennis Redtenbacher, 1906: 113.
[159a] 1♂ & 1♀ syntypes PANAMA: Bugaba (Champion) [stated by Redtenbacher to be in "own collection", but should have also referred to Godman's collection]
B. nigricornis Redtenbacher, 1906: 112.
[159a] 3♀♀ syntypes PANAMA: Bugaba (x2); V. de Chiriqui (x1) (Champion)

CHLOROPHASMA Redtenbacher

C. hyalina Redtenbacher, 1906: 114.
[159a] ♀ holotype PANAMA: Bugaba (Champion)

HOLCA Redtenbacher

H. proxima Redtenbacher, 1906: 114.
[159a] ♀ holotype COSTA RICA: R. Susio (H. Rogers)

STRATOCLES Stål

S. soror Redtenbacher, 1906: 106.
[157a] ♂ holotype NICARAGUA: Chontales (Janson)

TENERELLA Redtenbacher

T. tenerrima Redtenbacher, 1906: 109.
[159a] 1♂ syntype PANAMA: Bugaba (Champion)

PARANISOMORPHA Redtenbacher

P. insignis Redtenbacher, 1906: 90.
[154] 1♀ syntype COSTA RICA: R. Susio (H. Rogers)

FAMILY PHYLLIIDAE

PHYLLIUM Illiger

P. magnificum Brock, 1993 in press.
[ ] ♀ holotype WEST MALAYSIA: Tapah Hills, Cameron Highlands, Pahang IV 1991 (T.F. Wong)

Acknowledgement
I am grateful to Judith Marshall, Natural History Museum, for kindly reading a draft version of this paper and making some useful suggestions for improving the layout.

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A survey of the distribution of the unarmed stick insect *Acanthoxyla inermis* in Port Gaverne and Port Isaac, North Cornwall in 1992.

Malcolm Lee, Gullrock, Port Gaverne, Port Isaac, Cornwall, PL29 3SQ, U.K.
Introduction by Paul Brock. Illustration by Eve Bysouth.

Key words
Phasmida, *Acanthoxyla inermis*, British stick insects, Cornwall, Port Gaverne, Port Isaac.

Introduction

I have great pleasure in introducing Malcolm Lee's excellent study on *Acanthoxyla inermis* in his area, the first records from the north Cornwall coast. Malcolm's study follows Eve Bysouth's detailed survey conducted on *A. geisovii* in the St Mawes area in the 1980s, and both are to be congratulated on their enthusiasm and enterprise in recording these insects and adding to our knowledge of their habits.

A fuller version of Malcolm's report, including notes on the status of individual colonies, a map and excellent photographs showing the differences between British stick insects has been sent to the relevant bodies in Cornwall. It is with regret that the disclosure of exact localities can cause problems. Tresco Abbey Gardens is the only known site for *Clitarchus hookeri* in Britain and whilst visiting the gardens in autumn 1992 the staff complained to me about individuals from outside the UK who left with bag-fulls of these insects. Whilst serious studies are to be encouraged, there is no justification for collecting on such a scale and it seems some form of conservation is needed if future visitors are to enjoy seeing these rare insects in Britain.

Finally I must refer to Professor Salmon's outstanding book *The Stick Insects of New Zealand* (1992) which downgrades various *Acanthoxyla* species to subspecies of *A. prasina* (Westwood). I have discussed this matter with Professor Valerio Scali who agrees with me that they appear to be distinct species. Salmon (personal correspondence, 1993) comments that 'nobody as yet has taken up the challenge by doing chromosome work on these insects in New Zealand'. The position will not be certain until such studies have been made. If one agrees with Salmon, the British species should be known as *A. prasina inermis* and *A. prasina geisovii*.

The survey

In August 1990, I photographed a brown stick insect in my garden here in Port Gaverne. At the time I thought little of it. My wife had seen one in 1988, and my mother had mentioned catching them in Devon in the 1920s, when she was a small girl, so I had assumed that they were common in the South West.

In Spring 1992, after showing the photos to our local National Trust warden, Simon Ford, I was contacted by Chris Haes, the National recorder for these insects. From the photos he was able to confirm that my insect was the unarmed stick insect *Acanthoxyla inermis* Salmon, and he explained that they have a very localised distribution in the South West.

Having had other local reports of stick insects, I decided to undertake a survey to try and establish how widespread they were, and how they had got here. Several articles in the local monthly magazine asking people to contact me if they found one or if they had information on earlier sightings were very successful, with 16 reports of sightings in 1992 and a further 14 relating to previous years. Before detailing the results of the survey, a summary of the fascinating story of the British stick insects will be of interest.

Three species of stick insect have established themselves in the wild in Britain: the spiny stick

insect *Acanthoxyla geisovii* (Kaup), the smooth stick insect *Clitarchus hookeri* (White), and the unarmed stick insect *A. inermis*. Coincidentally all are native to New Zealand. Almost certainly they arrived here on imported plants, either as insects or, more likely, as eggs.

The first stick insect to be identified was the spiny stick insect, located at Paignton in 1908, and Tresco, Isles of Scilly in 1943 (Uvarov 1944). The Scilly colony may be as old as the Paignton one, since a consignment of New Zealand tree ferns was imported onto Tresco in 1907 and some of these were sent to Paignton the same year. They are also established at a few locations around the Fal estuary in Cornwall, principally at St Mawes where Tresco insects were deliberately released in 1959, and at Torquay and Ivybridge in Devon.

The smooth stick insect was first recorded at Tresco in 1949 (Uvarov 1950), which is still the only confirmed UK location. "Smooth" stick insects had been reported from several mainland locations but following research by Paul Brock in 1987 on insects from several locations, it was shown that these were in fact the very similar unarmed stick insect.

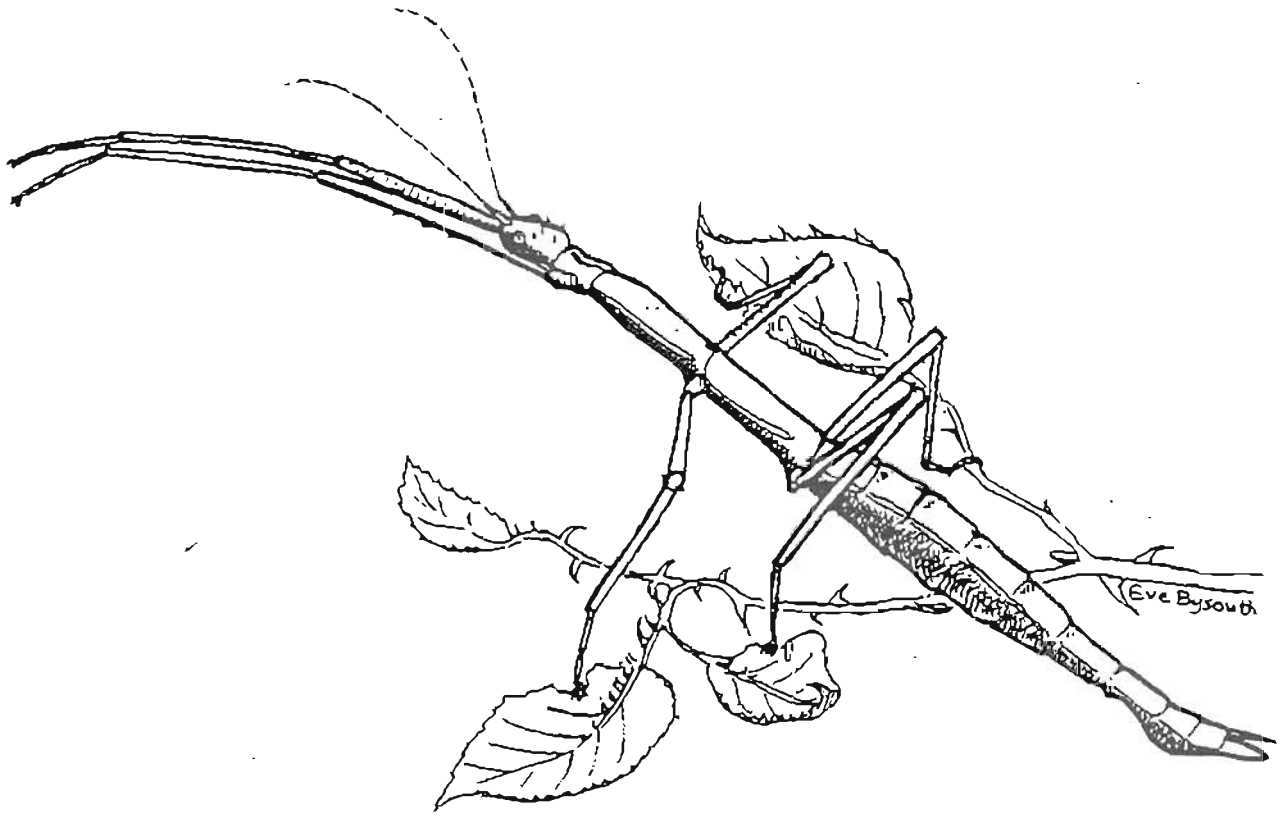

Figure 1. *Acanthoxyla inermis*, length 104mm.

The first mainland record for the unarmed stick insect was in Truro in 1979 but they have now been found at several locations, again mainly around the Fal estuary. There may have been more than one introduction, Scott's nursery in Merriot, Somerset and Treseder's in Truro both being likely sources. Treseder's was largely responsible for introducing tree ferns to Cornwall in late Victorian times (West Briton, 1987b). These exotic plants still flourish in many of our principal gardens. Neil Treseder, who retired from the family business in 1976, remembers seeing the insects at the nursery from his childhood days (West Briton 1987a). Further evidence for their long established status comes from the gardener at one location at Helford Passage, who reported seeing

them since the 1930s, when the garden was laid out with New Zealand tree ferns.

All three species can be either green or brown and have an adult body length typically within the range 85-105mm. Generally *A. inermis* are at the top end of this range and *C. hookeri* at the bottom. With numerous black spines over its body, *A. geisovii* is unmistakable. The absence of spines makes *C. hookeri* and *A. inermis* appear similar at first glance. They can be told apart since *C. hookeri* has a near continuous black line along its thorax, has pointed cerci and has no opercular spine, whereas *A. inermis* has a black line on the pronotum only, rounded cerci, and has a stout opercular spine.

Their life cycle is unusual. In Britain all the species breed parthenogenetically, that is, eggs develop without the need for fertilization by a male. Indeed, *Acanthoxyla* males are unknown, even in their native country; *C. hookeri* males are common in New Zealand, but none have been found here.

Date	Comments
04/92	Brown adult found on wall.
07/92	Green adult crawled onto school bag.
31/07/92	Brown adult found in hallway of house.
07/08/92	Green 67mm nymph found on wall. Owner of garden had disposed of insects in her garden some years ago and sees them most years.
15/08/92	125mm brown/purple mottled adult.
Mid/08/92	Green adult on wall.
20/08/92	Large colony of up to 20 adults.
Late/08/92	Several green adults seen on runner beans.
30/09/92	Green nymph about 70mm seen on bramble.
25/10/92	Olive adult on raspberry canes.
01/11/92	Large colony of 22 adults. Four green, three olive & 15 cherry red.
03/11/92	105mm brown/purple blotched adult on rear step. Large bramble which forms the garden hedge showed evidence of insect attack.
11/92	Garden adjacent to above. Adults often found on car bonnets in mornings.
06/11/92	Green 97mm adult found on wall
13/11/92	108mm green adult & 48mm brown nymph. Adult on bramble, nymph on red valerian.
15/12/92	Brown adult on handrail by garden steps.

Table 1. Records from Port Gaverne and Port Isaac in 1992.

The insects live for around six months, laying 200-300 eggs when they are adult. The eggs simply drop to the ground to hatch, mainly in late spring, into miniature versions of the adults, about 12mm long. They grow by shedding their skin and expanding before their new skin hardens. After five or six moults they become fully grown adults and, within a few weeks, start laying eggs. Most insects will die with the onset of cold weather, but it is possible that a few may survive

through very mild winters.

Of the insects seen by me during the survey, all were confirmed as *A. inermis*. The 16 reports of sightings in 1992 (Table 1) involved almost 60 insects, with two sites having around 20 insects each. The teachers at Port Isaac school also confirmed that further insects were found in upper Port Isaac and brought into school during 1992. It is clear that they are now widespread in gardens in upper Port Isaac and in Port Gaverne.

Adult insects were seen from April through to December (Table 1). The one seen in April may have overwintered, since my own weather records show that on only one night during the winter of December 1991 to March 1992 did the temperature fall to 0°C and the average daily minimum in January was 6°C. The peak times for sightings was, rather surprisingly, early November. This was more due to a strong gale removing leaves, thus rendering the insects more visible, rather than any increase in numbers.

The incredible camouflage of these insects undoubtedly leads to substantial under-recording of their presence. One resident who had expressed great interest in my survey, and had regularly visited one large colony, was amazed to find 22 insects in her own garden in November! They had clearly been overlooked for several months. This camouflage is totally ineffective when they are moving from plant to plant, which accounts for half of the reports being of insects on walls, windows, etc. One insect was even found in the house, where it had probably been brought in on a coat and had crawled off after the coat had been hung up.

Of those insects found on plants, the most common foodplant was bramble, but raspberry and rose were also favoured. Of the two large colonies, one was on bramble and the other on roses. One report was of insects on runner beans, although, when Paul Brock and I visited the garden, there was no evidence of feeding, so perhaps they were just passing through. A nymph was found on red valerian *Centranthus ruber*, on which it had been feeding.

Of 16 adults which were measured, almost 75% were in the range 94-99mm. Overall the average length was 99.3mm with the ten green insects having an average of 95.9mm and the six browns 104.8mm. This is a small sample but Eve Bysouth's 1985 (Bysouth 1990) survey of *A. geisovii* also showed browns were longer than greens. The real surprise of the survey was a huge brown/purple blotched 125mm insect found in Port Isaac. Apart from being the largest *A. inermis* recorded, it is also the longest insect ever found outdoors in the UK. Unfortunately, it died a short while after I received it. After death the insect shrank slightly to 120mm due to decrease in body fluid pressure. It is now in the collection of Paul Brock.

In mid November I located a 108mm green adult and a 48mm brown nymph at a site in Port Isaac. As they would not have survived much longer, I took them indoors for study. The adult had probably only just had its final moult, since it laid no eggs for two weeks and then went on to lay 250 eggs in 99 days before it stopped laying. By cleaning the cage daily I was able to record the number of eggs laid each day. Egg laying got off to a slow start and slowed down again at the end. The frequency distribution for the number of eggs laid per day is shown in Figures 2 and 3. Figure 2 shows results obtained over the 99 day egg laying period, Figure 3 shows the frequency distribution for the middle 69 days.

The overall mean was 2.52 eggs per day and the mean for the middle 200 eggs was 2.96 per day. At the time of writing, the brown insect has started laying eggs. It was noted that the eggs laid by

one insect all bore identical markings, but these differed from the markings on the other insect's eggs. This enabled those from the brown and green insect to be separated, even when they were laying concurrently. The brown insect is laying at a greater rate than the green one, with 113 eggs laid in the last 26 days, a mean of 4.36 eggs per day.

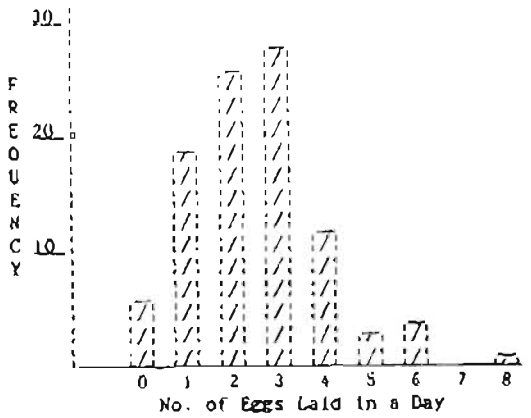

Figure 2. All 99 days.

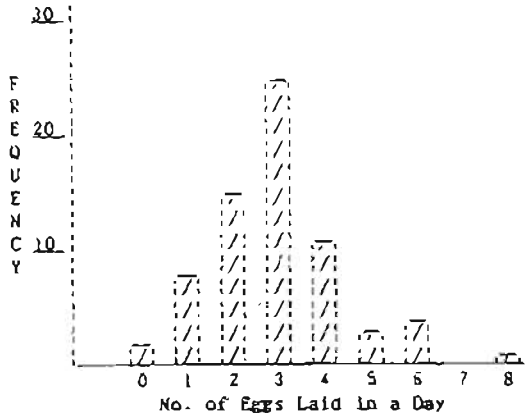

Figure 3. Middle 69 days.

The ambient temperature has a marked effect on egg laying. Initially the adult was in an unheated room with an ambient temperature of 13-15°C. When the temperature fell below 12°C egg laying became sporadic with only four eggs in seven days. When moved into a warm room with an ambient temperature range of 15.5-18°C egg laying immediately increased to 19 eggs in seven days. Outdoors, the onset of cold weather means that wild insects will lay far fewer eggs in their lifetime than captive specimens. Insects which do not become adult before the end of September may die before they lay any eggs.

Before this survey I had rarely seen stick insects so I was surprised to see the wide variations in colour of brown insects, and their ability to change colour, sometimes in a matter of minutes. Green insects did not show this ability, remaining a uniform apple green with a thin yellow line along the side of the thorax. Brown forms seen by me have varied from olive, light straw, mahogany red to brown/purple blotched, and shades in between.

The first time I noticed the ability to change colour was the huge insect from Port Isaac. The opercular spine was pale yellow when first observed, but less than an hour later, it had turned deep pink. The following morning the insect was quite pale but within ten minutes of opening the curtains it had gone back to dark purple mottling. The brown nymph I collected in November was very pale, but the following morning had become much darker. It has a regular daily cycle of colour changes, becoming pale at night and is now a mahogany red during the day.

Presumably this ability to change colour is to improve its already superb camouflage. Perhaps it is also related to the plants on which it feeds. It was noticeable that the browns in the large colony on bramble were all dark straw which was a perfect match for the old stems. The browns in the large colony on roses were all red/brown which was a perfect match for autumn rose stems. Whilst the number of browns found during the survey was just over half of the total, they accounted for over 80% of those on roses but only 33% of those on brambles.

It may be that most brown insects start out as green. In 1982 Mrs Watts of Penryn raised 400 *A. inermis* from eggs. Only three were brown and they were sickly and died before maturity (Turk 1985). In 1985 Eve Bysouth kept eggs from green, olive and brown *A. geisovii* separate but all

the offspring were green (Bysouth 1990).

My 48mm brown nymph found on 13th November had three moults before becoming adult. The dates of moult and body length are shown in Table 2. Egg laying began on 11th February, 14 days after becoming adult.

Date	Length	Increase in length	Days between moults
26-11-1992	62mm	29%	-
08-01-1993	84mm	35%	43
28-01-1993	106mm	26%	20

Table 2. Moulting data for the brown nymph.

Insects have been seen in Port Gaverne and Port Isaac for some years (Table 3). One of the first reports in 1992 was from a lady who told me that she used to work at Port Isaac school and had tipped out some stick insects in her garden at the end of term about ten years ago. She had thought they were dead, but has seen them most years ever since. The insects she tipped out were almost certainly dead, but she probably tipped out several hundred eggs at the same time. I subsequently spoke to Mrs Oaten who taught at the school in the early 1980s. She remembers getting insects in 1983 from another school, probably Wadebridge, which had surplus stock. It seems most likely that these first Port Isaac insects were the offspring of the 400 *A. inermis* bred by Mrs Watts in 1982; she has confirmed that many of those were given away to schools and other interested parties in the county (Turk 1985).

Date	Comments
1983	Insects acquired by school. Dead insects tipped out into private garden at end of term.
1987	Many insects in front hedge in June.
1988	Brown adult in garden in September.
1990	Brown adult in garden in summer.
1990	Brown adult on rose in garden.
1990	Many insects found in September when clearing bramble from overgrown garden.
1990	Insect seen on window in October.
1990	Green insect seen on wall in autumn.
1991	Green & brown insects seen in garden in summer.
1991	Children found one in summer while waiting for school bus.
1991	Seen on rose in garden in autumn.
1991	Green insect on bramble beside footpath.
1991	Brown insect in garden in December.
1991	On garden wall in December.

Table 3. Records from Port Gaverne and Port Isaac prior to 1992.

It is possible that other school insects from the 1982 source may have been accidentally introduced into the wild in Cornwall. The teacher at Blisland school, a few miles inland from here, advised me that the children found stick insects outdoors in the school nature garden in 1992. Stick insects without spines were also reported from a garden in St Ives, Cornwall, in 1990. Undoubtedly other sites will turn up.

In the ten years since their accidental release, the Port Isaac insects have spread only a few hundred metres from their original site. Although normally motionless, these insects can move surprisingly fast and could probably walk this distance in a single night. It seems likely that without the need to search for a mate, and given a sufficient food source, they have little inclination to move from their own bush.

Port Isaac has an equitable climate for these insects, very similar to their native New Zealand, with cool moist summers and frost free winters. Stick insect eggs however can clearly survive lengthy periods of frost. The hard winter of early 1987 brought several weeks of extremely low temperatures to Cornwall and the Scilly Isles. This caused severe frost damage to the sub-tropical gardens at Tresco, but that autumn both *C. hookeri* and *A. geisovii* were found by Paul Brock when he visited the gardens.

On 23rd March 1993, a very active 98mm green adult was found sunning itself on a wall in Port Isaac. My weather records show this winter was even milder than 1992, with the lowest temperature 3°C and an average January minimum of 9°C. Whilst the important factor for the species survival from year to year remains with the eggs, this is the first confirmation of a stick insect living through a mild winter.

The prospect for our stick insect colony is very good. Their widespread distribution in so many gardens means that any accidental spraying of one site with garden insecticide will not be catastrophic. The most heartening sign for the future wellbeing however is the attitude of those residents in whose gardens the insects were staying. Almost without exception they were delighted to share their garden with these fascinating insects. A few nibbled leaves on the roses was generally regarded as a small price to pay for the pleasure of observing these inoffensive creatures.

Acknowledgements

I am grateful to Eve Bysouth for permission to use her fine *A. inermis* drawing in my local monthly magazine articles. Without this illustration the response would have been much diminished. I am also grateful to Stella Turk at CBRU for supplying me with copies of the two Uvarov papers (1944, 1950). My most particular thanks go to Paul Brock, Membership Secretary of the Phasmid Study Group, for providing me with copies of articles, newspaper cuttings, and his own unpublished data on British stick insects, and for bringing me specimens of *C. hookeri* and *A. geisovii* in order that I may photograph them.

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West Briton Newspaper (1987a) Down in the garden "sticks" stirred. 27th August 1987.
West Briton Newspaper (1987b) Proud history of a garden firm. 15th October 1987.

Editorial note

In the interests of conservation, references to specific localities which were in Malcolm Lee's original manuscript have been omitted.

The Phasmid Database: changes to version 1.

P.E. Bragg, 8, Cornwall Ave, Beeston Rylands, Nottingham, NG9 1NL, U.K.

Key words
Phasmida, Phasmatodea, Taxonomic Database, Generic names.

Below are a number of corrections which should be made to the list of genera which was given in the last issue of Phasmid Studies (Bragg, 1992). There are a number of additions to make, these are mainly due to my original list being based on that of Bradley & Galil (1977). I am now in the process of working through all the described genera, in chronological order, in order to check which are valid. In order to check which genera are valid, it is obviously necessary to know the type species of each genus. The catalogue produced by Kirby (1904) designated type species for most genera, however Kirby made a few mistakes. I am in the process of checking the type species, with reference to the original publications. The type species are being added to the genera file of **The Phasmid Database**, this updated version will be available with the next release, hopefully in December 1993.

The following should be added to my original list, I have now confirmed that these are valid genera. However I have yet to check to which subfamily and tribe they belong.

Cladomimus	Carl	1915
Diagoras	Stål	1877
Dimorphodes	Westwood	1859
Entoria	Stål	1875
Eucles	Redtenbacher	1906
Eucarcharus	Brunner	1907
Euphasma	Redtenbacher	1906
Hypocyrtus	Redtenbacher	1908
Jeremia	Redtenbacher	1908
Neophasma	Redtenbacher	1906
Oestrophora	Redtenbacher	1906
Otocrania	Redtenbacher	1908
Pericentrus	Redtenbacher	1908
Pseudoceroys	Hebard	1922
Rhynchacris	Redtenbacher	1908
Sadyattes	Stål	1875

It is likely that there will be further additions once I have completed checking through the published names.

There are a number of other corrections to be made to the list, some are due to errors on my part and others are due to errors in Bradley & Galil's paper.

Phasmotaenia Navas, 1907 should replace the name *Phasmataenionema*. *Phasmotaenionema* was listed by Karny (1923: 240) and *Phasmatotenionema* was given by Bradley & Galil (1977: 193), having checked with the original publication, I have found, by referring to the original publication, that both are incorrect.

Carlius Uvarov, 1939 should replace *Brachyrhamphus* Carl 1915. The name *Brachyrhamphus* was used by Bradley & Galil (1977: 191) although Uvarov (1939: 458) had already pointed out that the name *Brachyrhamphus* was invalid as it was already in use for a genus of birds.

Kalocorinnis Günther, 1944 should replace *Kalokorinnis* Günther, 1932 (spelling & date change).
Bactricia Kirby, 1896 should replace *Bacticia* Kirby, 1904 (wrong date).
Argosarchus Hutton, 1898 should replace *Argosarchus* Brunner, 1898 (wrong author).

The date for most of the genera described by Audinet-Serville should be 1838, not 1839. The publication in which they were described was actually published during the week ending December 29th 1838 although the date on the book reads 1839. The genera affected by this are: *Ceroys*, *Creoxylus*, *Eurycnema*, *Monandroptera*, *Necroscia*, *Pterinoxylus*, *Pygirhynchus*, *Rhaphiderus*.

In my previous article (1992) I pointed out that *Echinoclonia* Carl is a junior synonym of *Apora* Brunner (I incorrectly gave the date as 1908 on page 39, this should be 1907 as given in the list on page 41). Since then I have found that the genus *Apora* Brunner 1907 is invalid as it is a junior homonym of *Apora* Gunnerus 1768, a genus of Echinodermata. However Article 60b of the International Code of Zoological Nomenclature (The International Commission on Zoological Nomenclature 1985) states that a new replacement name is not required as there is an available junior synonym. Therefore *Apora* should be deleted from the list of phasmid genera and replaced by *Echinoclonia* Carl 1913. The type species of *Echinoclonia*, fixed by monotypy, is *E. borneensis* Carl 1913, this is a junior synonym of *Echinoclonia laetior* (Brunner 1907) (synonymized by Günther 1932: 260). I designate *E. laetior* (Brunner 1907) [*Apora laetior* Brunner 1907] as the type of *Apora* Brunner 1907.

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Reviews and Abstracts.

Phasmid Abstracts

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

The editor of *Phasmid Studies* would welcome recent abstracts from authors so that they may be included in forthcoming issues. Lengthy abstracts may be shortened at the discretion of the editor. In the case of publications specialising in phasmids, *Phasma* and *Le Monde des Phasmes*, only the longer papers are summarised. The editor is grateful to Kim D'Hulster and Margaret Day for translations of some of the following papers.

Baarda, G. (1992) Voer!!! *Phasma*, 2(8): 3-5.

The fifth article in this series which looks at alternative foodplants for captive phasmids. The results are reported for a number of plants in the birch family (Betulaceae). These were tried with a variety of phasmids. Birch, *Betula* sp., was found to be eaten by 14 species when it was offered as a choice with the usual bramble or rose. Hornbeam (*Carpinus* sp.) and Alder (*Alnus* sp.) were also eaten by several species. Hazel (*Corylus* sp.) was the most successful member of the family, being eaten by 31 of the 32 species which were tested; the exception was *Oreophoetes peruanas* which is only known to feed on ferns.

Baarda, G. (1992) Voer!!! *Phasma*, 3(9): 9-11.

The sixth article in this series. Several strategies are suggested for dealing with the problems of obtaining food in winter. These include planting evergreens such as pyracantha and ivy in gardens, using houseplants and growing plants outdoors in tubs and then moving them into shelter in autumn. Several appropriate plants are suggested.

Bianchi, A.P. (1992) Karyological studies of Mediterranean stick-insects belonging to the genera *Clonopsis* and *Leptynia* (Insecta Phasmatodea). *Caryologia*, **45**(1): 1-19.

Karyotypes of three species of *Clonopsis* and of various populations of *Leptynia hispanica* and *L. attenuata* complexes were analyzed. The taxonomic status of the latter complexes is still uncertain. These genera include bisexual and parthenogenetic polyploid species and populations. The chromosomal numbers are: 2n = 32 in bisexual *C. algerica*, 2n = 22 in bisexual *C. maroccana*, 3n = 54 in telytokous *C. gallica*, 2n = 38 in bisexual *Leptynia hispanica*, 3n = 57 in telytokous triploid populations of *L. hispanica*, 4n = 76 in telytokous tetraploid populations of the same complex, 2n = 36 in a bisexual taxon of *L. attenuata* complex, 2n = 38 in another bisexual taxon and 4n = 76 in a parthenogenetic tetraploid taxon of the same complex. All the karyotypes are described. It is postulated that pericentric inversions and centric fusions have played a relevant role in chromosomal evolution of these genera. Because hybridization is the more frequent mode of speciation in these stick-insects, the polyploidy, connected with parthenogenetic reproduction is probably an allopolyploidy.

Bragg, P.E. (1992) The phasmid *Phenacephorus spinulosus* (Hausleithner) from Borneo, including a description of the female. *Entomologist's Monthly Magazine*, **128**: 185-192.

The taxonomic status of *Phasgania spinulosa* Hausleithner is reviewed, concluding that the species belongs to the genus *Phenacephorus*. The differences between the abdomens of the males

of *Carausius abbreviatus*, *C. mirabilis*, *Phenacephorus spinulosus* and *P. cornucervi* are illustrated. The female and egg of *P. spinulosus* are described and illustrated for the first time. The male is also illustrated and briefly described. Some notes on captive rearing are included.

Bragg, P.E. (1992) Phasmida from Bako National Park. *Sarawak Museum Journal*, 43(64): 295-319.

Eight species of Phasmid collected in the Bako National Park are discussed. Two new synonyms and a homonym are given, an existing synonym is corrected, and the lectotype of *Lonchodes amaurops* is designated. Illustrations of several species and some eggs are included. The genus *Dajaca* is reviewed and a new species, *D. filiformis* is described and illustrated.

Bragg, P.E. (1993) Parasites of Phasmida. *Entomologist*, **112**: 37-42.

The occurrence of parasites in phasmids is reviewed, the majority of records are of insects in the orders Hymenoptera and Diptera. Parasitic nematodes are reported from four species of phasmids, and mites from eight species in Borneo. These are the first records of phasmid parasites from Borneo and the number found suggests that parasites are under recorded. Phasmids of four species of *Haaniella* were found to have mites, in this genus mites were found in 63 out of 64 specimens which were examined in 1991.

Bruyère, E. (1992) Description d'un Gynandromorphe d'*Extatosoma tiaratum* (MacLeay, 1827). *Le Monde des Phasmes*, **20**: 3-5.

A gynandromorph of *Extatosoma tiaratum* is described and illustrated, it appears to be about one third male. The specimen has a complete wing on the right side of body, the left side is that of a typical female.

Carlberg, U. (1992) Cost of Autotomy in the Phasmida (Insecta) I. Species with low Autotomy Frequency. *Zoologischer Anzeiger*, **228**: 229-237.

The effect of different degrees of autotomy was studied in stick insects. As a measure of the cost of regeneration, an indirect method was used: the survival time (S_t) compared to the degree of autotomy or leg status (n). Species with low or no autotomy frequency were used: *Extatosoma tiaratum* (MacLeay), *Sipyloidea sipylus* (Westwood) and *Carausius morosus* (de Sinéty). *Rhaphiderus scabrosus* (Percheron) was also used since it was available at the time, although nothing is known about its defensive behaviour. Different patterns of survival and cost of regeneration were observed in the four species. Both *E. tiaratum* and *R. scabrosus* showed negative linear correlation between S_t and n, with different slopes. Both *C. morosus* and *S. sipylus* showed some most peculiar patterns. At a low degree of autotomy they were not influenced at all, while at a high degree of autotomy (removal of 3-4 legs) the survival time was severely affected.

Chen, S.C. (1992) A new species of the genus *Macellina* (Phasmida: Heteronemiidae, Pachymorphinae). *Acta Entomologica Sinica*, 35(1): 72-74. [In Chinese with an English summary].

A new species, *Macellina baishuijiangia* is described from Baishuijiang Reserve Area of Gansu. The type specimen is deposited in Beijing Forestry University. This species is allied to *Macellina souchongia* (Westwood).

Chen, S.C. & He, Y.H. (1992) *Micadina yingdensis* new species: A new walking stick injurious forest insect pest from Guangdong Province (Phasmida: Heteronemiidae). *Forest Research*, 5(2): 207-209. [In Chinese with an English summary]

A new species, *Micadina yingdensis*, is described from Guangdong Province in China. The type specimens are deposited in the Insect Museum of Beijing Forestry University. This new species is allied to *M. sonani* Shiraki, but differs from it in the following points; the apical margin

of the frons broader than the width of the first antennal joint, the lateral margin of 8th tergite not sinuated at the middle and cerci before the tip without a short tooth.

D'Hulster, K. (1993) Bewaren van takken. *Phasma*, 3(9): 1-4.
An illustrated article on how to preserve, set and store phasmids.

Deschandol, A. (1993) Qu'y a-t-il a l'intérieur d'une *Phyllium bioculatum*? *Le Monde des Phasmes*, 21: 8.
Describes and illustrates the different stages of egg development found by dissecting a female *Phyllium bioculatum*. Six different stages are recognised in addition to the stage which is laid. The earliest stage recognised is 2mm in diameter and 3mm long, a typical egg laid by the same female was 6.8mm long and 5mm at the widest point.

Giorgi, P.P. (1992) Sex and the male stick insect. *Nature*, **357**: 444-445.
Gives a outline of the five methods of reproduction in phasmids (normal sexual reproduction, parthenogenesis, hemiclonal hybridogenesis, gynogenesis, and androgenesis). The main theme is an explanation of the findings of workers in Bologna (see Mantovani & Scali, abstract below) who have reported natural androgenesis in species of *Bacillus*.

Gorkom, J. van (1992) Soortbeschrijving Phasmatodea. *Phasma*, 2(8): 14-15.
A short illustrated description of *Parahyrtacus gorkomi* Hausleithner. This species was originally collected by the author and Eric van Gorkom on Mindoro Island in the Philippines in 1985. It was described by Hausleithner in 1990 and named after the discoverers.

Gorkom, J. van (1993) De Indische Tak, een oude bekende. *Phasma*, 3(9): 14-15.
Narrates the history of *Carausius morosus* (Sinéty), the most studied phasmid. The article concludes that the culture in the insect house at Artis zoo, Amsterdam is directly descended from the original material collected in 1897 and passed to the zoo in 1904.

Hughes, L. & Westoby, M. (1992) Capitula on stick insect eggs and elaiosomes on seeds: convergent adaptations for burial by ants. *Functional Ecology*, **6**: 642-648.
The eggs of many phasmids bear a striking resemblance to seeds. These eggs are not only similar in size, shape, colour and texture to seeds, but in many species bear a capitulum. This structure resembles an elaiosome, a lipid-rich appendage on some seeds known to be an adaptation for burial by ants. Observations and experimental results are presented to show that capitula and elaiosomes are convergent in function as well as appearance. Capitula, like elaiosomes, promote removal of eggs to ant nests and buried eggs suffer reduced rates of parasitism by wasps. Phasmid nymphs are capable of emerging from eggs buried under 6cm of soil. Capitula are found only in phasmid species which drop their eggs to the litter and not in species which bury eggs or glue them to vegetation. Elaiosomes and capitula are both adaptations to use ant mutualists for burial, a striking example of evolutionary convergence between the plant and animal kingdoms.

Kittmann, R. & Schmitz, J. (1992) Functional specialization of the scoloparia of the femoral chordotonal organ in stick insects. *Journal of Experimental Biology*, **173**: 91-108.
The femoral chordotonal organ is important for the control of the femur-tibia joint during standing and walking. It consists of a ventral scoloparium with about 80 sensory cells and a dorsal scoloparium with about 420 cells. This study examines the function of these scoloparia in the function of the femur-tibia control loop. The study found that the ventral scoloparium functions as the transducer of the femur-tibia control loop but the dorsal scoloparium serves no function in

this loop.

Langlois, F. & Lelong, P. (1992) Une Nouvelle Methode de Chasse: La Douche Froide! *Le Monde des Phasmes*, **20**: 6-7.

Describes a new method of collecting phasmids. Searching must inevitably be done at night due to most phasmids being nocturnal, and a head torch is obviously essential, although prospecting and choosing likely sites can be done by day. In captivity phasmids react by moving and showing their presence when the cage is sprayed with water. Also, the same result has been observed when air or smoke is blown over them. To test these methods in the field, collecting was done using cigarette smoke, air and a fine humidifying spray. The best results were obtained by the smoke but the air current also produced good results; the insects were disturbed and showed themselves. However the authors became very thirsty and tired from all the blowing involved, there is also a risk of fires using the cigarettes. The spray proved invaluable in night searching. *Leptynia hispanica* are hard to find, but all insects: phasmids, orthoptera, mantids, cockroaches and even spiders move when sprayed and become noticeable, even in the centre of a bush. *Leptynia hispanica* in fact does a backward somersault from its perch and can thus be collected. This method has only been tested on the three French species. The authors would be interested to hear from anyone else trying these methods.

Lelong, P. (1992) Morphologie des Oeufs des deux Especes Europeennes de *Leptynia*. *Le Monde des Phasmes*, **20**: 8-18.

Describes and illustrates the external morphology of the eggs of *Leptynia hispanica* and *L. attenuata*. There are ten photographs produced by a scanning electron microscope, showing whole eggs and finer details.

Manaresi, S., Marescalchi, O. & Scali, V. (1992) The chromosome complement of the hybrid Bacillus whitei complex (Insecta: Phasmatodea): I. The paleo- and neo-standard karyotypes. *Cytologia (Tokyo)*, **57**(1): 101-109.

The thelytokous hybrid *Bacillus whitei* (2n = 35, XX female) endemic to Southeastern Sicily, is clearly derived from *B. rossius* crossed with *grandii*, but a variety of cytotypes have been found in these parthenogens. The most widespread, standard karyotype perfectly fits the suggested hybrid derivation except for the fourth metacentric element, certainly deriving from *B. rossius*, in which, however, nowadays invariably shows a corresponding acrocentric chromosome; on the other hand the acrocentric "modern" element has been found in hybridogenetic strains of *B. whitei*, very recently discovered among clonal ones. Linking together reproductive biology and geographical distribution of the "metacentric" and "acrocentric" standard karyotypes, two hybridization events between *B. grandii* and either a "paleo" or "neo" *B. rossius*, respectively, are here suggested. C-positive satellites and corresponding Ag-NOR, are found on a wide array of chromosomes, mostly reflecting those of both parental species, but also on new locations. The high dynamics of rDNA cistrons, mainly evidenced in the *B. rossius* genome, makes NORs not entirely reliable as long-term cytotaxonomical markers, but rather useful in short-term comparisons.

Manaresi, S., Marescalchi, O. & Scali, V. (1992) The chromosome complement of the hybrid *Bacillus whitei* complex (Insecta Phasmatodea): II. The repatterned cytotypes. *Cytologia (Tokyo)*, **57**(1): 111-119.

The hybrid *Bacillus whitei* complex clearly derives from two different interspecific hybridization events between *B. rossius* and *B. grandii grandii*. The older one gave origin to nowadays parthenogenetic clones with a "metacentric" "paleo"-karyotype, while from the more recent one originated the presently hemiclonal hybridogenetic strains, which exhibit the

"acrocentric" "neo"-karyotype. These two 35-chromosome sets have been referred to as standard karyotypes. Extensive chromosomal analysis of both central and peripheral populations showed a variety of differently repatterned cytotypes (2n = 35-37), all clearly derived from the "paleo"-standard karyotype. This study analyzes these cytotypes and suggests their derivation from the standard "paleo"-karyotype mainly through Robertsonian fissions of the largest chromosomes and a few heterozygous translocations. Chromosome repatterning appears to increase with the increasing distance from the Canicattini Bagni area which therefore appears to be the hybrid radiation centre. The "fissionist" versus "fusionist" trend in the phasmid karyotypes is discussed and the particularly convincing evidence of intraspecific Robertsonian fissions of the largest chromosomes of the *B. whitei* set is stressed. The utilization of such fissions as unambiguous models for the molecular analysis of centromeric regions is suggested and the synthetic rDNA activity in the hybrid of both parental sets is also pointed out.

Mantovani, B. & Scali, V. (1992) Hybridogenesis and androgenesis in the stick-insect *Bacillus rossius-grandii benazzii* (Insecta, Phasmatodea). *Evolution*, **46(3)**: 783-796.

In northwestern Sicily interspecific hybrid females between *Bacillus rossius* and *B. grandii benazzii* are sympatric with facultatively parthenogenetic demes of the former and bisexual populations of the latter. Preliminary observations suggested that hybrid females are maintained by hybridogenetic reproduction, not by current F_1 hybrid production nor through parthenogenesis. Being hybridogens, a complex of hemiclonal linages, they are referred to as *B. rossius-grandii benazzii*. In this study *B. rossius-g. benazzii* females were crossed with males of *B. g. benazzii*, *B. g. grandii*, *B. g. maretimi*, and *B. rossius*. Allozyme analysis of the progeny showed that the great majority of them were actually produced by hybridogenesis with a hemiclonal inheritance of the maternal *B. rossius* genotype (*Br-m*) and actual syngamy with a sperm from the fathering male, so that *Br-m-gb-p*, *Br-m-gg-p*, *Br-m-gm-p*, and *Br-m-r-p* offspring were obtained in the respective crosses. All-paternal progeny (androgenetics) were also produced (*Bgb-pgb-p*, *Bgm-pgm-p*, *Br-pr-p*) and two gynogenetic descendants were observed. Cytological investigations on virgin eggs that failed to hatch revealed in most of them a haploid-diploid blocked blastoderm; this rudimentary parthenogenesis appears to be an important prerequisite for further evolution of this hybridogen. Reproductive modes of descendants were also analyzed; although *Br-m-g-p* hybrids are still able to reproduce by hybridogenesis, a progressive disruption of the hybridogenetic-androgenetic system takes place in synthetic *B. rossius* (*Br-m-r-p*, *Br-pr-p*) and abundant thelytokous parthenogenetic offspring are obtained from females of androgenetic origin. The evolutionary role of these hybridogens appears to be linked to their shift towards parthenogenesis; this has apparently occurred in the southeastern Sicilian hybrid *B. whitei* (= *B. rossius/g. grandii*), which exhibits both hybridogenesis and parthenogenesis.

Mantovani, B., Scali, V. & Tinti, F. (1992) New morphological and allozymic characterization of *Bacillus whitei* and *Bacillus lynceorum* hybrid complexes (Insecta Phasmatodea). *Biologisches Zentralblatt*, **111**(2): 75-91.

A more precise characterization of body morphology - mainly based on eye pigmentation patterns and cercus shape - and of egg chorion sculpturing of the two interspecific hybrids *Bacillus whitei* and *B. lynceorum*, is given. Morphological details fully support the *B. rossius* x *B. grandii* parentage for the former and the *B. atticus* x *B. rossius* x *B. grandii* one for the latter. Allozyme analysis reveals that the great majority of *B. whitei* clones are found in sympatry with *B. grandii*, thus suggesting their production through an early hybridogenetic phase. On the other hand, the much more numerous and differentiated clones of the triploid *B. lynceorum* appear to have originated chiefly from two hybridization steps, namely through the production of fertile *B. atticus/rossius* hybrids first, followed by their fertilization from *B. grandii*.

Qi, Y.H. & Liu, S.L. (1992) A new record of *Tirachoidea westwoodi* (Wood-Mason, 1875) from China and a description of its male (Phasmatodea: Phasmatidae). *Acta Zootaxonomica Sinica*, 17(2): 250-252. [Chinese with English summary].

In this paper gives the first records of *Tirachoidea westwoodi* (Wood-Mason), 2♂♂ and 2♀♀, from Jinping County, Yunnan Province, China. It has been found to feed on *Eucalyptus* spp. The male of this species is described for the first time.

Roubauld, P.E. (1993) Parthenogenèse chez les Phasmes. *Le Monde des Phasmes*, 21: 9-11.

Discusses the geographical distribution of parthenogenesis in *Bacillus rossius* and the effects of continual parthenogenesis in *Carausius morosus*.

Tinti, F., Mantovani, B. & Scali, V. (1992) Allozymatic characterization of middle-southern Italian and Sicilian populations of *Bacillus rossius* (Phasmatodea). *Bollettino, Societa Entomologica Italiana*, **123**(3): 184-194. [Italian with English summary]

The allozymatic characterization of 19 new populations of *B. rossius* from middle-southern Italy and Sicily is reported. Their attribution to the two known Italian subspecies is clear: the Calabrian (4) and Sicilian (13) samples belong to *B. r. redtenbacheri*, which is also distributed on the Adriatic and Ionic coasts of the Italian peninsula, while two more northern Tyrtherian populations (Elba Island and Circeo) belong to the other subspecies *B. r. rossius*. Reproductive biology and microevolutionary features of the examined taxa are discussed.

Tinti, F. & Scali, V. (1992) Genome exclusion and gametic DAPI-DNA content in the hybridogenetic *Bacillus rossius grandii benazzii* complex (Insecta: Phasmatodea). *Molecular Reproduction and Development*, **33**(3): 235-242.

The egg maturation of the *Bacillus rossius grandii benazzii* complex is analyzed by DAPI fluorometry, which, besides the assessment of the meiotic stages, also allows their DNA measurements and the analysis of sperm-head evolution into male pronuclei in these polyspermic eggs. The genome exclusion mechanism of stick insect hybridogens appears to be more primitive than those observed in the already known hybridogenetic complexes of *Poeciliopsis* and *Rana esculenta*. Unfertilized eggs of hybridogens are capable of self activation, but the cytology of the related clonally reproducing *B. whitei* indicates that its parthenogenetic mechanism stems from the hybridization event (hybrid theory) rather than from tychoparthenogenetic potentialities (spontaneous theory).

Veltman, K. (1993) *Carausius morosus*, toch 'n bijzondere tak! *Phasma*, 3(9): 5-8.

Reviews some basic facts about *Carausius morosus* and gives observations of hatching behaviour which differs from that of *Bacillus rossius*. Three photographs showing different stages of hatching of *C. morosus* are included.

PSG 121, *Phenacephorus spinulosus* (Hausleithner).

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Key words
Phasmida, Rearing, *Phenacephorus spinulosus*, Mt. Kinabalu, Sabah, Borneo.

Classification

Berghard Hausleithner described this species in 1991 as *Phasgania spinulosa*, base on a single male specimen which had been collected by C.L. Chan & L. Chin in 1981. Females of this species were not available to Hausleithner and males of several genera of Lonchodini are very similar. The species takes its name from the spines along the abdomen of the male.

The female has lobes on the mid femora (Fig 2a) and a simple crest on the head (Fig 2b). This species therefore belongs in the genus *Phenacephorus* which was described by Brunner von Wattenwyl in 1907. As it has only recently been described, this species has been mentioned only a few times in the literature.

Phasgania spinulosa Hausleithner, 1991: 230, fig 9. (Holotype: Sinsuran, Sabah).
Phenacephorus spinulosus (Hausleithner), Bragg, 1991: 3.
Phenacephorus spinulosus (Hausleithner), Bragg, 1992: 185-192.

Distribution

This species is only recorded from two localities, both in Sabah: Sinsuran and Mt. Kinabalu Park. It is common along the trails near Mt. Kinabalu Park Head Quarters. On three nights in 1992, Paul Inglis and I counted one, three and nine adults.

There are a few specimens in the Natural History Museum, London, these were collected by Allan Harman in the early 1980s, also from Mt. Kinabalu.

Culture history

Two females and four males of this species were collected at night in the area around Mt. Kinabalu Park Head Quarters in July 1990. The insects survived for about two weeks in captivity and 30 eggs were collected. These eggs were incubated and three specimens, one female and two males, were raised in the U.K. The PSG culture (PSG 121) is based on these, and another adult pair which I collected in August 1992, again from Mt. Kinabalu. Eggs and nymphs have been distributed to several PSG members.

Some specimens were also collected by Ulrich Ziegler from the same area, but his culture died out.

The male (Fig 1b).

The male varies in length from 49.5-51mm. The body, head and legs are mid brown and densely granulose. The colour of the abdomen gradually changes to dark brown towards the rear.

The head bears two quite large spines which point forwards and outwards. The antennae are mid brown in colour.

The mesonotum, and abdominal segments 1-7 all have a swelling on the upper surface of the hind edge. This has the form of a blunt spine on the first six abdominal segments although on the median segment this may not always be particularly spine-like. The swelling on the 7th segment is very small, little more than a tubercle. The 8th segment widens greatly at the hind end and the 9th narrows at the rear, together with the short 10th segment, they form a distinctive kite-shaped

swelling on the end of the abdomen.

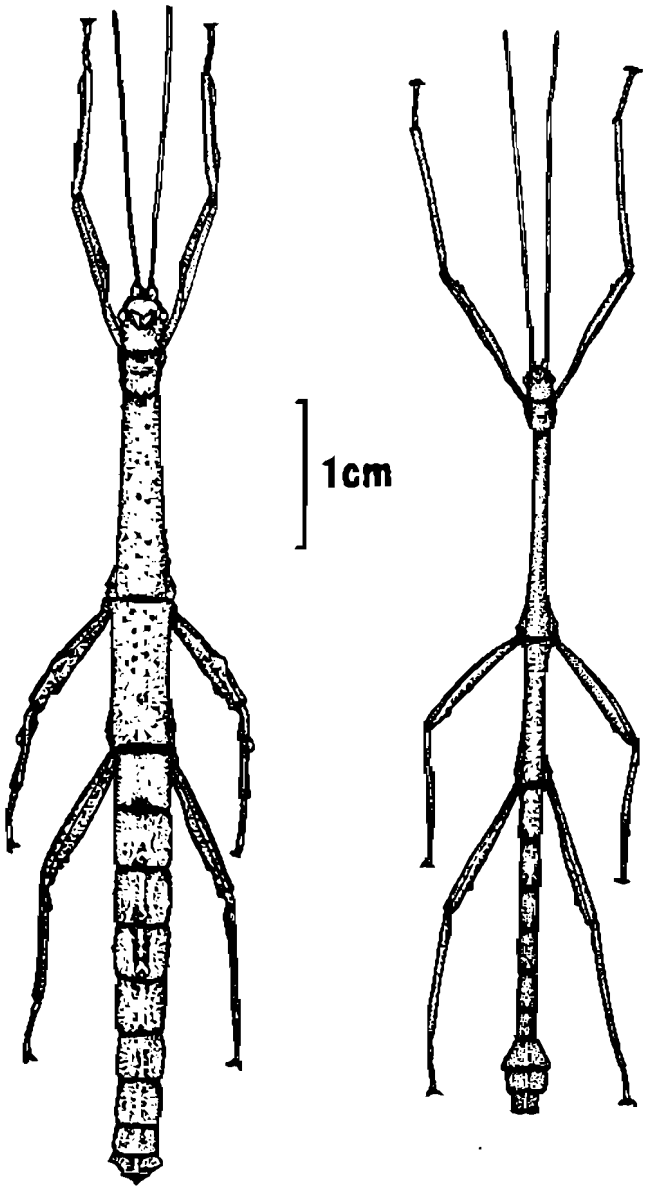

Figure 1. Female & male *P. spinulosus*.

The legs are plain except for a few small spines on the underside of the apices of the femora. In each case the spine or pair of spines nearest the body are quite robust, those nearest the apices are small.

The female (Figs 1a, 2a and 2b).
The female varies in length from 56-60.5mm. The body is mid brown and densely covered in fine granules. There are some black tubercles on the thorax and black ridges running along the abdomen. Abdominal segments 5 and 6 may be very dark brown. The legs are mid brown with black speckles.

The head is more or less flat, and between the eyes are two simple crests lying at an angle of about 45° to the midline (Fig 2b). The antennae are as long as the front legs, light to mid brown sometimes with darker patches.

Abdominal segments 2-9 all have a small swelling at the hind edge, these correspond to the blunt spines of the male (although in the male they occur only as far as the 7th segment). The 5th segment has quite a large swelling on the upper surface, the size and shape of this varies.

The fore femora are narrow at the base, widening out to become quite robust. As with the male, there are a few small spines on the underside of the apices of all the femora.

The mid femora are short, strong, and have a rounded lobe on the upper surface (Fig 2a). The middle tibiae have two lobes about one third of the way along, the one on the outside is a large rounded lobe while the one on the inside is more low lying.

Variation
The males show no significant variation and there appears to be little variation in the females of this species. The only notable variation in the females is a slight difference in the size and shape of the swelling on the 5th abdominal segment.

This lack of variation is a sharp contrast to the other *Phenacephorus* species which is in culture

(PSG 73, *P. cornucervi*), which has highly polymorphic females. The nymphs in my culture are a very pale cream colour, almost white and they seem to begin to darken when they are about half grown.

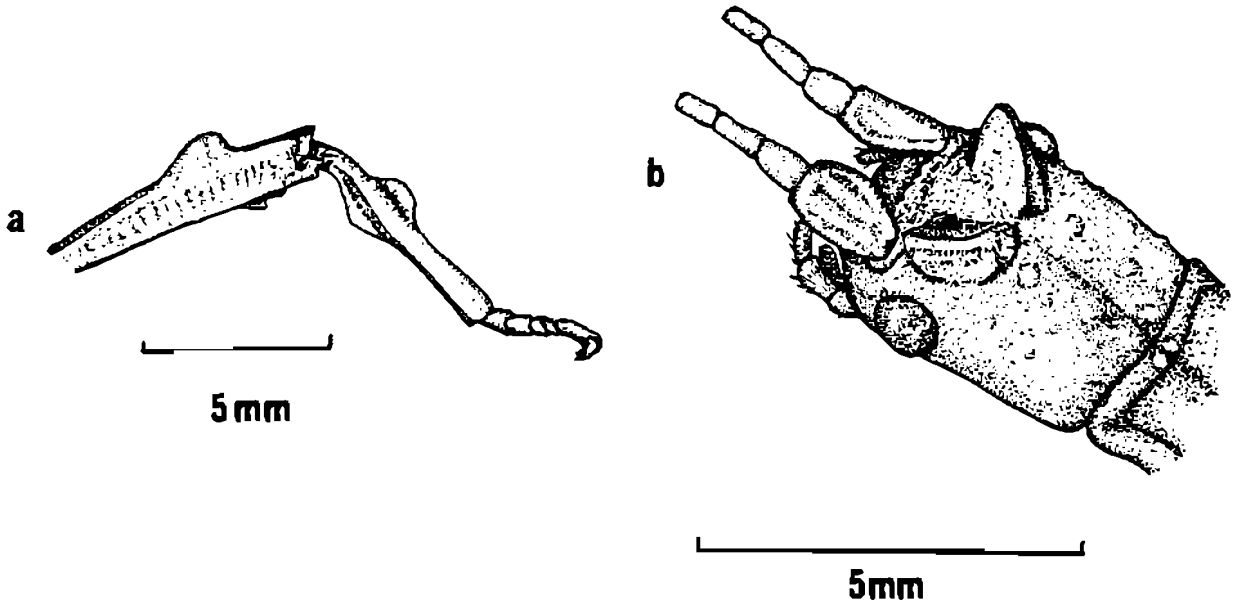

Figure 2. (a) mid femur and (b) head of the female.

The egg (fig 3).
The egg is small, typically 2.3mm long, 1.7mm in height and 1.5mm in width. The capsule is uniformly dark grey, almost black. The surface appears pitted with tiny holes. The micropylar plate has a black rim and is almost oval, but slightly wider at the polar end. The operculum is very slightly concave and has a dark brown capitulum. The opercular angle is very small, only about +1°.

Hatching takes four to five months in unheated conditions (about 10-15°C) but would probably take only three to four months if incubated at higher temperatures. Care is needed to ensure that the eggs do not become too dry.

Foodplants
This species will readily feed on bramble (*Rubus* spp.), raspberry (*Rubus idaeus*), firethorn (*Pyracantha* sp.) dog rose (*Rosa canina*), ivy (*Hedera helix*), eucalyptus (*Eucalyptus gunnii*), oak (*Quercus* sp.) and flowering currant (*Ribes* sp.). I have not tried other plants but would expect quite a range to be eaten.

Rearing
I have successfully reared several generations of *P. spinulosus* in my standard cages (Bragg 1987 & 1989). However a high humidity seems to be essential (70-90%).

The thirty eggs of *P. spinulosus* which were collected in Sabah were incubated at ambient temperatures. From these eggs three adults were raised, two male and one female. The males became adult some time before the female. The female produced only 87 eggs, and died before

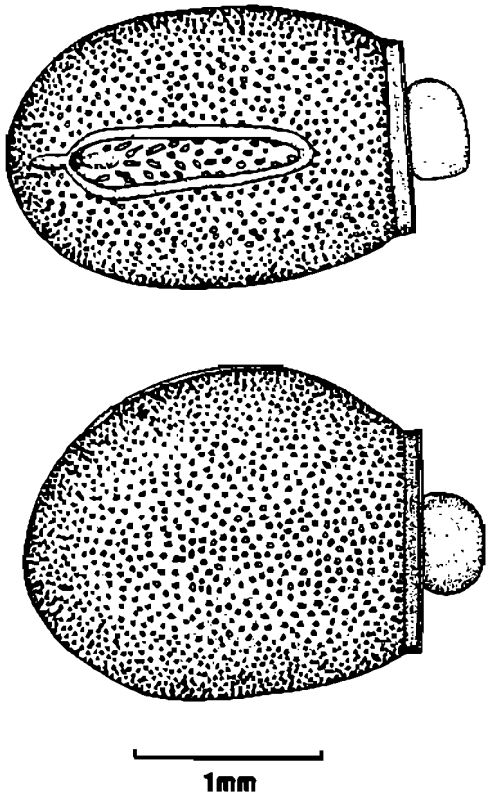

Figure 3. Dorsal & lateral views of the egg.

the males, so I assumed that she did not live for a normal lifespan and would normally have produced more eggs, this theory later proved correct. Some of these eggs were distributed to other members of the PSG and a few were kept and distributed as nymphs.

The rather poor success rate from the initial 30 eggs was probably due to the eggs being badly treated in the four weeks immediately after they were laid. During this time I was travelling around Borneo and the eggs were subjected to varying temperatures and a lot of bumping around! Subsequent experiences have produced much higher success rates.

The female which I collected in 1992 laid its first eggs on 30th August 1992 and the first hatching was on 20th January 1993 (141 days). The eggs, as usual, were kept in the cage without any additional heating. The female continued to lay eggs until she died in 19th April 1993. Although I did not keep a record of the total number of eggs laid (because she had already been laying before capture), I estimate that about 250 eggs were laid. This is based on the egg laying rate of one egg per day (88 eggs in 89 days from 17-11-1992 to 13-02-1993), however as this rate is from the coldest period it is probable that the number of eggs laid was much higher; in addition she would have been laying eggs before she was caught.

Other members have reported difficulty with this species which I believe is due to keeping them too dry. The eggs are very small and particularly prone to drying out, leaving them in an open container in a room for a few days appears to be fatal.

They are an attractive species and as they are quite small, they do not need much feeding. In my usual conditions of very humid cages I have found the hatch rate can be very high and survival of the nymphs is good. I gave away all my eggs but recently noticed some nymphs which I assume are due to a few eggs which must have lodged in the corner of the cage!

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Pharnacia serratipes (Gray).

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Taxonomic notes by P.E. Bragg.

Key words
Phasmida, *Pharnacia serratipes*, *Pharnacia acanthapus*, Rearing, Breeding, Foodplants.

Classification

This species was originally described, from a male, as *Cladoxerus serratipes* by Gray in 1835. The female was described as *Bacteria acanthopus* by Burmeister in 1838. There is sometimes some confusion over the date of Burmeister's description because, although his book was published in two volumes, each volume was originally issued in two parts; the first part of volume two, which includes the phasmids, was issued in 1838, the final part of volume two appeared in 1839. The genus *Pharnacia* was established by Stål in 1877.

The name *P. acanthopus* has nearly always been used for this species. This is probably because the only published key to the genus did not include *serratipes* (Redtenbacher, 1908: 449-450) and Redtenbacher was not aware that the two species were the same. In fact Kirby had previously published the synonym (Kirby, 1904: 359) but Redtenbacher, and everyone else, appears to have overlooked this. I have checked the type specimen of *P. serratipes* with my own cultured specimens and can confirm that the species in culture is *serratipes*. The cultured females agree with the published descriptions of *P. acanthopus* and with Redtenbacher's key, so Kirby was correct; *serratipes* and *acanthopus* are the same species.

This species has been mentioned in the literature on a number of occasions since it was first described, usually under the name *acanthopus*. As is often the case with species which were described a long time ago, there has been some confusion with the identification of this species by various authors. Several of the references refer to specimens which were subsequently found to be wrongly identified and have since been corrected or described as new species; these are placed in square brackets below.

Cladoxerus serratipes Gray, 1835: 42.
Phibalosoma serratipes, Westwood, 1859: 75.
Phibalosoma serratipes, Stål, 1875: 63.
[*Pharnacia serratipes*, Kirby, 1896: 448, 450. Misidentification - later changed by Kirby.]
Pharnacia serratipes, Kirby, 1904: 359.
Pharnacia serratipes, Redtenbacher, 1908: 455.
Bacteria acanthopus Burmeister, 1838: 565. [synonymised by Kirby, 1904: 359.]
[*Phasma (Cladoxerus) acanthopus*, de Haan, 1842: 131.]
Phibalosoma acanthopus, Westwood, 1859: 74.
[*Phryganistria acanthopus* (Haan), Stål, 1875: 63.]
[*Phibalosoma acanthopus*, (?), Wood-Mason, 1877: 161.]
Pharnacia acanthopus, Redtenbacher, 1908: 451, pl. 21.8.
Pharnacia acanthopus, Werner, 1934: 2.

Redtenbacher (1908: 451) considered that de Haan's specimens were possibly a different species, one which he had described as *Pharnacia biceps* [= *Tirachoidea biceps* (Redtenbacher)]. He also thought that Westwood's examples of *P. serratipes* were in fact *P. acanthopus*, this is of course true, but Redtenbacher did not appear to consider the possibility that the male *serratipes* was the same species! Redtenbacher also considered Wood-Mason's to be a new species, *P. ingens* (1908: 453).

There have been several papers in recent years which mention this species in various experiments with captive material (Carlberg, 1988, 1989a, 1989b), and one discusses captive rearing (Herbert, 1988); all refer to the name *acanthopus* .

Until 1992, *P. serratipes* was regarded as the longest stick insect in the world, however this was based on Kirby's 1896 specimen which is not a specimen of *serratipes* (Bragg, in press). The maximum recorded body lengths for genuine *P. serratipes* are 243mm for the female (Redtenbacher, 1908: 454) and 175mm for the male (Gray, 1835: 42).

Range

This species was originally described from West Malaysia, and Redtenbacher (1908: 454) has since recorded it from West Malaysia, Singapore, Java, Sumatra, and Borneo, mostly based on specimens in his own collection. It is presumably commonly found in the wild in West Malaysia to judge by the quantity of deadstock that is sold in tourist shops in Singapore and Kuala Lumpur and the fact that some are imported into the UK.

Origin of Culture

This species was originally brought into culture by accident. Tony James imported ova that turned out to be *Pharnacia serratipes* mixed with some eggs of *Tirachoidea cantori* from a dealer in the Cameron Highlands, Malaysia, in 1980. These became established and the culture was later designated as culture PSG 25, with the name *P. acanthopus* applied to it.

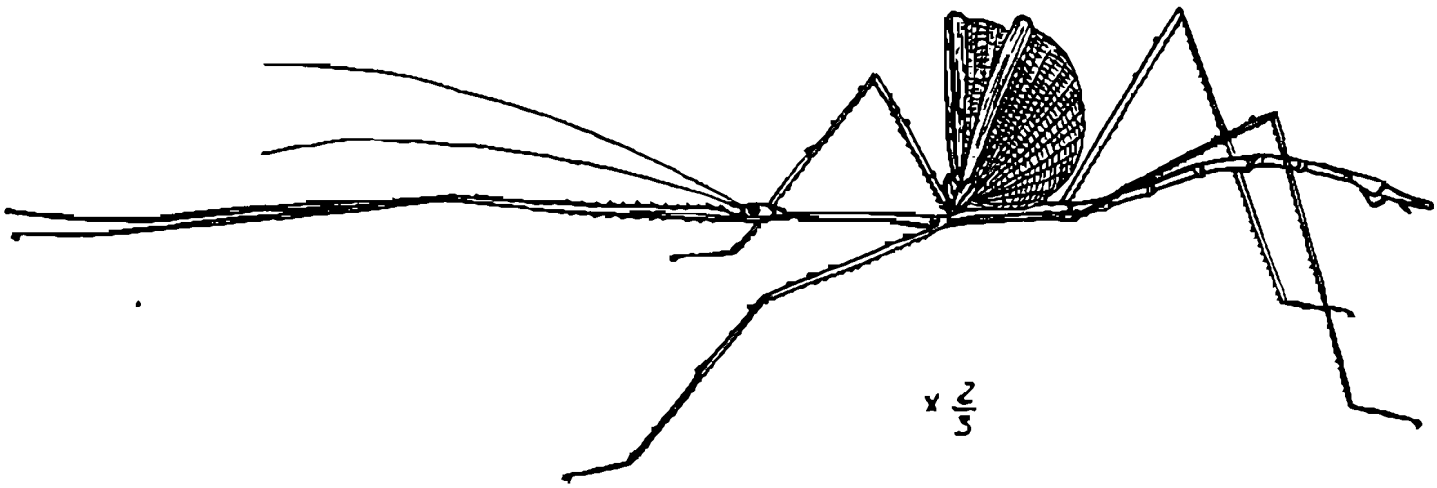

Figure 1. Male *Pharnacia serratipes*.

Description of the adults

This is a typical *Pharnacia* species, being very long and thin. It is one of the largest species to be kept in Europe.

The females in my culture reach a body length of 215-230mm with a maximum width of 15mm when in full egg production. The leg lengths are about: fore 170-185mm, mid 115-130mm, hind 145-160mm; the antennae are about 90mm long. The overall length from the front feet to the tip of the abdomen is about 410-425mm. Typical colouring is either light apple green, or brown, some may also be nearer to black. The green females are very rare, in my recent generation I have only had two green ones out of about forty adult females. Mel Herbert (1988: 9) reports that he had

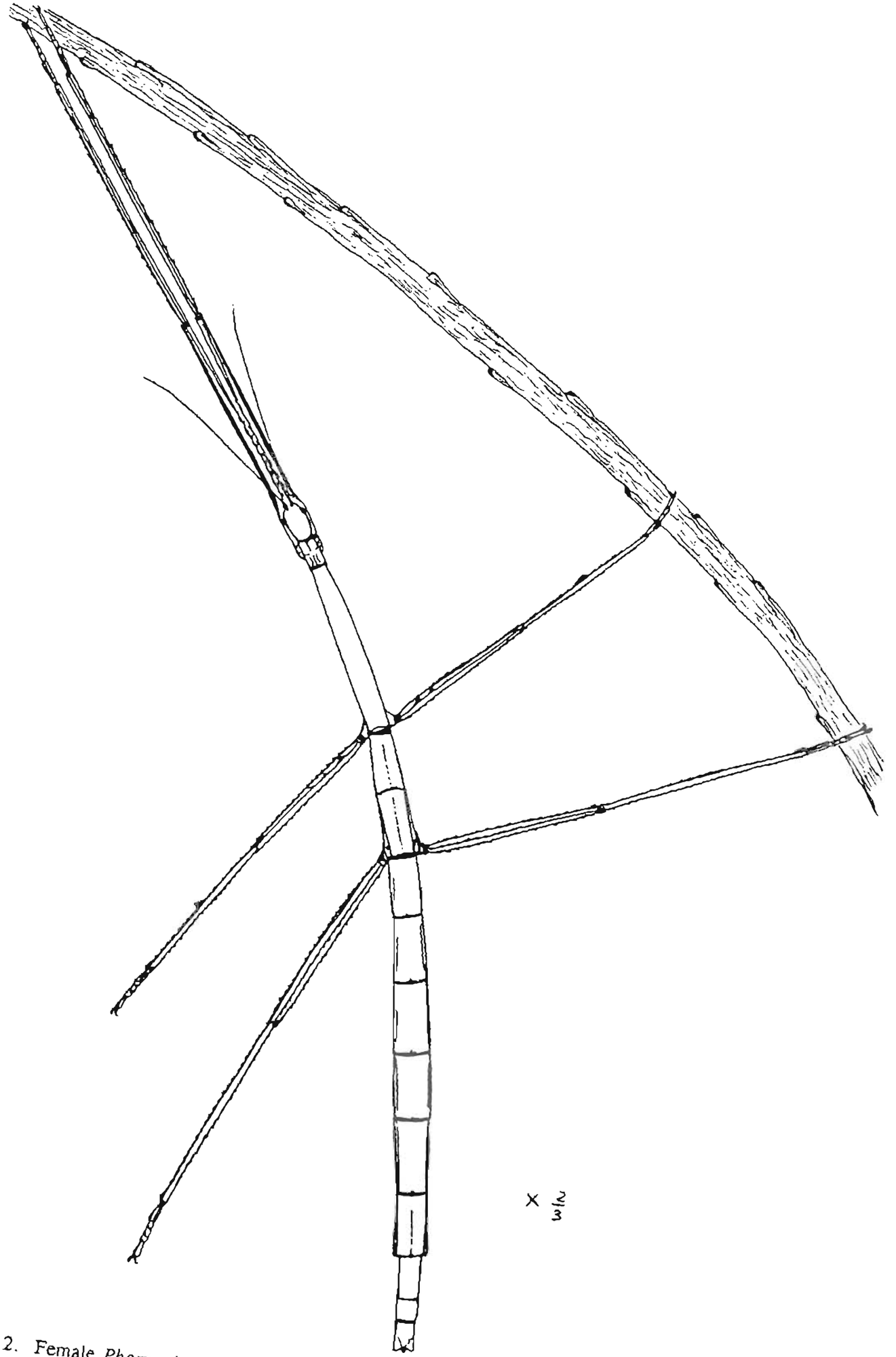

Figure 2. Female *Pharnacia serratipes*.

individuals with large white patches on the dorsal surface. The body is thin and spineless. The legs are all very long and thin and bear many serrations, especially on the top section of the front and mid femora. The mid femora bear two large, flattened thorns on their top section, which are variable in size and in some individuals totally absent. The first tarsal segment is always longer than the others and quite flattened. It is interesting to see that the mid tarsi in particular sometimes only have four segments, something which I have only seen in this species; this is probably due to the insects losing a leg when young and then regrowing the leg as they get older. The insides of the hind legs are purple in colour. The operculum is not very large and does not extend beyond the tip of the abdomen. The praeopercular organ forms a long, very noticeable spine near the base of the operculum. The cerci are small.

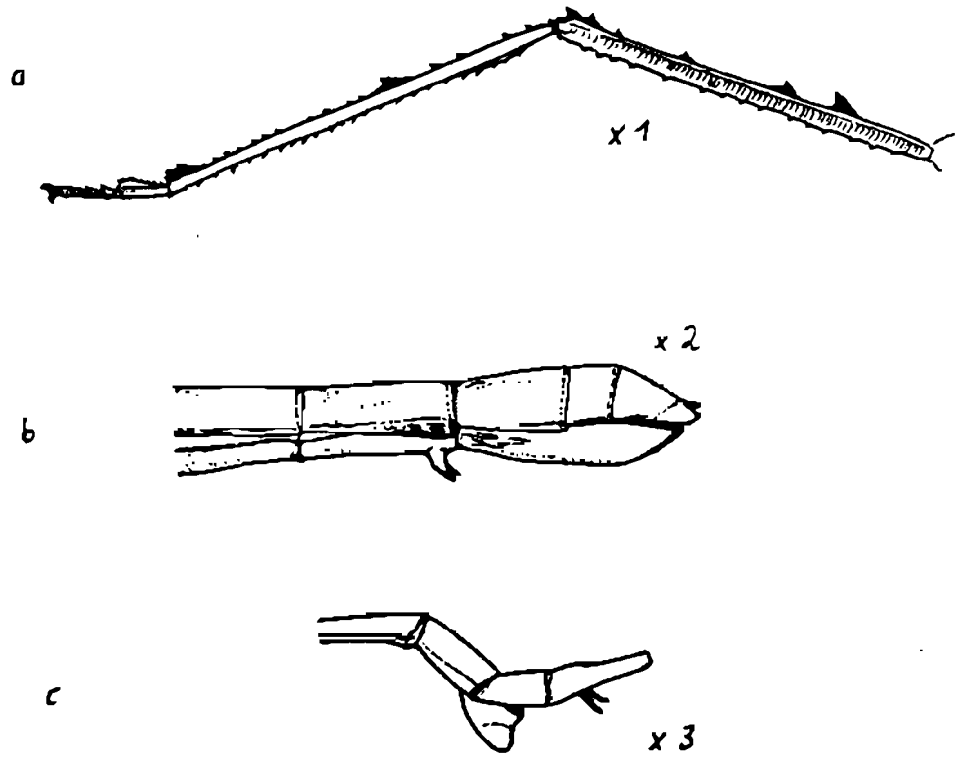

Figure 3. (**a**) ♀ midleg (**b**) ♀ operculum (**c**) ♂ operculum.

The males are much smaller and thinner than the females. In my culture they reach body lengths of 145-165mm with a width of about 3mm. The leg lengths are: fore 125-130mm, mid 80-90mm, hind 105-110mm; the antennae are a bit longer than those of the females at 90-100mm. This gives an overall length from the front feet to the tip of the abdomen of 300-320mm. The basic colour is greenish brown. On both sides of the mesonotum is a blueish stripe, with a black stripe below it. The black stripe continues along the wing, the leading edge of the wing is white. The wings, as in most *Pharnacia* sp., are quite small and span about 75-80mm from one tip to the other. The colouring of the wings is a light, translucent grey-brown, with darker brown veins. The legs are all very long and thin and, like those of the female, bear many serrations. There is a large genital "bump" near the tip of the abdomen which ends in one pair of claspers and a pair of cerci (fig. 3c).
According to Mel Herbert, males have seven instars, and females nine. Both sexes are hardy and females live a year or longer as adults.

Eggs (Fig. 4)
The eggs are relatively small for such a large species as this, and it is sometimes difficult to believe that such long nymphs can hatch from such small eggs. They are about 5mm long, 4mm high and 2.5mm wide. The colour is a uniform light creamy-brown. They are slightly flattened, resulting in a quite long oval shaped operculum with pointed ends. In the centre of the brown operculum is a small dark brown, rounded capitulum on a short stalk. The micropylar plate looks like a

deformed heart and is greyish in colour.

In my opinion, the eggs are best incubated on damp peat, at a room temperature of 20-25°C; in these conditions, hatching takes about five months and I have had a 100% hatch rate. They tend to go mouldy easily so it may be a good idea to keep them only slightly damp, or in very airy conditions. I had some nymphs hatching with deformed legs but that is no problem after the first skin shed. Mel Herbert reported that he had quite good results keeping the eggs on damp tissue paper. Females in my culture produce about three or four eggs per 24 hours.

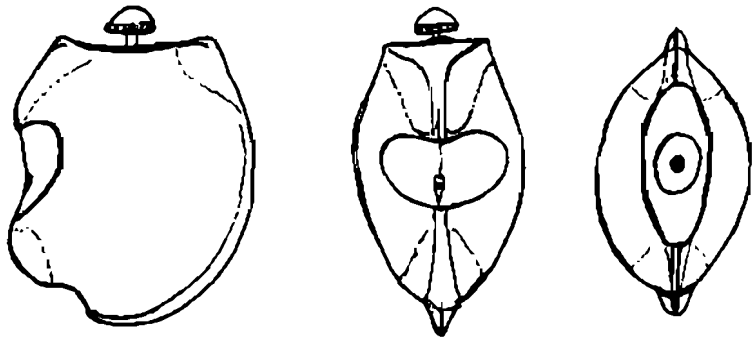

Figure 4. Egg: Lateral, dorsal and opercular views.

Nymphs (Figs. 5 & 6)
The newly hatched nymphs are relatively large when compared to those of other species. They have a body length of about 30mm and an overall length of 60mm. Their colour is green with brown mottling. There is a brown stripe running from the eyes along the mesonotum. The legs are banded in light and mid brown. As they grow they change in colour to a uniform brown or green. Young nymphs often curl their abdomens and may look as if they are deformed (Fig. 5). The nymphs, especially the larger ones, need a lot of space to shed their skins, but generally they grow very easily and I have had almost no losses.

Defence
Both adults and nymphs try to escape by falling or walking away. The nymphs in particular lose legs very easily and you have to be very careful when handling them. When the adults are disturbed, and the disturbance continues, they will go into their "crazy" mode in which the legs are moved very fast and they try to kick with the hind legs, with the body arched. I have never seen a male opening his wings for any reason.

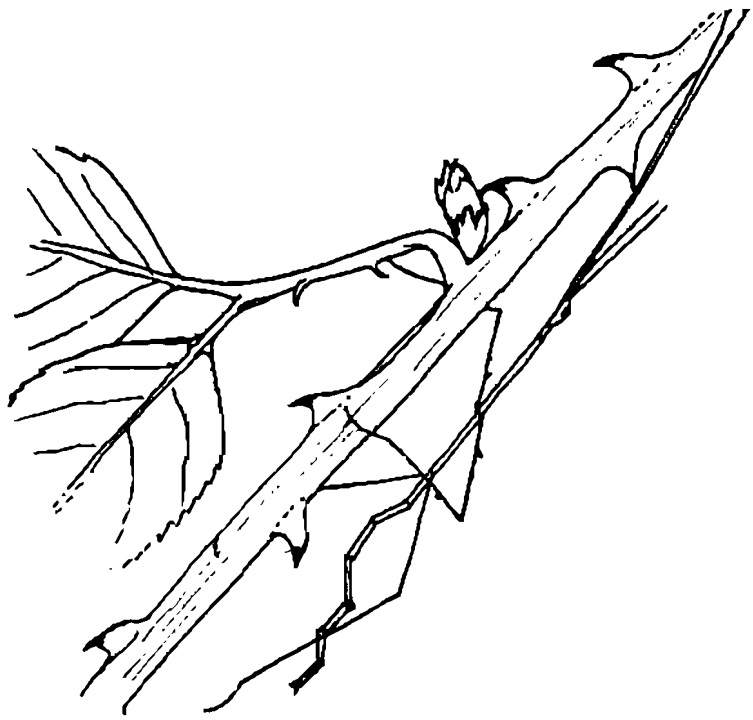

Figure 5. Half grown nymph in a typical resting position.

Foodplants
Bramble (*Rubus* sp.), several oaks (*Quercus* spp.), rose (*Rosa* sp.) and primecherry (*Prunus serrulata*) are eaten. Some will

Figure 6. Newly hatched nymph.

also eat beech (*Fagus* sp.).

Rearing

This is a very nice species which is easy to culture but requires a lot of room owing to its great length. I kept mine in a large (180cm x 90cm x 45cm), well ventilated, *Plexi-glas* (acrylic) terrarium. I kept them damp (70-80%) and at temperatures of 22-26°C and they did very well in these conditions. Now I have also tried keeping them in a well ventilated gauze cage at a very low humidity and have found that they also do very well in these circumstances. A high humidity is only needed for the final skin shed, without it they are not able to come out of the old skin and will lose legs. It is a good idea to keep the last instar nymphs in separate cages so that shedding nymphs are not disturbed by other nymphs climbing around the cage. When I started keeping this species I lost many large nymphs in this way. Again, be very careful with handling them because they shed legs easily, especially as nymphs.

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Phenacocephalus coronatus Werner.

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Key words
Phasmida, *Phenacocephalus caronatus*, New Guinea.

Introduction

In August 1992 I collected a new species of *Phenacephorus* at Sepilok in Sabah. To be sure that it was a new species I visited Leiden Museum to checked some specimens in their collection. Here I found more specimens of my species and a second new species, also from Borneo. The second of these species is quite long and slender, more like a typical *Lonchodes* or *Carausius*. In 1930 Werner had described a new genus, *Phenacocephalus*, as being intermediate between *Carausius* and *Phenacephorus*. Although the rest of his description did not fit the Leiden species, I decided to examine the type specimen of *Phenacocephalus*, just to be certain. When I borrowed the specimen from the Institut Royal des Sciences Naturelles de Belgique (ISBN) it was immediately obvious that this was indeed completely different.

Having gone to the trouble of borrowing the specimen I decided to illustrate it and perhaps save others having to borrow the specimen in the future.

Phenacocephalus Werner 1930

Werner's original description of the genus is brief, stating only that it is intermediate between *Carausius* and *Phenacephorus*, has a longitudinal carina on the mesosternum, no large lobes on the mid femur and a large lobe between the eyes.

P. coronatus is the sole representative of its genus, and the only published record is that of the female holotype which was collected by Prince Léopold at Sakoemi, New Guinea on 11th March 1929. Werner (1930: 179) gives the date as 2nd March 1929, I assume he mistook the 11 for Roman numerals. The description of the genus and of the species was published twice but the original publication is not mentioned in the catalogue of specimens in the ISBN collection (Vanschuytbroeck & Cools 1981: 9).

Phenacocephalus coronatus, Werner, 1930: 179-180.
Phenacocephalus coronatus, Werner, 1931: 26.

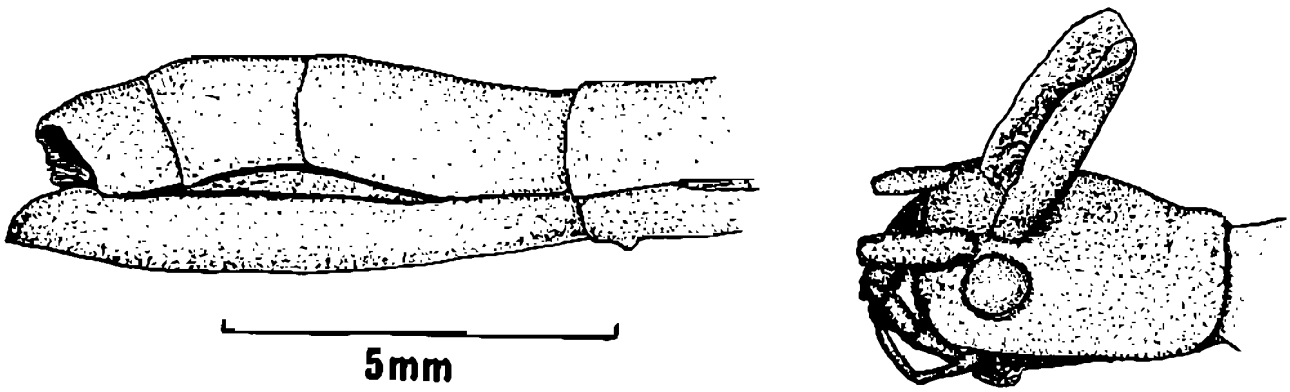

Figure 1. Head and anal segments of the holotype.

Twenty-three years later Günther (1953: 558) moved the genus from the subfamily Lonchodinae into the Necrosciinae. Having examined the specimen I am inclined to agree with Günther's placement. The problem is that the species is wingless and only the female is known; if it was winged then it would clearly be in Necrosciinae but to be sure with wingless forms, the male is needed. Use of Redtenbacher's key to Necrosciinae (1908: 470) shows that this genus is close to *Leprocaulinus* Uvarov 1940 (= *Leprocaulus* Redtenbacher 1908).

The type specimen of *Phenacocephalus coronatus*

The illustrations (Figs. 1 & 2) should aid identification of this species. The specimen is not set straight and has some limbs missing, this has been corrected in the illustration. The following observations may be useful.

The type specimen has several broken parts, both antennae are clearly truncated and the following parts of the legs are missing: left fore leg, right 5th tarsomere, most of the left mid tibia, right hind tarsus. The abdomen appears to be laterally flattened, it is probable that the living insect had a more rounded abdomen so it would be wider than the illustration shows.

Colour is mid brown throughout. There is a fine carina running backwards from the front of the mesonotum and fading out at about the eighth abdominal segment. The fore femur, mesonotum, metanotum and abdomen have numerous small tubercles; those on the body become fewer in number towards the rear and are absent on the last few abdominal segments.

Werner gave only six measurements of the specimen. Table 1 gives a full set of measurements. It should be noted that Werner's measurement for the metanotum is in fact that of the combined metanotum and median segment. The length that I have given for the fore tarsus is the length of the four remaining tarsomeres plus the length of the 5th tarsomere on the mid leg.

Two of Werner's measurements disagree with mine. Werner gives 18mm for the fore femur compared to my 19mm; it is possible that originally the specimen was complete and that Werner measured the left fore femur, which is now missing. His total length of 76mm was clearly measured directly from the specimen, making no allowance for the fact that the specimen is curved; my measurement is the total of the constituent parts.

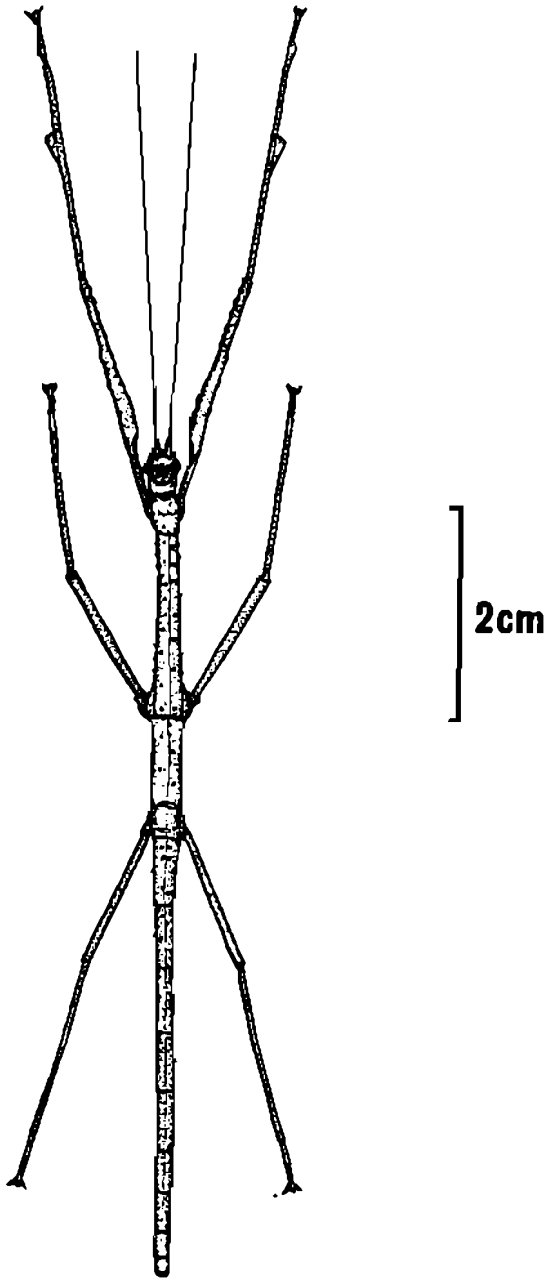

Figure 2. *P. coronatus*, holotype.

	mm
Total length	78
Antennae (broken)	>36
Head	4
Pronotum	3.5
Mesonotum	18
Metanotum	7.5
Median segment	3.5
Abdomen (segments 2-11)	41.5
Fore femur	19
Fore tibia	20.5
Fore tarsus (estimated length)	5.5
Mid femur	13
Mid tibia	14
Mid tarsus	5
Hind femur	15
Hind tibia	18-18.5
Hind tarsus	5

Table 1. Measurements of *Phenacocephalus coronatus*.

Acknowledgement

I am grateful to Jacques Cools of the ISBN for the loan of the specimen and information about the other specimens in the collection.

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The leaf-piercing eggs of *Asceles*.

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Key words
Phasmida, *Asceles*, *A. margaritatus*, leaf piercing eggs.

I recently received from Dr. Francis Seow Choen a small batch of curious leaf-piercing eggs collected from Sepilok Forest Reserve, Sabah. They are *Asceles margaritatus* Redtenbacher, a species of Necrosciinae, showing yet another quite distinct type of egg from this hotch-potch of a subfamily. Eggs of the winged type of *Asceles margaritatus* were shown at the January 1990 PSG meeting (*PSG Newsletter*, 42: 2) and again at the July 1993 meeting, but as far as I know no illustrations have previously been published. These closely match some eggs earlier received from Paul Brock from Tanah Rata, Cameron Highlands, West Malaysia, which must therefore also be *Asceles* or a very closely related genus. Three Asceles-type eggs are illustrated here.

***Asceles margaritatus* Redtenbacher** [winged variety] (Fig. 1)
The main egg is 3.5mm long, 2.5mm high and 2.4mm wide, with a piercing spine another 1.9mm long. It is a translucent pale buff with delicate mottling in light brown, particularly around the micropylar plate. The operculum is set at a strong positive angle of around 30° and is unusual in having a capitulum-like structure in the line of the main axis of the egg, thus almost at the ventral edge of the operculum. The micropylar plate (0.9mm x 1.1mm) is almost circular, with a distinct 0.6mm median line. The spine has a rim 0.6mm from the tip where it rests on the pierced leaf; beyond this, where it emerges from the leaf, it is almost completely black. The internal micropylar plate has a conspicuous wide notch below the micropylar stalk and an isolated median line. The eggs appear to have been laid on the upper surface of the leaf, the species of which is as yet unknown.

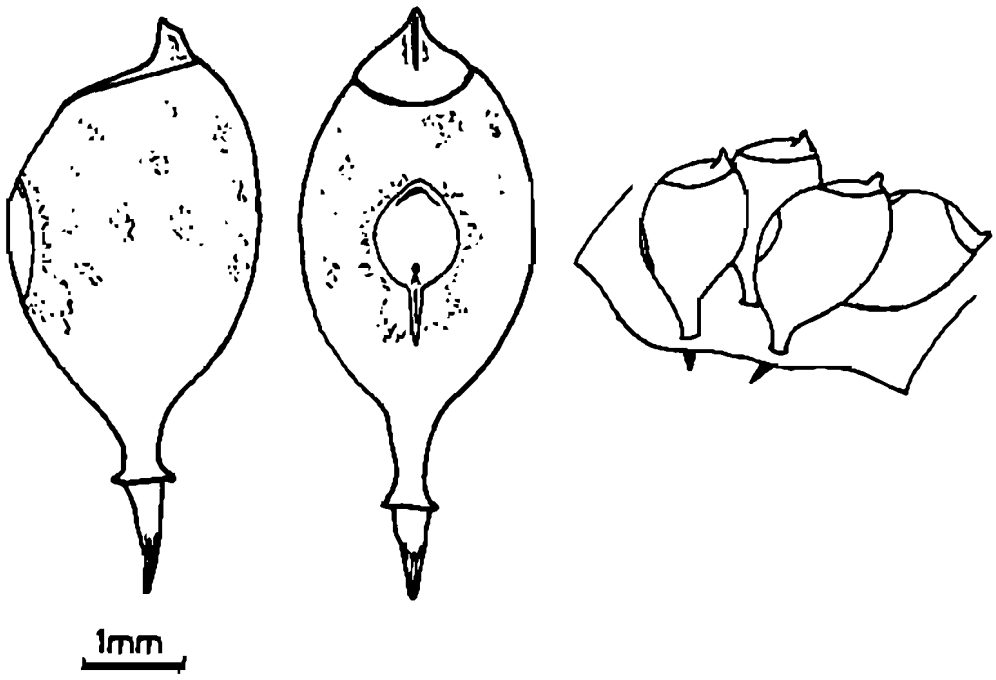

Figure 1. Lateral & dorsal views of *A. margaritatus*, and a group in situ on a leaf (to a smaller scale)

Asceles **sp.** (Fig. 2)

This description is based on Phil Bragg's material laid by two females (PEB-1639 and PEB-1647) which were collected at Niah National Park, Sarawak, in August 1992. The main egg is 2.5mm long, 1.5mm high and 1.3-1.4mm wide, with a 0.6mm spine. It is a pale translucent colour, with a clearly marked pale brown area between the micropylar plate and the operculum; this area varies in width but always encloses the front of the plate. The operculum is again at an angle of around 30°, with a short blunt protrusion. The micropylar plate and median line are distinctly raised, the plate (0.3mm x 0.5mm to 0.25mm x 0.6mm) is brown and significantly narrower in some eggs than others; the median line is white. The spine is white and blackish at the tip. The internal micropylar plate is similar to that of the previous species. Phil says that these eggs were pale green when freshly laid. He also collected another similar species of *Asceles* (PEB-1628) from Niah which laid eggs (which I have not examined) of a similar size and shape but were a mottled brown colour.

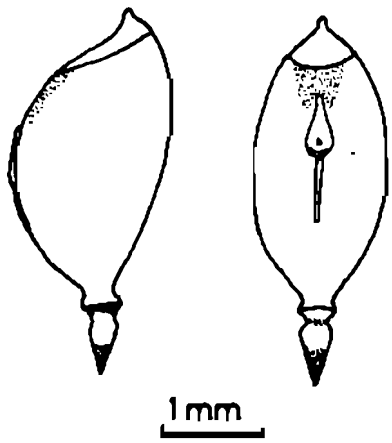

Figure 2. Lateral & dorsal views of *Asceles* sp.

Asceles- **like species** (Fig. 3)

Paul Brock intends to describe this as a new species, the material is from Tanah Rata. The main egg is 2.5mm long, 1.9mm high and 1.7mm wide, with a 1.0mm spine. It is a translucent pale brown with white mottling, forming a compact area of white around the micropylar plate and speckles on the rest of the surface. The operculum is also set at a positive angle of 30° but this time it has a whitish "hood" and a brown pit dorsally. Below the lower rim the spine is brown. The internal micropylar plate is similar to the previous species but without the very conspicuous notch.

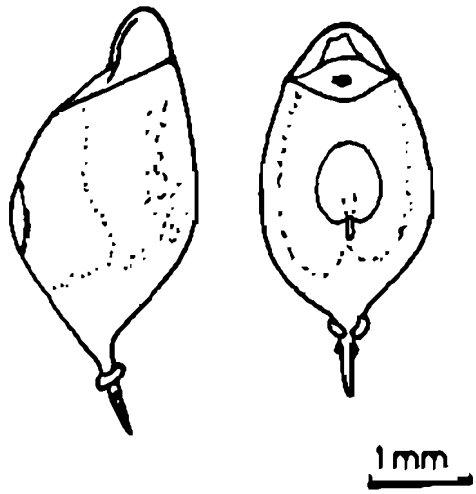

Figure 3. Lateral & dorsal views of *Asceles*-like species.

Defensive and flying behaviour in *Sipyloidea* sp. (PSG 103).

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Key words
Phasmida, *Sipyloidea* sp., defensive behaviour, escape, flight.

Further to my article concerning the push-back fright response of this and other species (Bradburne, 1992), I have seen *Sipyloidea* sp. on several occasions extend this movement into an actual backward "jump", assisted by a downward abdominal thrust, as the insect wriggles to escape. This action tends to lead to flight, especially in the males.

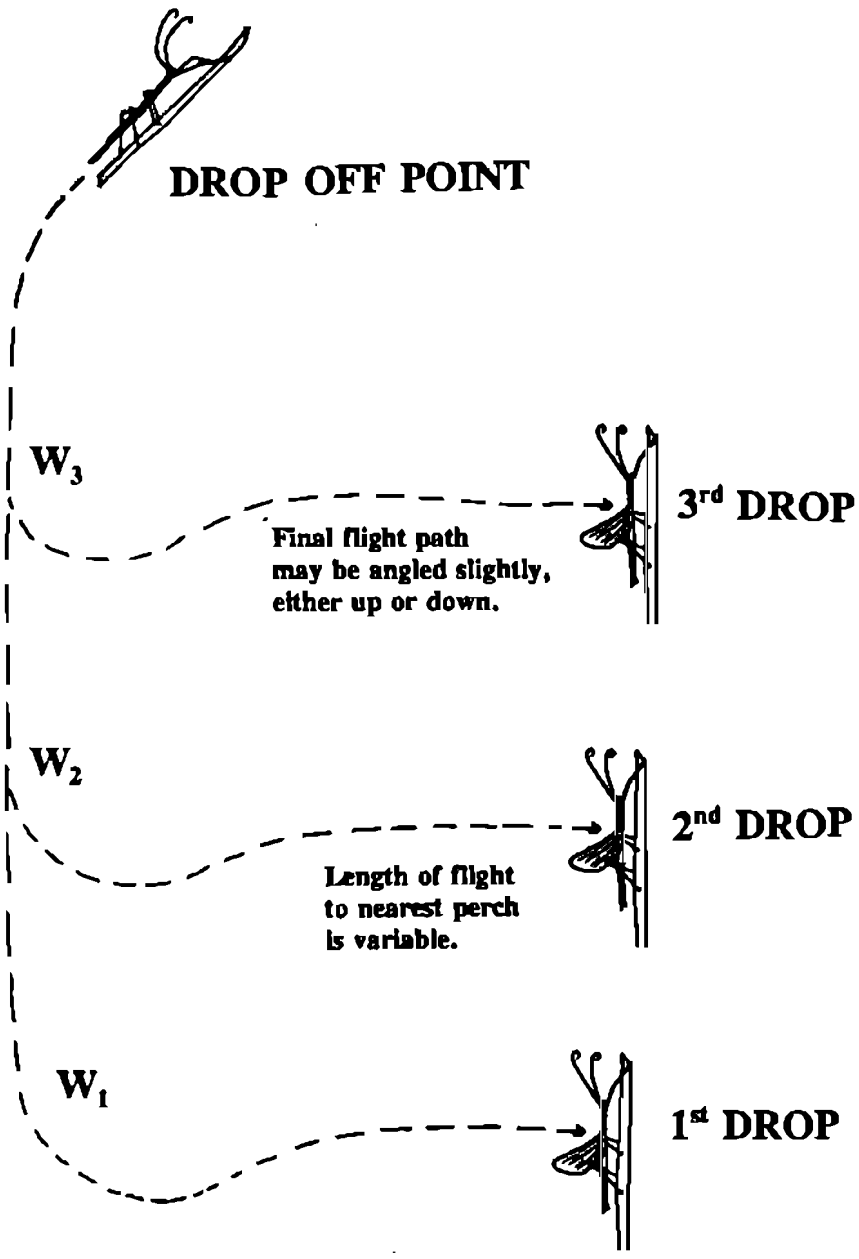

Figure 1. Flight paths of male PSG 103 after successive drops. Wings are opened at points W_1, W_2 or W_3.

Unlike Diptera and the lacewings (Neuroptera), the jump is not immediately followed by the wings opening, but by a period of free fall. This is probably due to the large size of the insects' wings in comparison with the size of their flight muscles. This slow opening therefore tends to result in the males dropping at least 30cm before deploying their wings. It is interesting to note however that subsequent disturbances, if done in rapid succession, cause the insect to fall less and less distance before opening their wings (Fig. 1). Possibly this is due to their wings being more prepared for flight because they have flown only moments ago. It is likely that when resting the wings are in a fully folded state, but soon after flight they are only partially folded away and so better prepared for take off again.

If the insect has less than 30cm to drop, it simply falls to the floor. Obviously this is a safe distance to fall and would save energy in the wild where the insect could simply catch hold of a slightly lower branch without resorting to flight.

Unlike most of the species in culture, the female PSG 103 is an active flier, and does so quite often (especially when you don't expect it to!), although much less frequently than the males. They will even, if stressed for some reason, take off on their own accord; this generally only happens after dusk. Although they tend to drop slightly at first, especially when egg laden, they are certainly capable of upward flight over several metres (Fig. 2).

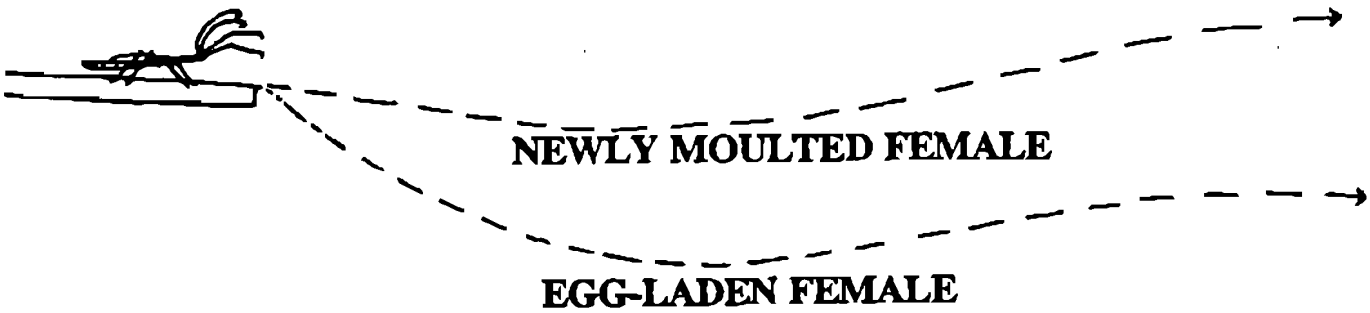

Figure 2. Flight path of female after take off from a level surface.

The males, far from being clumsy flappers like males of *Heteropteryx dilatata*, are expert fliers. They easily manage to dodge around obstacles, such as people trying to catch them, and I have even seen one hover for over a second when I held my hand above it, blocking its path. Often I have seen them circle upwards in flight around the central light in my bedroom. This may be a moth-like response, allowing long distance navigation by the moon when in search of mates in the wild. Certainly the very long antennae, almost as long as the body, could be highly sensitive chemoreceptors, and perhaps able to pick up any females' pheromones from some distance away. The males do not have ocelli, so this directional response cannot be due to these simple light / dark sensors.

Take off from a level surface in this species seems to follow a particular pattern. If they decide to take off by themselves, they will first adopt a very erect stance with their body well raised off the ground, presumably to give them more room for their first downbeat (This, I think, is why *Extatosoma tiaratum* males cannot take off from the ground, their legs have become too short in order to assist with camouflage). Then, while waving their antennae slowly up and down, and often looking left and right, they rear up so that their head is higher than their abdomen and their front two legs are lifted off the ground (Fig. 3). They remain in this position for several seconds. If they decide not to fly they will either bring their fore legs in beside their head and become stationary, as is often seen in *Carausius morosus*, or they will simply put their legs down and walk away.

If they do decide to fly, just before take off, the maxillary palps will spread out, just as they do when the insect is "tasting" its food when feeding. Then, possibly with a small jump, they take off. The insects always fly with their legs splayed out, presumably to be able to catch onto the

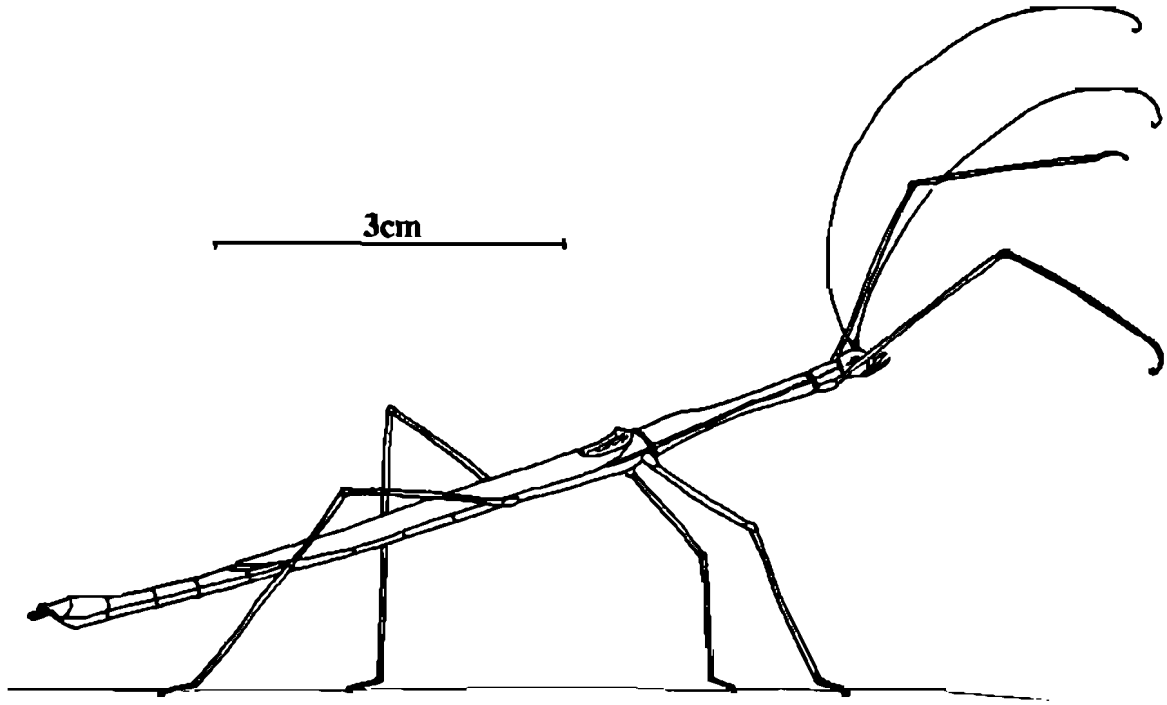

Figure 3. Take off stance of PSG 103.

chosen branch most easily. They also open and splay out their last two abdominal segments so that they are spread out in a similar way to when the insects are copulating. This seems a strange thing to do , and as yet I cannot see any sensible reason for this behaviour. I have seen the same posture of the abdomen on one other occasion, performed by a solitary male sitting on a branch one evening after dark. He remained in this position for at least 15 minutes, with the green feathery fringes inside the tip of the abdomen filled with haemolymph (hence the colour) and gently pulsating. Could this be another way of picking up female pheromones? I have only observed this once in a stationary insect.

Perhaps the most startling flying achievement that I have witnessed to date was a pair of *Sipyloidea* sp. copulating in flight! The male took no part in the flying, merely staying perched on the female's back throughout. This happened some time after dark when the temperature was around 24°C. I opened the cage door and disturbed a mating couple resting on the glass. To my surprise, instead of falling to the floor, the female started flapping her wings and managed a one metre long downward flight at about 40° from the horizontal; no mean feat, considering the extra weight she was carrying! The pair remained joined together even as I returned them to their cage.

It would be interesting to know whether other similar species such as PSG 4 and PSG 89 exhibit similar flight patterns to PSG 103, or if such behaviour is species specific.

Reference

Bradburne, R.P. (1992) Some observations on the defensive behaviour of various species. *PSG Newsletter*, **50**: 11.

A new *Libethra* from Ecuador.

Wim Potvin, Brusselbaan 7, 1600 St. Pieters-Leeuw, Belgium.

Key words
Phasmida, *Libethra* sp., breeding, rearing.

Origin of culture

I bought one adult pair of stick-insects from Ecuador at the AES exhibition in England on 3rd October 1992. By comparison with other species, I identified them as a *Libethra* sp. About two weeks later the male died. Two weeks thereafter the female died too, but she had already laid 14 eggs. The nymphs started hatching in March and they accepted bramble without any problems, but some of the nymphs died before their first skin shedding. At the moment I have 7 adult females, 3 adult males and 2 male nymphs at the third and fourth instar. For the moment everything is going very well. The oldest females have just started laying eggs and as soon as I have enough eggs I will send them to other breeders. I wonder if there is anybody else that might have this species in culture.

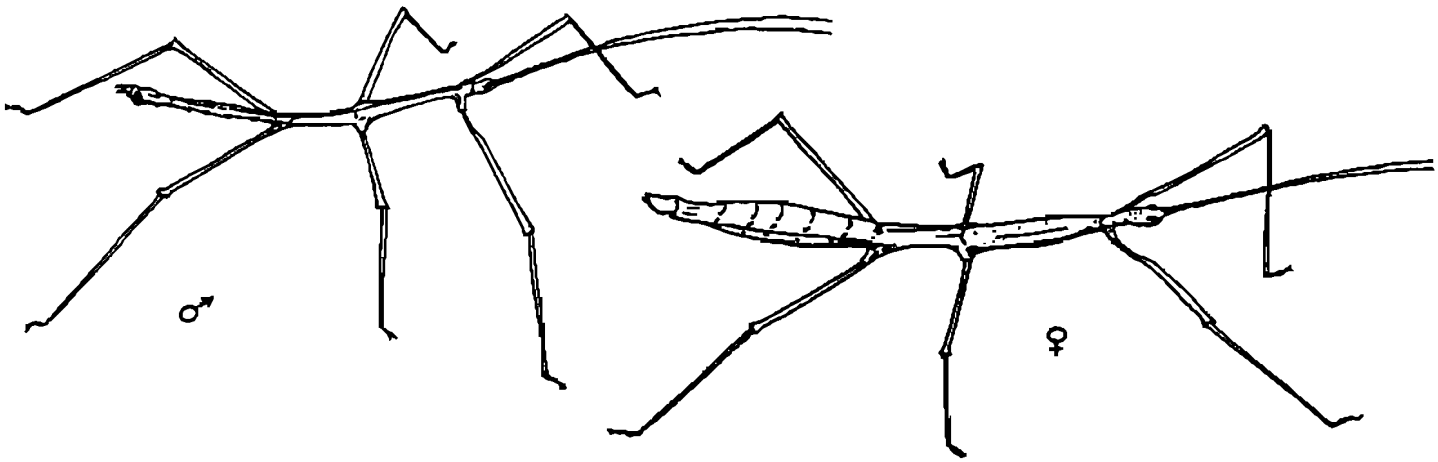

Figure 1. Male and female *Libethra* sp.

Males (Figs. 1 & 2)

The males resemble the males of *Libethra regularis* Brunner, but they are more slender and a bit longer. Their colour is not as dark as that of the males of *L. regularis*; their body is brown. The legs are also brown in colour and they have two very small black points on each knee. The tarsal segments are short. The arolium and the two elaspers are very small, being almost invisible. Their eyes are very large in comparison with the head. Only the mesothorax has got a few very small spines, these look like black points. Further their skin is very smooth. The males have got a dark brown line on the dorsal surface of their body; at some places this line is not very visible. Their antennae are clearly longer than their fore legs. Their typical rest position is with their fore legs straight before them, in line with their antennae. The males become adult after about four and a half months. I do not see them mating very often and when they do so, it is not for longer than one night.

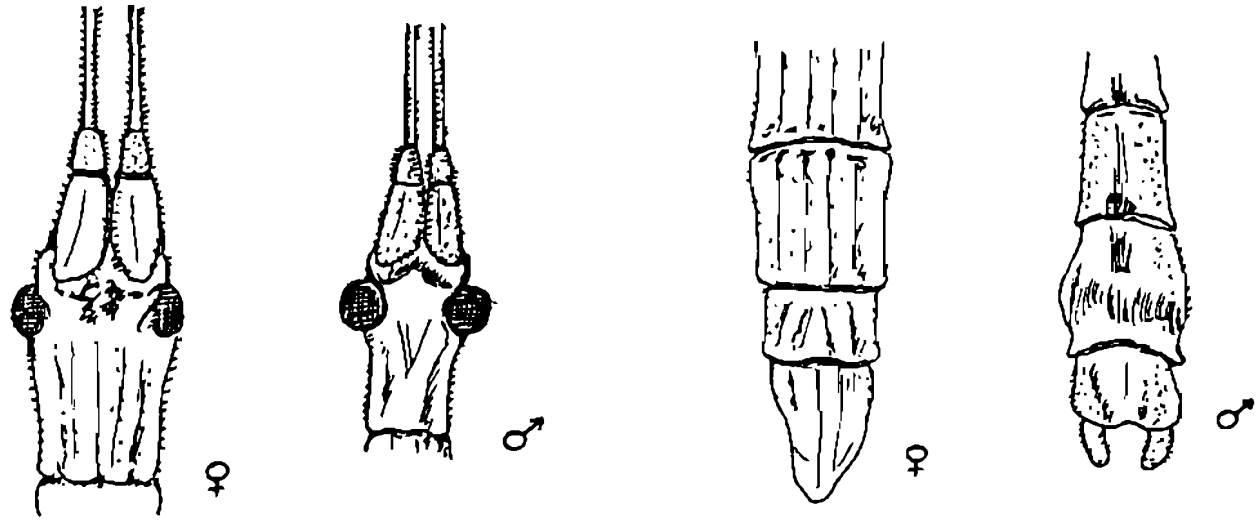

Figure 2. Heads and terminal segments of the adults.

Females (Figs. 1 & 2)
The females are also longer and more slender than the females of *L. regularis*, although they are similar to them. This species also has a relatively fat abdomen. Their body surface is completely smooth. The body colour is light brown to beige. The front legs are the same colour as the body, but the middle and hind legs are much darker in colour, being dark brown. The antennae end exactly at the end of the front legs. Their eyes are not as large as the eyes of the males. The females also take up the typical resting position of the males. The females become adult in about 5 months and then they start laying eggs after 3 weeks. After that they lay about 3 or 4 eggs per week.

	males	females
Antennae	47	31
Front femora	18	16
Front tibia	22	17
Front legs	43	36
Middle legs	34	28
Hind legs	42	36
Body (without antennae)	57	57

Table 1. The average sizes of males and females in millimetres (mm).

Eggs (Fig. 3)
The eggs are about 3mm long, 2mm high and 1.3mm wide. They are light grey in colour and they have four large squarish pits on each side. The operculum is flat and oval shaped. There is no capitulum. There is a black triangle on the pale micropylar plate. The eggs are very large in

comparison with the females and that is the reason why the females produce only a few eggs each week.

Nymphs

The nymphs are typical of *L. regularis* nymphs and they have the same rest position (Fig 3). They hatch about 5 months after the eggs are laid. Newly hatched nymphs have a body length of about 15mm. They don't move much during the day, even at night they won't walk more than is needed to find their food. None of my nymphs had problems with skin shedding.

Behaviour

They don't have any really active defensive methods, only passive ones. The males in particular resemble branches. They often simply hang between the food plants. The females mostly lie on the ground. When they are disturbed they run away, but not very fast and the females don't run away as fast as the males. They are easily calmed down by putting them in their cage again and they will immediately stop in their typical rest position.

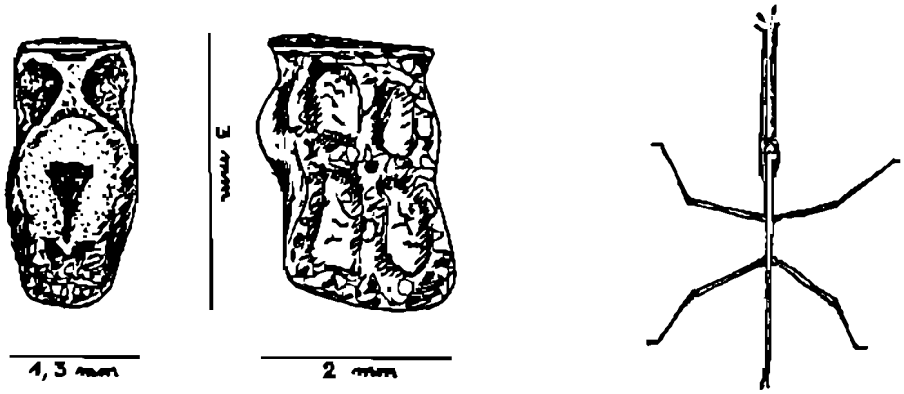

Figure 3. Dorsal & lateral views of the egg, and a nymph in the typical resting position.

Food plants

When I bought them there was oak in the plastic box, but they accepted bramble immediately. Also the newly hatched nymphs didn't have any problem starting to feed on bramble. The other accepted foodplants are rose and pyracantha. They don't like ivy or privet.

Breeding conditions

I kept the eggs, nymphs and adults at a temperature between 19°C and 24°C. The eggs were kept slightly humid and the animals have a fairly high humidity, being sprayed every evening. The cage is not very large, but must be high enough for successful skin shedding. A layer of sand or soil about 4cm deep is needed because the females bury their eggs.

Comments

This seems to be an easy species to breed. I don't know yet how long the adults live, but I assume that they will live for at least 4 months, by comparison with *L. regularis*. It is very remarkable that the male's body is exactly as long as the body of the female. At the first sight the male seems to be larger than the female, this is because they have longer legs.

Acknowledgements

I am very grateful to my father who helped me by making the black ink drawings for this article. I would also like to thank Mr Ian Abercrombie for the good reception and hospitality in England.

Some notes on *Dinophasma guttigera* (Westwood) from Borneo.

P.E. Bragg, 51, Longfield Lane, Ilkeston, Derbyshire, DE7 4DX, UK.

Key words
Phasmida, Phasmatodea, *Dinophasma guttigera*, Sarawak, Borneo.

Introduction

Dinophasma guttigera appears to be a common species in some parts of Sarawak, I have found it on each of my four phasmid collecting trips. Initial attempts to rear this species in captivity failed because a suitable foodplant could not be found in the UK. This problem has now been overcome and this species is now being successfully reared.

Classification

This species belongs to the small subfamily Aschiphasmatinae, in the family Pseudophasmatidae. There are less than 50 described species in the subfamily which is split into six genera. The subfamily appears to be restricted to south east Asia. The genus *Dinophasma* is only recorded from Borneo and contains three described species all of which have wingless females and winged males. The females of this genus are easily distinguished from other members of the subfamily by the presence of a large upright spine on the mesonotum. *D. guttigera* has been mentioned in the literature on several occasions since its description by Westwood in 1859.

Phasma guttigerum, Westwood, 1859: 35, pl. 27.6.
Datames (?) guttigerus (Westwood), Kirby, 1904: 400.
Dina guttigera (Westwood), Redtenbacher, 1906: 87.
Dina guttigera (Westwood), Günther, 1935: 7.
Dina guttigera (Westwood), Günther, 1943: 151.

Westwood placed this species (and three others) in the genus *Phasma* because he was unsure where it belonged: "The following insects differ so materially from all other apterous species, that I am uncertain (in the absence of males of each) whether they should be referred to other groups of the Apterophasmina, or be raised to the rank of separate genera. In this uncertainty I prefer leaving them under the old generic name *Phasma*" (Westwood 1859: 34). Redtenbacher (1906: 86) created the genus *Dina* for this and two new species, however the name *Dina* was already in use for a group of worms and Uvarov (1940: 173) proposed *Dinophasma* to replace Redtenbacher's name. Günther's use of *Dina* in 1943 is no doubt due to both his and Uvarov's papers being published during the second world war.

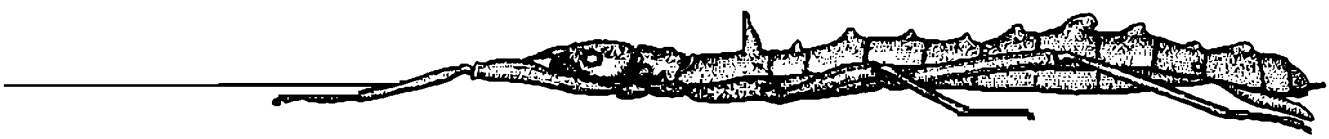

Figure 1. Female *Dinophasma guttigera*, side view.

Distribution in Borneo

Westwood's single female specimen, now in Oxford University Museum, is from "Sarawak (Borneo)" and was collected by D. Wallace. Günther records the species from the Pajau River (1935: 7) and Mahakam (1943: 151). I have found this species in several areas of the western end of Sarawak: Mt Serapi, Mt Santubong, kampung Bengoh and in an area of swamp forest at

Simunjan. The highest altitude at which I have found this species is 580m on Mt Serapi.

The adults

Both sexes have similar coloration. With the exception of the antennae, the whole of the insect has a base colour of dark brown which is overlaid by numerous light brown and brownish-yellow blotches and smears. The antennae are light brown in colour. The male is fully winged and capable of good flight, in contrast there is no sign of wings in the female (Fig 2). The female is larger than the male and has a large upright spine at the back of the mesonotum; the metanotum and each abdominal segment has a raised hump on the hind edge (Fig. 1)

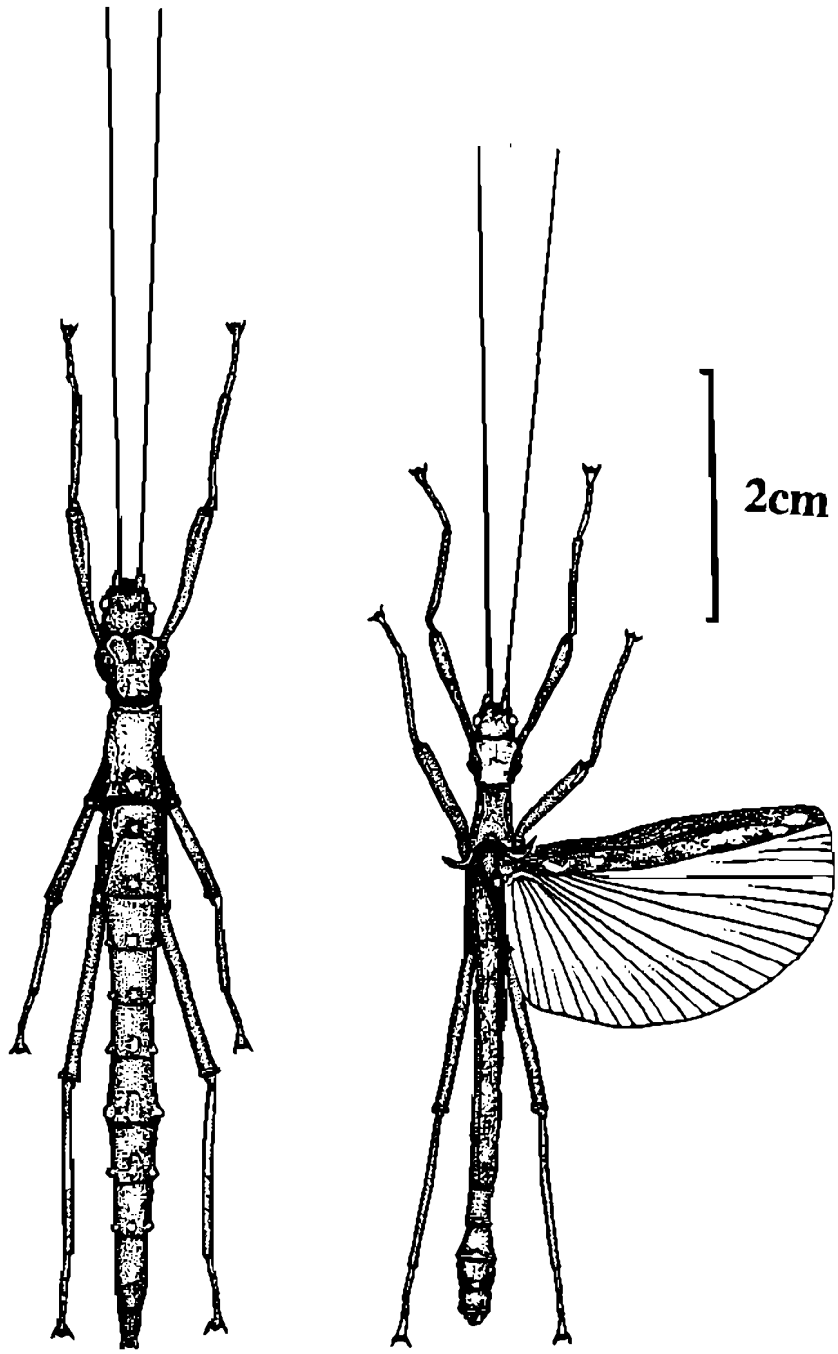

Figure 2. Female and male *D. guttigera*.

Foodplants

Almost all of the 26 specimens of this species which I have collected were found on *Melastoma* sp., the other specimens, usually males, were all on plants close to *Melastoma* bushes. This plant, which is sometimes called Singapore Rhododendron, is a common shrub in secondary forest and on roadsides in northern Borneo and is the foodplant of this species in Sarawak. Several specimens of what I believe to be an undescribed species of *Dinophasma* were found on this plant in Sabah. This suggests that this genus has a strong preference for *Melastoma*. In the UK several attempts to culture the species failed despite trying a wide variety of foodplants. However in September 1992 I returned home with two females which fed on fuchsia (*Fuchsia* sp.).

The egg (Fig. 3)

The capsule is a laterally flattened disk which is slightly higher at the opercular end. The capsule

is a uniform mid brown and covered in fine hairs (Fig. 3); the rim of the micropylar plate and operculum are yellowish brown. The operculum is oval and lacks a capitulum. The micropylar plate is a narrow band which extends around the rim of the egg, starting and ending at the operculum. The micropyle is difficult to see externally but is directly opposite the operculum (which I have indicated by an arrow on Fig. 3); at this point the micropylar plate is slightly wider. The standard terminology used for phasmid eggs defines the dorsal surface as that on which the micropylar plate is found. However in the case of this egg (and the eggs of *Orthomeria*, *Presbistus* and *Aschiphasma* which I have examined), the plate extends around the egg so that the dorsal surface is unclear. I have treated the edge of the egg with the micropyle as the dorsal surface and the length of the egg as the longest axis.

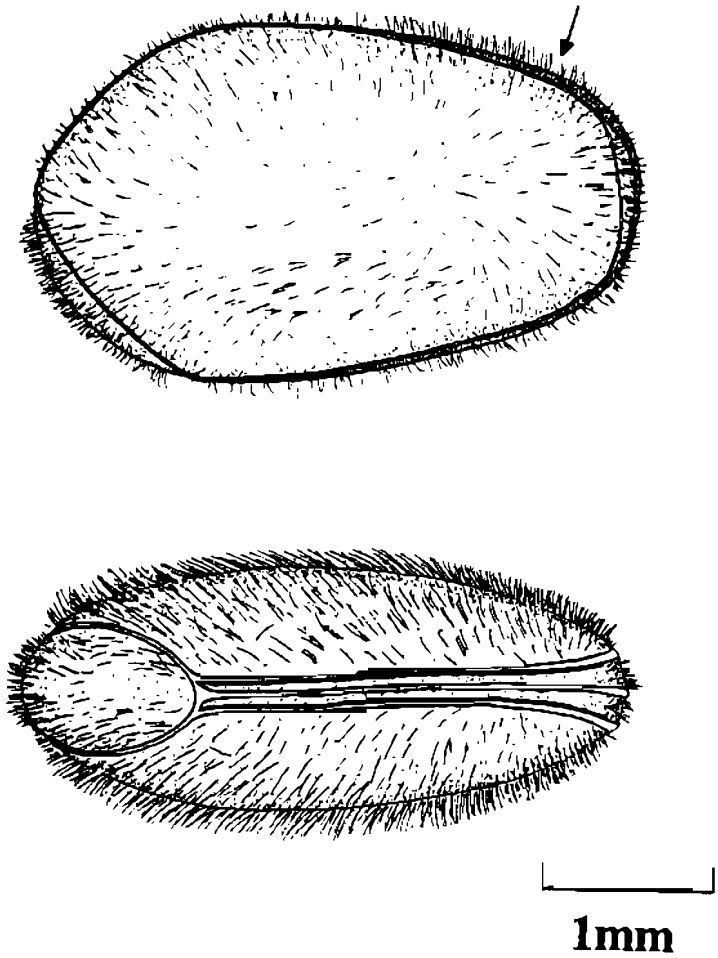

Figure 3. Lateral & ventral views of the egg.

Typical measurements are length 3.4mm, height 2.2mm and width 1.6mm. The mass of 23 newly laid eggs was found to range from 7.45-5.61mg with a mean of 6.85mg and a standard deviation of 0.45.

Eggs laid in July 1992 were incubated at ambient temperatures in Sarawak for the first 30 days then at ambient temperatures in the UK. The first egg hatched after 84 days.

Rearing

Almost 200 eggs were laid by eight specimens collected during July and August 1992. Eggs, in batches of 50, were distributed to three other members of the PSG. More than 50% of my eggs hatched when incubated at room temperature in high humidity, in agreement with my previous experience with this species. Nymphs were reared in a small plastic box and one or two fresh fuchsia leaves were put into the box each day. When I went away for ten days at Christmas they were transferred to a potted fuchsia in a small cage. When I returned, the plant and nymphs had all died. Paul Jennings reported several of his 50 eggs hatching and one male was reared to adult. Ian Abercrombie only had two eggs hatch but raised both, a male and a female to adult. It is hoped that a sustainable culture will result from these. Ian reported that the first insect became adult at the end of March 1993. This means they take 7-8 months, from the eggs being laid, to become adult. Now that a foodplant suitable for both nymphs and adults is known, it has not been too difficult to establish this species in culture. Ian has given away several lots of eggs and nymphs of this species to members of the PSG and *D. guttigera* has been added to the PSG species list, as

culture 150 (Bragg 1993).

Behaviour

Specimens which I have found in the wild have always been found at night, resting on the foodplant, or a nearby plant. Defensive behaviour falls into three stages. Stage one, the insect lowers its body and lies flat on the leaf or stem, making no attempt to move off. Stage two is triggered by persistent close disturbance, touch, or by insect repellant on the collector's hands. In stage two the insect jumps backwards, falling to the ground, or clinging to a lower branch in a repeat of stage one. Males will often fly off once they have jumped backwards. Stage three occurs if the insect is picked up and held firmly in the fingers; fluid is sprayed from at least two places on each side of the thorax. I have only observed stage three on three occasions, the third time in captivity, in each cases the insect was a female. My usual collecting technique is to let the insect drop into a plastic bag rather than picking up the insect, this probably explains why I have not seen this behaviour more frequently. On one occasion, in the wild, I was able to photograph the insect concerned, there were four white globules of fluid on the thorax, the liquid does not seem to be ejected any distance. Careful sniffing of the liquid produces a strong, sharp burning sensation in the nose, this is slightly reminiscent of the effect of sniffing concentrated ammonia solution!

Acknowledgement

I am grateful for permission to the illustration of the egg which was drawn by Vernon Bayliss as part of his third year undergraduate project at Aberystwyth University.

References

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Günther, K. (1935) Phasmoiden aus Centralborneo. *Arkiv för Zoologi*, **28A(9)**: 1-29.

Günther, K. (1943) Die Phasmoiden (Orthoptera) der "Borneo-Expedition Dr. Nieuwenhuis" aus dem Stromgebiet des oberen Mahakam. *EOS, Madrid*, **19**: 149-172.

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

Redtenbacher, J. (1906) *Die Insektenfamilie der Phasmiden*. Volume 1. Leipzig.

Uvarov, B.P. (1940) Twenty eight new generic names in Orthoptera. *Annals and Magazine of Natural History*, **(11)5**: 173-176.

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

Reviews and Abstracts.

Phasmid Abstracts

The following abstracts briefly summarise articles which have recently appeared in other publications. Some of these may be available from local libraries. Others will be available in university or college libraries, many of these libraries allow non-members to use their facilities for reference purposes free of charge. If the publication is not available in your area your library should be able to obtain it through the inter library loans service; there is usually a charge for using this service.

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, *Phasma* and *Le monde des phasmes*, only the longer papers are summarised.

Baarda, G. (1993) Voer!!! *Phasma*, **3**(10): 7-9.

The seventh article in this series. A cycle is considered as the best way of using the available foodplants at different times of year. Switching to rose and hawthorn is advised as soon as it becomes available in spring, this avoids the poor quality bramble, the author changes to raspberry in June as rose becomes mildewed, and the to bramble for winter feeding. Different types of oaks can be used, some are more hardy than others, potted oaks can be used in winter when none are available outdoors.

Bragg, P.E. (1993) New synonyms and new reeords of phasmids (Insecta: Phasmida) in Borneo. *Raffles Bulletin of Zoology*, **41**(1): 31-46.

Five species of Phasmida which have not previously been recorded from Borneo have been found in Brunei, Sarawak and Sabah. One species, *Planispectrum bengalensis* (Redtenbacher 1906), represents a genus which is previously unrecorded from Borneo. Six new synonyms are given and an old synonym is corrected. The eggs of *Asceles conicipennis*, *Sosibia peninsularis* and *Orthonecroscia pulcherrima* are described and illustrated for the first time. The lectotypes of four species, *Asceles acutegibbosus* Redtenbacher 1908, *Ocellata atrosignata* Redtenbacher 1908, *Lopaphus hadrillus* Westwood 1859 and *Platymorpha bengalensis* Redtenbacher 1906, are designated.

Bragg, P.E. & Chan, C.L. (1993) A new species of stick insect of the genus *Lonchodes* from Mount Kinabalu, Sabah. (Phasmida: Heteronemiidae: Lonchodinae: Lonchodini). *Entomologist*, **112(3-4)**: 176-186.

A new species of Phasmida, *Lonchodes harmani* is described from Mt. Kinabalu and the Crocker Range in Sabah and from Kuala Belalong in the Temburong District of Brunei. The adults of both sexes and the eggs are described and illustrated. The species has been reared in the UK and some information on captive rearing is given.

Brock, P.D. (1993) Studies on the stick-insects of the genus *Leptynia* in Spain. *Bulletin of the Amateur Entomologists' Society*, **52**(389): 165-171, plates Y & Z.

The author describes a collecting trip to Spain in 1991. A number of sites for the two species of *Leptynia* are mentioned and a comprehensive distribution map is included. Notes on behaviour and foodplants are included along with a note on captive rearing. The plates include colour photographs of *L. hispanica* and *L. attenuata*.

Floyd, D. (1993) *Oreophoetes peruana* - A very unconventional stick insect! *Bulletin of the Amateur Entomologists' Society*, **52**: 121-124, plate X.

Describes the rearing of *Oreophoetes peruana* (Saussure), a brightly coloured fern eating phasmid from Peru. Ten species of ferns have been tried as foodplants, these and their suitability are listed in a table. The male and female are illustrated by colour photographs.

Gorkom, J. van (1993) Soortbeschrijving Phasmatodea: PSG 143, *Sipyloidea* sp. *Phasma*, **3**(10): 12-13.

Brief description and illustration of PSG 143, a species of *Sipyloidea* originally collected at an altitude between 500m and 1000m on Gunung Batur, Bali, by Eric van Gorkom.

Kamp, T. van der (1993) Spaans geluk. *Phasma*, **3**(10): 14-15.

An account of finding *Leptynia hispanica* near Torremanzanas, Spain. This is followed by sone notes on rearing this species.

Lee, M. (1993) Etude de *Acanthoxyla inermis* à Port Gaverne et Port Isaac en Cornouaille. *Le Monde des Phasmes*, **23**: 3-9.

A translation of the article which appeared in *Phasmid Studies* **2**(1): 25-32.

Lelong, P. (1993) Phylogénie et reproduction du genre *Bacillus* en Méditerranée. *Le Monde des Phasmes*, **22**: 3-13.

Discusses the origins and phylogeny of ten species (two of which have yet to be described) and twelve other subspecies of *Bacillus*. There is a showing distribution in the Mediterranean region and a more detailed map of the distribution in Sicily.

Molio, N. (1993) *Phaenopharos* sp. "Red microwings" PSG N° 104. *Le Monde des Phasmes*, **22**: 18-19.

A brief description and illustrations of PSG 104, *Phaenopharos* sp. from Thailand.

Robert, J.-Y. (1993) Un, deux, trois... Sortez! *Le Monde des Phasmes*, **23**: 11-15.

Discusses the hatching rhythms of the eggs of *Extatosoma tiaratum*. The results show that most eggs hatched during the morning.

Veltman, K. (1993) *Carausius morosus*, toch een bijzondere tak! deel 2. *Phasma*, **3**(10): 1-6.

A continuation of the article in *Phasma* **3**(9): 5-8, this article describes an experiment which was originally described by H. van der Werken in 1979. The problems encountered while trying to photograph *C. morosus* emerging from the egg are mentioned. The experiment involved 55000 eggs in order to produce the sequence of photographs. This article includes two photographs of the later stages.

Publications noted

The following papers have recently been published but copies or abstracts have not yet been received.

Bassler, U. (1993) The femur-tibia control system of stick-insects - A model system for the study of the neural basis of joint control. *Brain Research Reviews*, **18**(2): 207-226.

Manaresi, S., Marescalchi, O. & Scali, V. (1993) The trihybrid genome constitution of *Bacillus lynceorum* (Insecta, Phasmatodea) and its karyotypic variations. *Genome*, **36**(6): 317-326.

Marescalchi, O. & Scali, V. (1993) Karyotypes and Ag-NORs of 5 Heteronemiidae (Insecta, Phasmatodea) from Somalia. *Bollettino di Zoologica*, **60**(1): 53-62.

Scapigliati, G., Fausto, A.M. & Mazzini, M. (1993) Morphological and cytoskeletal characterization of haemocytes in stick-insects (Phasmatodea). *Bollettino di Zoologica*, **60**(1): 25-32.