

## Notes on *Necroschia affinis* (Gray, 1835), *Necroschia fragilis* (Redtenbacher, 1908) and *Necroschia pallida* (Redtenbacher, 1908).

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### Abstract

*Necroschia affinis* (Gray, 1835) was originally described from India. The holotype of *affinis* lacks the abdomen and consequently this species cannot be reliably distinguished from several similar species. Lectotypes are selected for *Necroschia pallida* (Redtenbacher, 1908) and *Necroschia fragilis* (Redtenbacher, 1908), and both species are illustrated. *Necroschia pallida* (Redtenbacher, 1908) is reinstated as a valid species. It is proposed that *Necroschia fragilis* (Redtenbacher, 1908) be used for the species that occurs in Peninsular Malaysia and Singapore. A two-legged *N. pallida* is recorded: the first record of a two-legged phasmid found in the wild. The eggs of *N. fragilis* and *N. pallida* both have an exceptionally large pseudocapitulum; both eggs are illustrated.

### Key words

Phasmida, *Necroschia affinis*, *Necroschia fragilis*, *Necroschia pallida*, Lectotype, Borneo, Peninsular Malaysia, India.

### Introduction

*Necroschia affinis* (Gray, 1835) was originally described from India. It has since been recorded from Borneo and Peninsular Malaysia, but there are no subsequent records from India. Examination of specimens in several museums has shown that material treated as *affinis* by several authors consists of more than one species. The only type specimen of *affinis* is the holotype male in the Natural History Museum, London (BMNH); it lacks the abdomen, and is therefore indistinguishable from several similar species of *Necroschia*.

Although Brock (1999: 96) speculates that the locality for *affinis* is “likely to be Malaysia” there is no valid reason to assume this to be the case. In 1835 Gray described three species from “India Orientali” [East Indies] and two are almost certainly from Malaysia; however, *affinis* was described from “India”, not India Orientali. Gray also described material from Ceylon (Sri Lanka) so it is quite possible that some material did come from India.

*Necroschia affinis* was recorded from Borneo and Peninsular Malaysia by Redtenbacher (1908: 525). In 1935 Günther synonymised the Bornean species *Necroschia pallida* (Redtenbacher, 1908) with *affinis* (Gray, 1835). However, Borneo could not be the origin of the specimen that Gray described in 1835 because there was no British presence in Borneo until the arrival of James Brooke in 1838.

The specimens of “*Necroschia affinis*” from Borneo and from Peninsular Malaysia are different species. The species from Peninsular Malaysia and Singapore, treated as *affinis* by Brock (1999) & Seow-Choen (2000), is identical to *Necroschia fragilis* (Redtenbacher, 1908). With Gray specifying India, rather than the East Indies, and the current impossibility of distinguishing *affinis* (Gray), I propose that *fragilis* (Redtenbacher) be used for the Peninsular Malaysian species.

The Bornean specimens in Berlin (ZMHB) and Vienna (NHMW) that Redtenbacher (1908: 525) recorded as *affinis* are the same species as *Necroschia pallida* (Redtenbacher, 1908). The Bornean *Necroschia pallida* is clearly different from the Peninsular Malaysian *N. fragilis*. *Necroschia pallida* is therefore reinstated as a valid species, and a lectotype is selected.

Although *fragilis* and *pallida* have a very similar habitus they may be distinguished by the features given in table 1.

Specimens in my own collection are individually numbered and prefixed by PEB-. For the examined material, handwritten data is shown in italics and printed data in normal print.

<b>Table 1. Features to distinguish <i>N. fragilis</i> and <i>N. pallida</i>.</b>		
	<i>fragilis</i>	<i>pallida</i>
Hind legs of female	Exceed the abdominal apex.	Not reaching the abdominal apex.
Shape of cerci (both sexes)	Slightly clubbed, rounded apex.	Slender, taper to a point.
Relative lengths of abdominal terga in male.	8th & 9th of similar length.	9th longer than 8th.
Pseudocapitulum of egg	Convex.	Flat.

***Necroschia affinis* (Gray, 1835)** (fig 1).

*Platycrana affinis* Gray, 1835: 37. Holotype ♂ (BMNH) India.

*Necroschia affinis* (Gray); Westwood, 1859: 142.

*Aruanoidea affinis* (Gray); Kirby, 1904: 379.

The three references above all relate to the holotype. All other references to *affinis* relate to *Necroschia fragilis*, *Necroschia pallida*, or other species of *Necroschia*; none are of Indian origin.



**Figure 1.** *Necroschia affinis* (Gray, 1835), holotype male.

***Necroschia fragilis* (Redtenbacher, 1908)** (figs 2-11).

*Aruanoidea fragilis* Redtenbacher, 1908: 528; Brock, 1998: 30. Lectotype: ♂ (NHMW, data below), Paralectotype ♂ (NHMW, data below). [Synonymised with *Necroschia affinis* (Gray) by Brock, 1996: 90.]

*Necroschia affinis*; Seow-Choen *et al.*, 1994: 10; Brock, 1996: 90; Seow-Choen *et al.*, 1996: 44 fig (♀); Tay & Seow-Choen, 1996: 185; Brock, 1999: 190, plate 18 (♀); Seow-Choen, 2000: 22, plate 59 a (♂), b-c (♀), d (egg); Otte & Brock, 2005: 210.

*Aruanoidea confusa* Redtenbacher, 1908: 525; Brock, 1998: 22. Holotype ♀ (NHMW, 1037) Singapore, Bukit Timah, 1871, leg. Ransont. Synonymised with *Necroschia affinis* (Gray) by Brock, 1996: 90.

[*Aruanoidea fragilis* Hausleithner, 1991: 221 – probable misidentification].

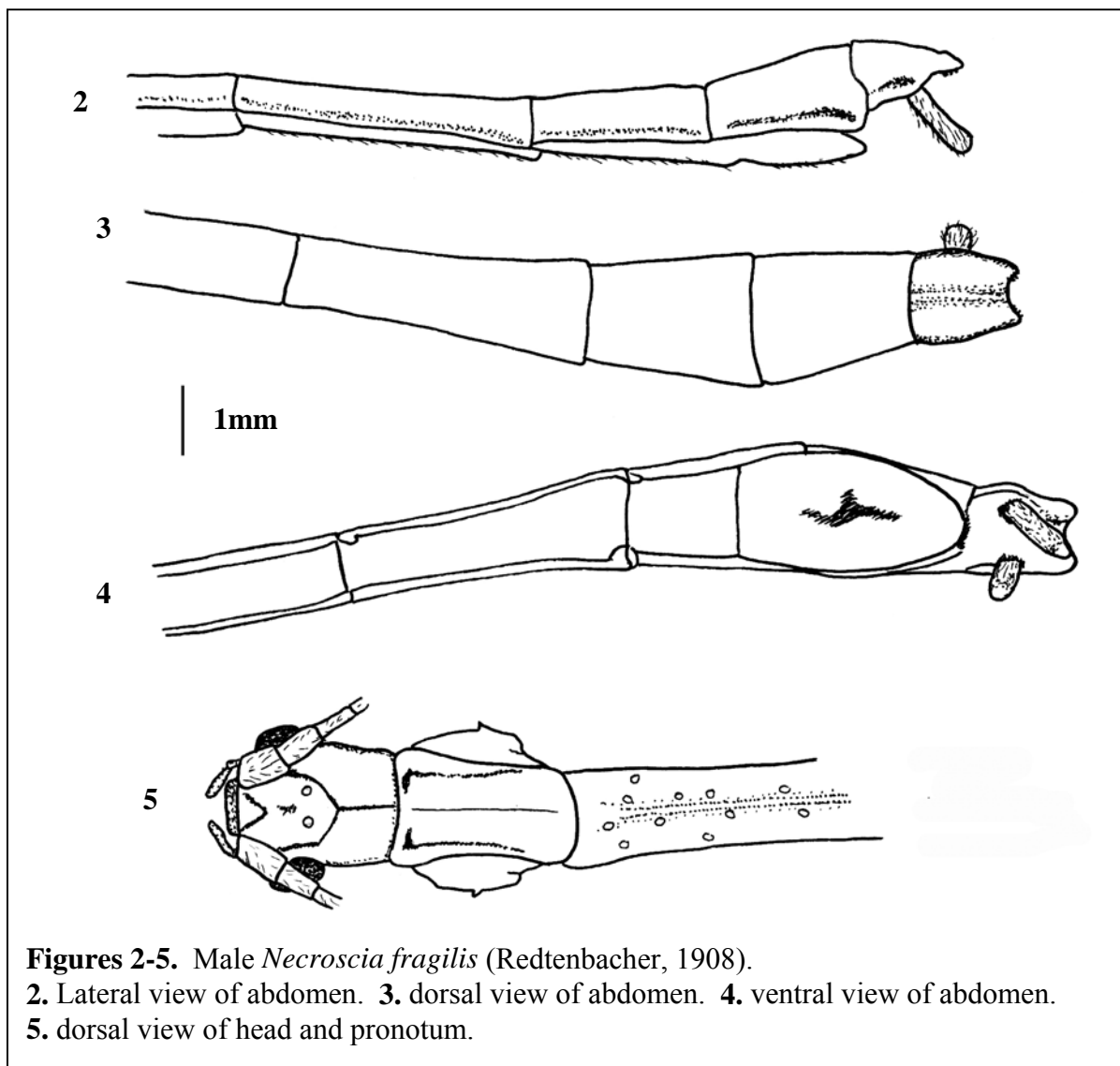
**Material examined**

♂ Lectotype [**here selected**] (NHMW, 1049) 24.443; Coll. Br.v.W. Perak, Jachau leg.; det. Redtenb. *Aruanoidea fragilis*.

♂ Paralectotype (NHMW, 1049) Grubaur 1902 Kwala Kangsar, Perak; Mus. Ceas. Vindobon.; det. Redtenb. *Aruanoidea fragilis*.

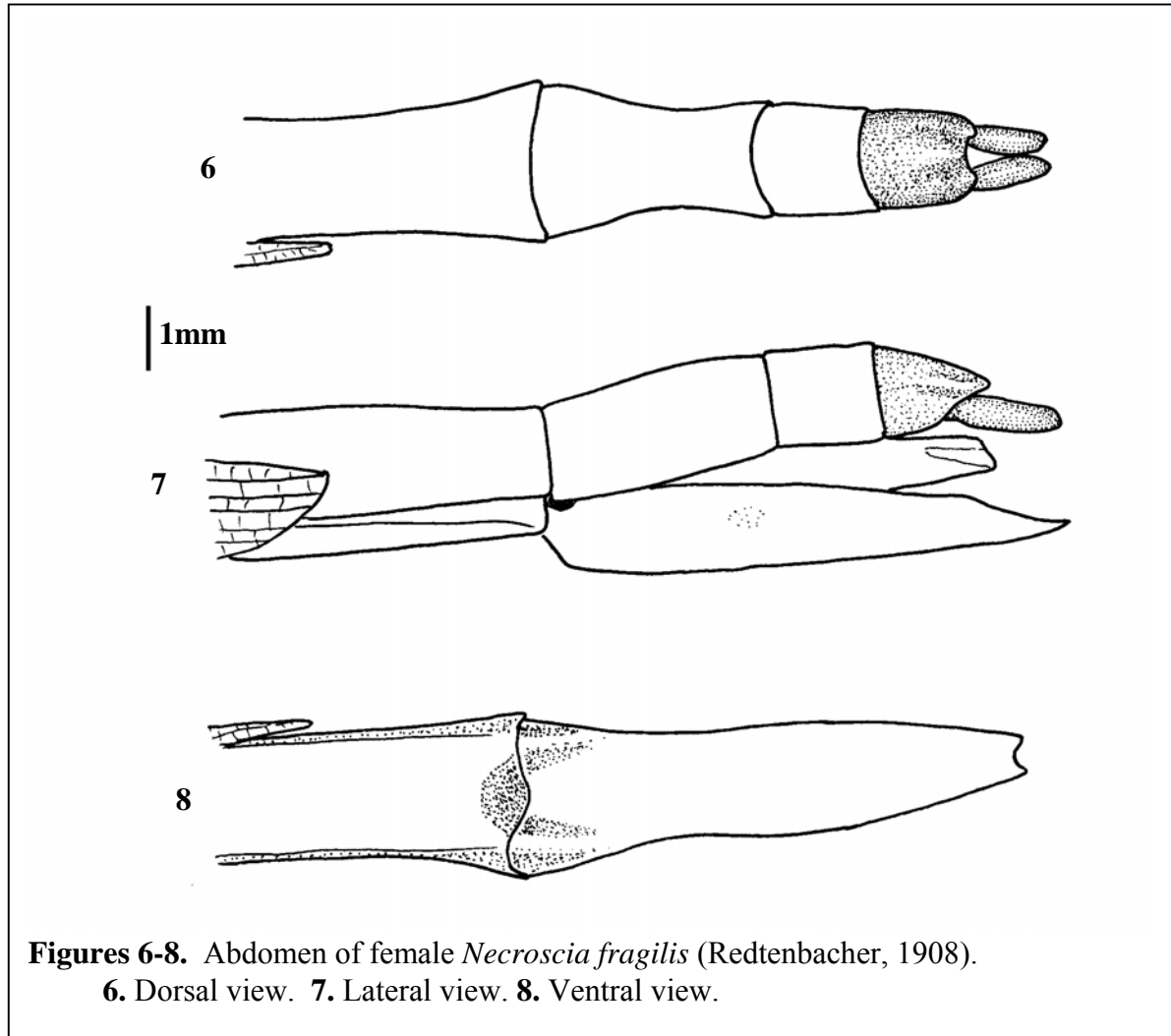
♂ (P.D. Brock) W. Malaysia: Cameron Highlands, 12.i.1992, via Wong; *Necroschia affinis* (Gray).

♀ & egg (PEB-3285) West Malaysia [no date]. Bought from dealer, iv.2002, price £2.00.



I borrowed Paul Brock's male specimen and took it to NHMW to compare it with the type material of *fragilis*. Illustrations included here are of Brock's male (figs 2-5), and my own female and egg (figs 6-11).

Because I was concentrating on Bornean material, I omitted to examine the holotype of *Aruanoidea confusa* Redtenbacher. However, it is likely that Brock was correct to associate it with *fragilis* (Brock synonymised *fragilis* and *confusa* under the name *affinis*). I also failed to check Redtenbacher's specimen(s) of "*affinis*" from Perak (Redtenbacher, 1908: 525); this material is also likely to be *fragilis*.

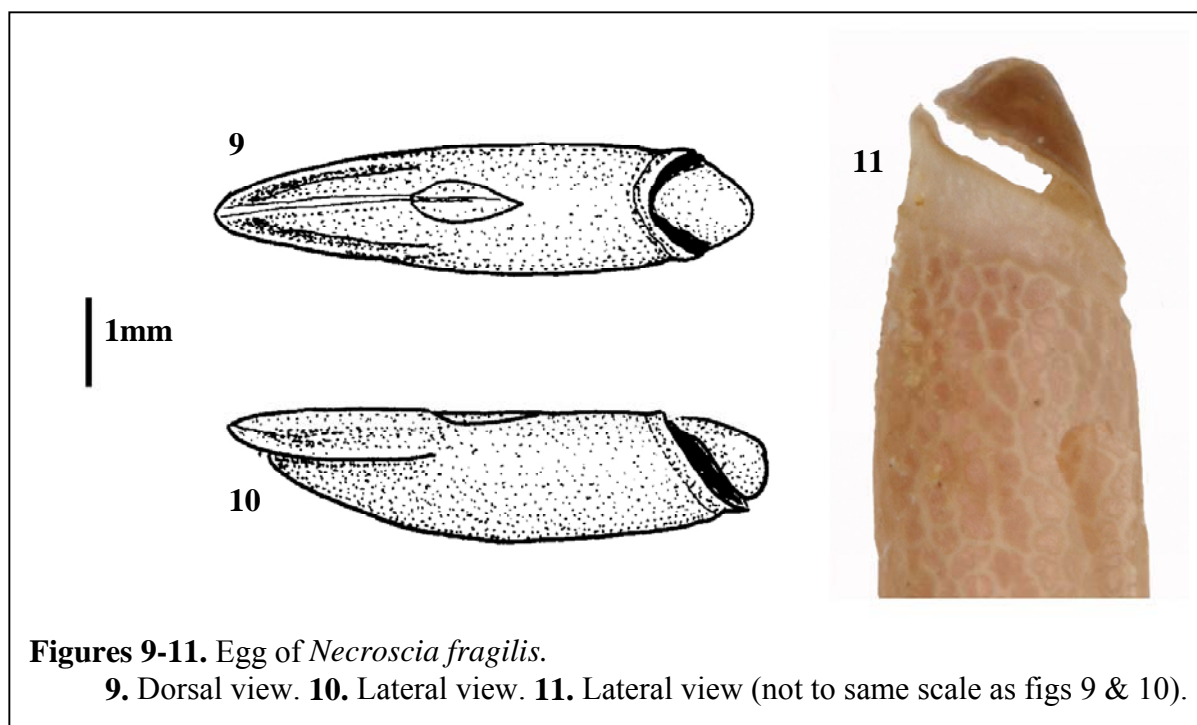


**Figures 6-8.** Abdomen of female *Necroschia fragilis* (Redtenbacher, 1908).  
6. Dorsal view. 7. Lateral view. 8. Ventral view.

Hausleithner (1991: 221) recorded two males of *fragilis* from Kinabalu Park, Sabah: this is probably a misidentification. There are two relatively common species of green *Necroschia* in the Park HQ area; the male of one is very similar to *fragilis*, but may be distinguished by examination of the anal segment (specimens of this unidentified species are coded 1990/M in my collection).

#### **Egg** (figs 9-11)

The examined egg was removed from the genital operculum i.e. it was ready to be laid when the insect was killed. The operculum of the egg has a large, strongly convex, plate-like pseudocapitulum mounted on a stalk; it is so large that it was initially mistaken for a partly detached operculum (fig. 11). Capsule pale brown with a cream micropylar plate. Length 6.2mm, height 1.6mm, width 1.4mm.



**Figures 9-11.** Egg of *Necroschia fragilis*.  
**9.** Dorsal view. **10.** Lateral view. **11.** Lateral view (not to same scale as figs 9 & 10).

***Necroschia pallida* (Redtenbacher, 1908)** (figs 12-26).

*Aruanoidea pallida* Redtenbacher, 1908: 524; Brock, 1998: 48. Lectotype ♀ (NHMW, data below); Paralectotypes: ♀ (NHMW, data below); other(s) [including ♂] (MNHN) Sabah, Kinabalu.

*Aruanoidea affinis* Redtenbacher, 1908: 525 [in part – Bornean material only].

*Necroschia affinis* Günther, 1935: 13; Bragg, 2001: 571; Otte & Brock, 2005: 210.

[Synonymised in error with *Necroschia affinis* (Gray, 1835) by Günther, 1935: 13. **Corrected here**]

[Not *Aruanoidea pallida*; Günther, 1932: 70. **Misidentification**].

**Material examined**

Lectotype [**here selected**] ♀ (NHMW, 1030) 19.604; Coll. Br.v.W. Kina Balu, Borneo Staudinger.; det. Redtenb. *Aruanoidea pallida*.

Paralectotype ♀ (NHMW, 1030) Coll. Br.v.W. Kina Balu, Borneo Staudinger.; det. Redtenb. *Aruanoidea pallida*.

♂ (NHMW) 21.945; Coll. Br.v.W. Kina Balu, Borneo Staudinger; det. Redtenb. *Aruanoidea affinis*.

♂ (NHMW) Borneo; Mus. Ceas. Vindobon; det. Redtenb. *Aruanoidea affinis*.

2♂♂ (SMTD) Kinabalu, Borneo.

♂ (SMTD) Kinabalu, Borneo; *Aruanoidea affinis* Gray, *K.B.*

♀ (ZMHB) Borneo; *affinis* Brunner det. [rest of data not recorded]

2♂♂ (ZMUH) Kinabalu, Borneo; *pallida* Günther det. [rest of data not recorded].

2♀♀ (PEB-2376, PEB-2392), ♂ (PEB-2378) BRUNEI, Teraja, waterfall trail. P.E. Bragg, 03.xi.1994.

4♀♀ (PEB-2388, PEB-2389, PEB-2390, PEB-2391), 2♂♂ (PEB-2380, PEB-2381) BRUNEI, Badas, swamp forest. P.E. Bragg, 31.x.1994.

♂ (PEB-3116) SABAH, Sepilok, Arboretum. P.E. Bragg, 07.viii.2001.

♀ & eggs (PEB-3554), ♂ (PEB-3555) SABAH, Sepilok, Arboretum. P.E. Bragg, 13.xii.2006.

2♂♂ (PEB-3563, PEB-3564) SABAH, Sepilok, Orang Utan Centre. P.E. Bragg, 15.xii.2006.

♂ (PEB-3581) SABAH, Crocker Range, Kota Kinabalu-Tanbunan road. coll. S. Chew, 26.ix.2006.

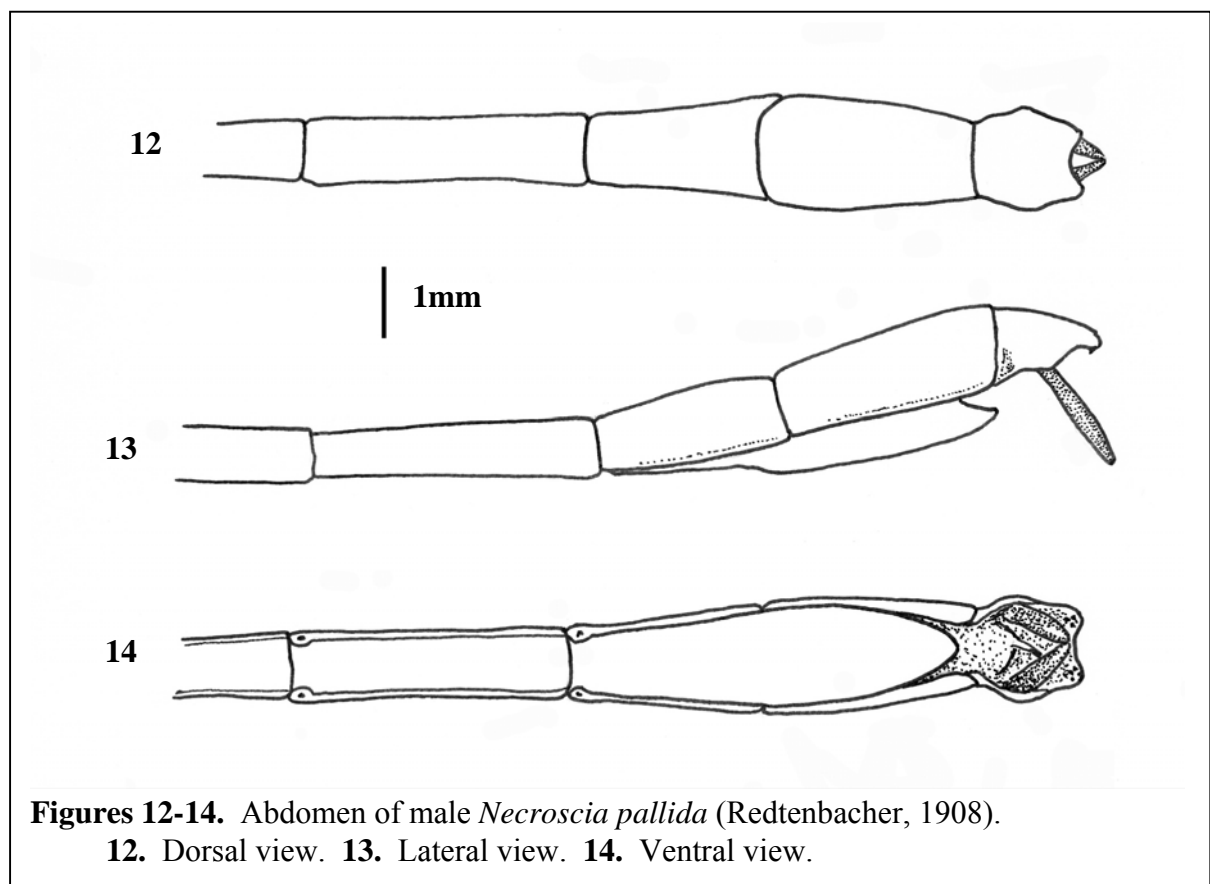
- ♂ (PEB-891), ♀ & egg (PEB-1003) SARAWAK, Mt Serapi, 180m. P.E. Bragg, 26.vii.1991.  
♂ (PEB-1533) SARAWAK, Kuching, 4.5 mile. P.E. Bragg, 28.vii.1992.  
♀ (PEB-2375), ♂ (PEB-2384) SARAWAK, 15km NE of Selangau. P.E. Bragg, 26.x.1994.  
♀ (PEB-2377), ♂ (PEB-2386) SARAWAK, Tarum (near Debak). P.E. Bragg, 05.xi.1994.  
2♂♂ (PEB-2382, PEB-2383) SARAWAK, Tarum (near Debak). P.E. Bragg, 25.x.1994.  
♂ (PEB-2385) SARAWAK, Betong, along roadside. P.E. Bragg, 25.x.1994.

This species has been misidentified on a number of occasions. Some of the confusion is perhaps partly due to Brunner and Redtenbacher labelling some specimens of *pallida* as *affinis*. Two males of *pallida* in NHMW were labelled as *affinis* by Redtenbacher. A female in Berlin (ZMHB) was misidentified by Brunner: it is labelled “*affinis* Brunner det.”

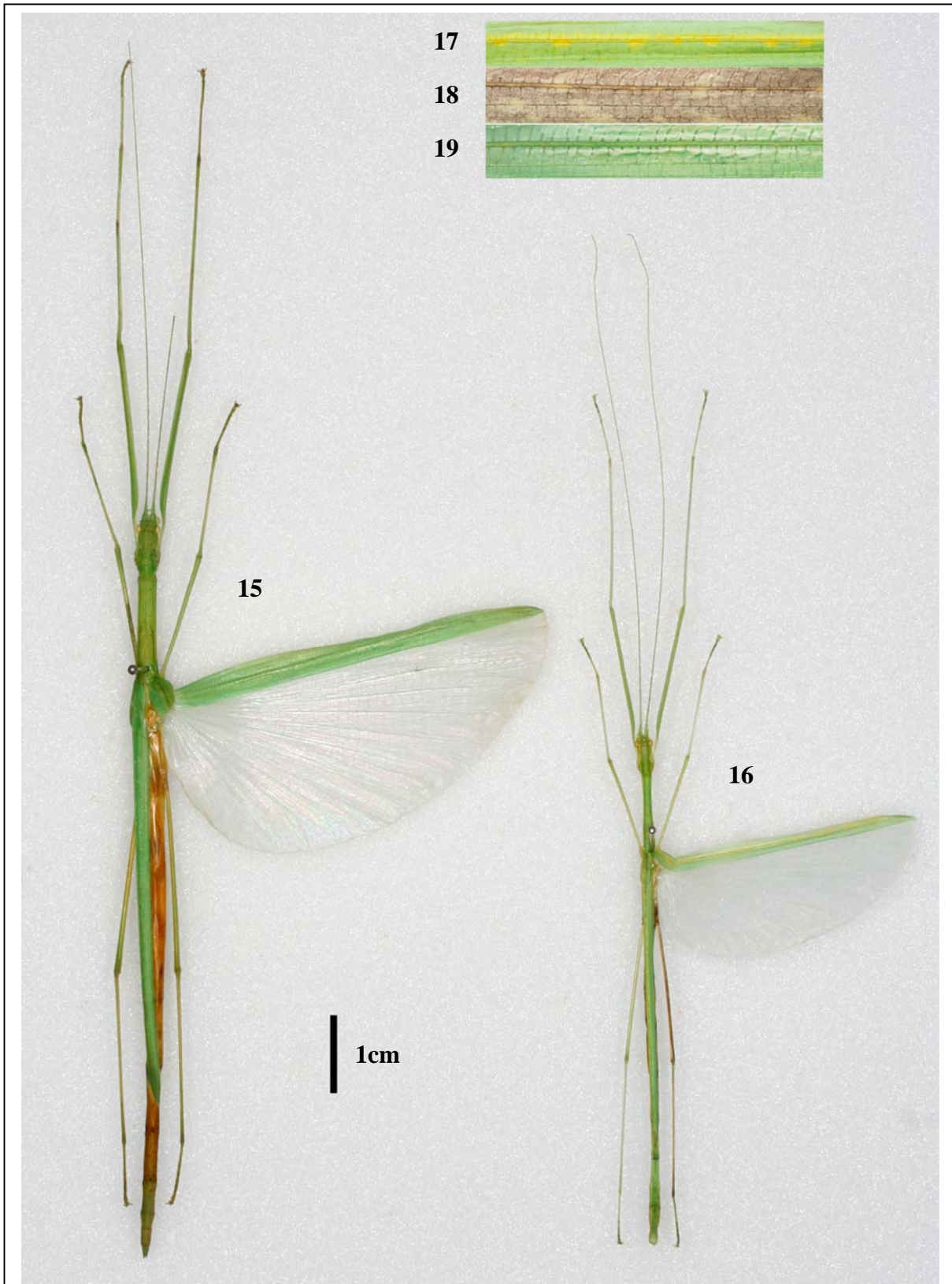
I have not examined the type material in Paris (MNHN), which should include at least one male, but since Redtenbacher did not recognise his males of “*affinis*” as belonging with the *pallida* females, it is quite possible that the MNHN material is a different species.

Two male specimens of “*pallida* det. Günther” in Hamburg (ZMUH) are correctly identified; these specimens have not previously been recorded. However, the female specimen of “*pallida*” in ZMUH that was recorded from Bukit Obat (Günther, 1932) is a different species; this is currently unidentified and I have 2♀♀ and 1♂ in my own collection that have been assigned the code 1994/Z.

I have not examined the male and female “*affinis*” that Günther recorded from Tibang in 1935 (specimens in Stockholm: NHRS). I have not examined the female, from Samarinda in Kalimantan, which was recorded by Giglio-Tos (1910: 49) as a doubtful specimen of *Aruanoidea affinis* (specimen in Torino: MRSN). The identities of these three specimens are unclear; they may be *pallida* or they may be one, or more, of the similar species of *Necroschia* which occur in Borneo.



**Figures 12-14.** Abdomen of male *Necroschia pallida* (Redtenbacher, 1908).  
12. Dorsal view. 13. Lateral view. 14. Ventral view.



**Figures 15-19.** *Necroschia pallida* (Redtenbacher, 1908).

**15.** Female. **16.** Male.

**17-19.** Portions of costal region of the hind wings(not to same scale).

**17.** Male. **18.** Brown female. **19.** Green female.

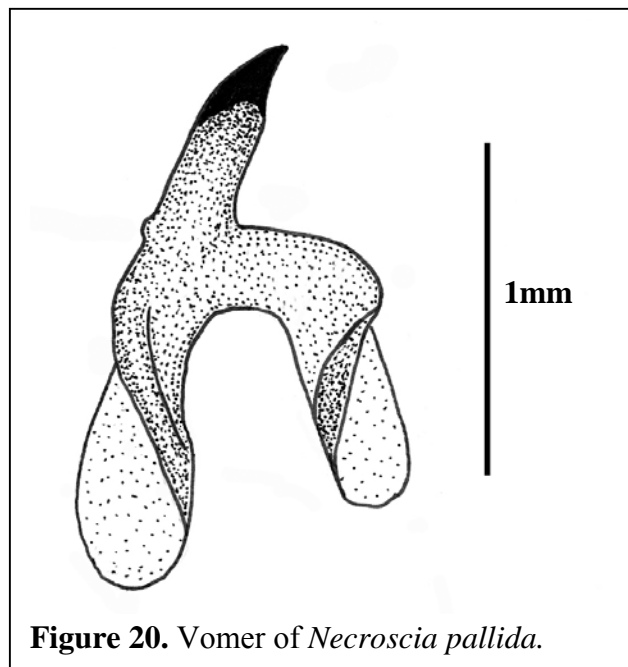
### Diagnosis

There are at least seven species of *Necroschia* in Borneo that have a very similar habitus and coloration. The relative lengths of the legs and wings are useful characteristics for helping to distinguish some of these species. However, these features alone are not sufficient to distinguish all the species, detailed examination of the ocelli, anal segment, cerci, and praeopercular organ is necessary.

**Both sexes:** Body, legs and costal region of wing mid-green, or occasionally brown; anal region of wings clear; eyes pale cream. Lacking distinct ocelli. Mesonotum sparingly granulose with a fine median longitudinal carina. Cerci cylindrical, slightly constricted at the base, apex tapering to a point. Full measurements for the largest specimen of each sex in my collection are given in table 2.

	♂	♀		♂	♀
Total length	68.5	101	Fore femur	19.9	27.9
Antennae	71	88	Fore tibia	20.1	29.6
Head	2.6	4.4	Fore tarsus	8.4	11.2
Pronotum	2.6	4.0	Mid femur	13.1	17.5
Mesonotum	10.9	14.5	Mid tibia	11.9	15.6
Metanotum	4.6	6.9	Mid tarsus	5.7	6.6
Median segment	4.8	8.0	Hind femur	19.3	25.7
Fore wing	4.2	6.9	Hind tibia	19.0	23.9
Hind wing	35	55	Hind tarsus	7.2	8.6

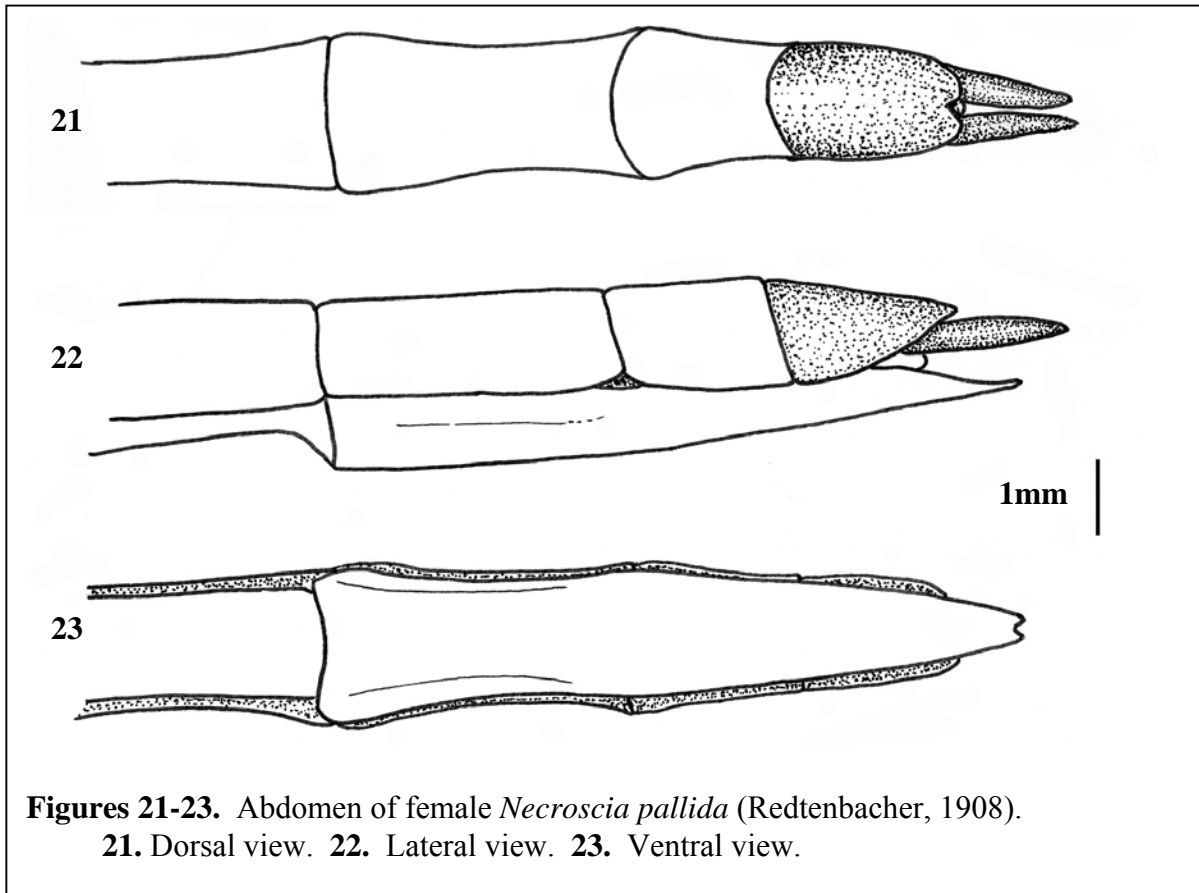
**Male** (figs 12-14,16-17 & 20): No brown males have yet been found, all are green. Head, thorax and tegmina with a narrow pale yellow stripe, costal vein of hind wing with yellow spots along the length (fig 17), and a few yellow spots occur on the tegmina in addition to the stripe. Hind legs just reaching apex of abdomen; in a few cases the legs exceed the abdomen by up to 1mm, probably due to shrinkage of the abdomen during preservation. Wings to distal end of 5th abdominal segment. Anal segment with an apical notch (fig 17). Vomer with a single spine curving to the right (fig 20). Body length 61.5-68.5mm.



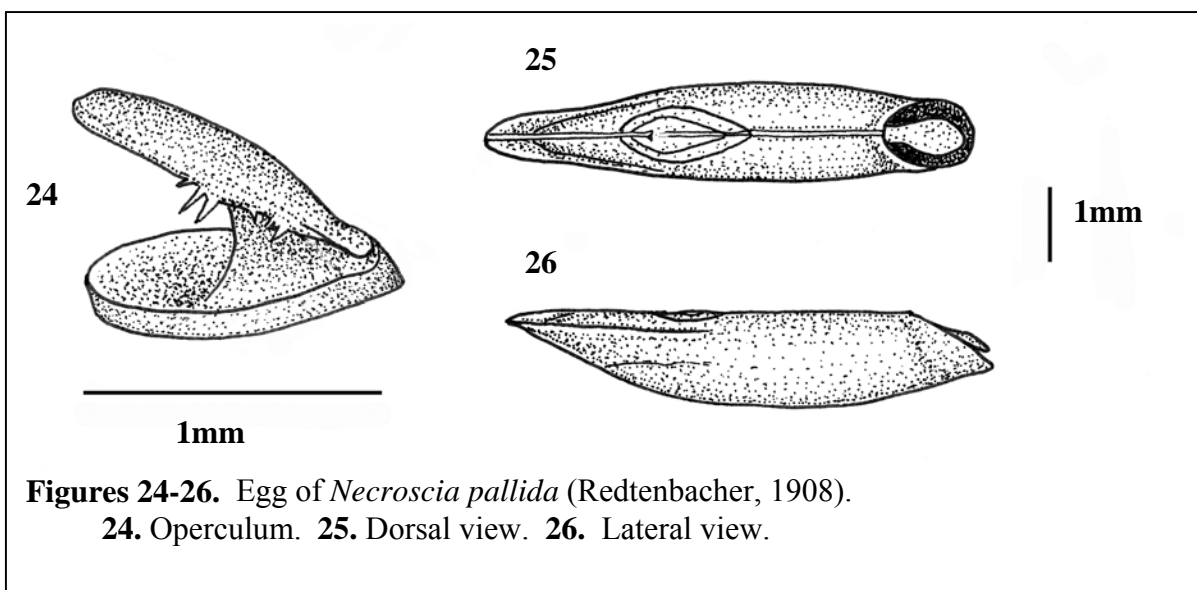
**Figure 20.** Vomer of *Necroschia pallida*.

**Female** (figs 15, 18-19 & 21-23): Two of the 11 females were brown; none have the yellow markings found in the male. Hind legs just reaching the end of 7th abdominal segment. Wings reaching half way along 6th abdominal segment (some appear to reach the 7th segment due to distorted or shrunken abdomens). Lacking an obvious praeopercular

organ. Body length 85-101mm.



**Egg** (figs 24-26): Capsule very pale brown with a cream micropylar plate. Length 7.1mm, height 1.4mm, width 1.4mm. The egg has a large flat pseudocapitulum that is attached to the operculum at the dorsal end (fig 24). The pseudocapitulum could be mistaken for the operculum but is recognisable because it is slightly too small to be the operculum.



### Distribution & habitat

All the specimens that I have collected are from lowland rainforest areas. One specimen in my collection (PEB-3581), which I did not collect, was collected at an unspecified point along the Kota Kinabalu to Tanbunan road and could therefore be from either lowland or montane forest. The distribution map (fig 27) shows the known localities; the specimen from the Kota Kinabalu to Tanbunan road is plotted at approximately the mid point. Based on specimens that I have personally collected in Borneo, *Necroschia pallida* is almost as abundant as *Necroschia prasina* (Audinet-Serville) (24 and 28 specimens respectively), and both are much more common than any other species in the genus (from 1 to 7 specimens).

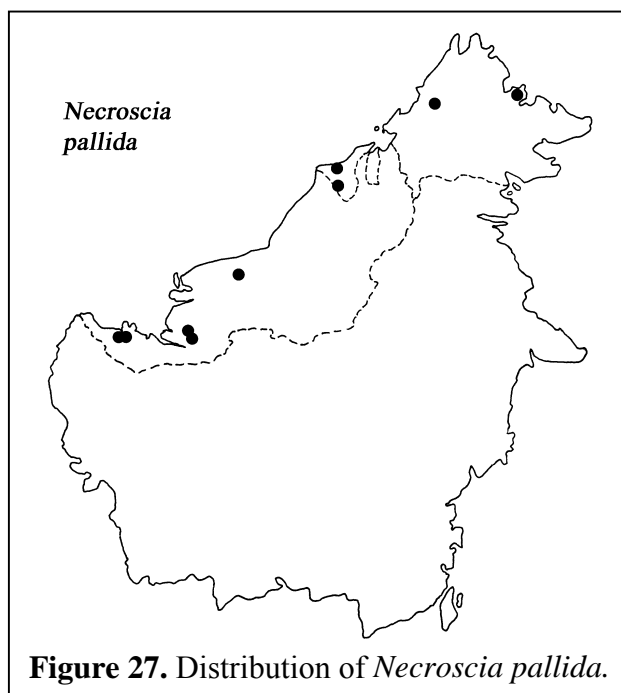


Figure 27. Distribution of *Necroschia pallida*.

### Notes

Two male specimens, collected at Sepilok on 15<sup>th</sup> December 2006, are particularly memorable. PEB-3564 had three legs when found, something I have only encountered twice before in the wild: in a male *Carausius chani*, and in a female *Phobaeticus kirbyi*. The three-legged *N. pallida* had a right mid leg and both hind legs present. What was more startling was the second male PEB-3563 which was on the adjacent branch of the same tree – it had only two legs: left hind leg, and right mid leg. I believe this is the first record of a two-legged phasmid being found in the wild. To find two such phasmids in close proximity suggests a common cause for the leg loss. In captivity phasmids usually lose legs either by interaction with other phasmids in a crowded cage, or because of difficulty shedding their skin. In the wild both of these causes are unlikely, when unconfined they should be able to select suitable conditions to shed their skin. There had been heavy rain earlier in the evening and it was still raining slightly when they were found, both were in exposed position, so it is conceivable that the leg loss was caused by heavy rain. A more likely explanation is predation by small predators, perhaps ants; a large predator is unlikely to have lost both phasmids. If they were attacked while sheltering during the heavy rain escape would have been more difficult than normal.

All the examined specimens are green, or were clearly originally green, except for two of the four females from Badas swamp forest (PEB-2388, PEB-2389) that were brown when they were found. This coloration should not be confused with specimens that are discoloured due to preservation. One of my females (PEB-2377) was originally green but has lost all the green except for a few veins on the costal region of the wings; the resulting colour is similar to the brown specimens but easily recognisable under magnification.

The paralectotype has a pinkish tinge to the anal region of the wings; this not present in any other examined specimen of this species.

### Acknowledgements

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