Studies on the leaf insects (Phasmida: Phylliidae) of Australia

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Studies on the leaf insects (Phasmoda: Phylliidae) of Australia

PAUL D. BROCK AND JACK HASENPUSCH

Abstract

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

Key words

Chitoniscus, Nanophylium, Phyllium, leaf insects, walking leaves, Queensland

Introduction

Leaf insects (also known as walking leaves) have always fascinated entomologists. Thirty-seven species have been described in 4 genera, although some existing synonymy (partly because of considerable variation within species) is doubtful. From our examination of museum collections worldwide, it is evident there are several species awaiting formal description.

There has been some confusion over which leaf insects are resident in Australia, with up to 3 species mentioned, albeit doubtfully (Balderson et al. 1998, Brock 1999a).

As part of a project on Australian phasmdas, the authors have researched literature records and examined material in museum collections. We correct here the misidentification of species and describe a new Phyllium (Phyllium) species.

Summary of literature mentioning Australian leaf insects.—The following main references cover reports of these insects, all from northern Queensland:

McKown (1942): two specimens in the vicinity of Cairns.


Key (1974): in his supplement to the 1970 publication. Key reported two Phyllium species in the rainforests of north Queensland, identified as “apparently” P. siccifolium [including a good figure of the female] and P. frondosum Redtenbacher [correctly known as Phyllium (Phyllium) siccifolium (L.) and Phyllium (Phyllium) frondosum Redtenbacher 1906]. Key added that the latter species may be a synonym of Phyllium pulchrifolium Serville 1838. However, this is not the case: pulchrifolium is a synonym of Phyllium (Pulchrifolium) bioculatum Gray 1832 (Brock 1999b).

Monteith (1971): discusses the Phyllium species figured by Key, linking it closely with an undescribed species from Popondetta, Papua New Guinea. Also, mention is made of a second species from Iron Range National Park.

Monteith (1978): description of the first male of an Australian Phyllium species, the species appearing to be Phyllium siccifolium.

Vickery (1983): lists the same species as Key (1974); these are also repeated in Balderson et al. (1998), although in the latter publication the authors mention that Australian species may be distinct, following my communications on this issue.

Rentz (1988): First reference to Nanophylium pygmaeum Redtenbacher in Australia, with notes on rearing a male [initially with female characteristics; also discussed/illustrated in Rentz (1996)]. The specimen was collected in approximately the same locality where Monteith (1971) collected his nymph.

Brock (1999a): suggests that Nanophylium may be a Phyllium species.

Brunet (2000): comments regarding leaf insects that, ‘A typical example is the short-antennae leaf insect (Phyllium siccifolium), which is commonly found within sclerophyll forests in eastern Australia.’

No reference was made to Australian species in Klante’s revision of Phyllium (1976), and only Nanophylium pygmaeum is briefly covered in Grösser (2001), a useful book incorporating all except one described species of leaf insect.

Key’s attempts at identifying 2 species at first seem wide of the mark. However, Phyllium (Phyllium) monteithi n. sp. has a close affinity with P. (P.) siccifolium, particularly females. Key may have seen a female of P. (P.) frondosum (from Papua New Guinea, known only from females so far) or a frondosum-like species. This theory helps confirm my view that Nanophylium pygmaeum is the male of a frondosum-like species, taking into account similarity in leg shape. Support for this link is strengthened by examination of a probable pair of leaf insects from Pantai, Nabile, Irian Jaya (P.D. Brock collection). The male is very similar to N. pygmaeum, except it has bold white patches on its hindwings and longer antennae. Another male from Ulakwa River, Irian Jaya, ix. 1912 – iii. 1913, leg. A.E.R. Wollaston (BMNH), however, has only a hint of a white patch on the hindwings. Whilst a possible new species, this material may represent no more than a form or subspecies of pygmaeum; further specimens are needed to evaluate this. It is not certain that the single damaged female represents this species, although from our
studies of leaf insect shape, it is considered very likely. Another clue
is Monteith (1971), where Fig. 2 shows the large, broad forefemur
of a female nymph from Iron Range, north Queensland, Australia,
which resembles that of a Phyllium (Phyllium) species with more
broadened forelegs than P. (P.) sicillofum. By contrast, Zompro
and Grösser (in press) propose that Nanophyllium belong to a new
tribe, largely based on hindwing color (brown in Nanophyllium,
transparent in other Phylliidae). Discovery of an undoubted female
of Nanophyllium is needed to clarify the position.

The type locality of N. pygmaeum is Katau, Papua New Guinea
(which is near northeastern Australia). Although there are minor
differences between specimens from Australia and Papua New
Guinea/riari Jaya, without further evidence, on balance these are
insufficient to warrant separate species status.

In an effort to expand our knowledge of leaf insects, a survey was
initiated from the Australian Insect Farm (www.insectfarm.com.au)
in February 2001, also using publications of the Entomological
Society of Queensland, Land for Wildlife (North Queensland)
and Kuranda, Envirocare, North Queensland. A similar approach
proved useful in obtaining new information from the public when
Pat Matyot (Matyot, pers. comm. 1988) asked for sighting of leaf
insects (Phyllium (Palpcriphyllium) biculatum Gray 1832) in the
Seychelles.

In Queensland, three leads were received from Cairns and
Kuranda, both areas where this insect has been seen previously.
Unfortunately, visits revealed no live leaf insects. Andrew Horn
(Kuranda) reported that green and brown mottled leaf insects had
been seen on several occasions, dislodged to the ground, usually after
a cyclone or severe storm. They were beneath Cryptocara mackin-
noniana, also the likely foodplant of leaf insects located in a garden
in Cairns. Allen Walford-Huggins (pers. comm.) found a female leaf
insect on the road after a cyclone at Lake Placid, Cairns.

Eggs of Phyllium (Phyllium) monteithi n. sp. were obtained from
a female found at Roln Forest, Gadjarga State Forest, 2 November
1964. These have been closely compared with Phyllium (Phyllium)
sicillofum from South-East Asia and Phyllium (Phyllium) zobrooi
Grösser 2001 from New Guinea; zobrooi is considered to be the
closest relative.

Abbreviations for Depositories

| AMSA | Australian Museum, Sydney, Australia |
| ANIC | Australian National Insect Collection, Canberra, Australia |
| BMNH | Natural History Museum, London, United Kingdom |
| CMUZ | University of Zoology, Cambridge, UK |
| MCSN | Museo Civico di Storia Naturale “Giacomo Doria”, Genova, Italy |
| MNNH | Museum d’Histoire Naturelle, Paris, France |
| NHMW | Naturhistorisches Museum, Wien, Austria |
| QDPC | Queensland Department of Primary Industries, Indooroopilly, Australia |
| QMBA | Queensland Museum, Brisbane, Australia |
| UQIC | University of Queensland, Saint Lucia, Australia |

Key to the known species of Australian leaf insects

The mesonotum in front of the forewings is distinctly transverse
in Chitoniscus Stål, but almost quadrato in Phyllium (Phyllium) Illiger.
Nanophyllium Redtenbacher are only known from a few males with
brown or brown and white hindwings (these transparent in other
known Phylliidae).

Females (Figs 2, 7)

Abdomen very tapered, segments not lobed laterally. Body length 75
mm. .................. Phyllium (Phyllium) monteithi sp. n. Outer margin of abdominal segments 6 to 8 lobed laterally. Body
length 60 to 62 mm . . . . Chitoniscus lobiventris (Blanchard 1853)

Note – the female of Nanophyllium pygmaeum Redtenbacher 1906
is unknown. However, it almost certainly has forelegs with a large
external lobe, and a much broader abdomen, compared with the
above mentioned species.

Males (Figs 1, 4)

Forewings long and slender, hindwings transparent. All femora with
typical slender leaf-like expansions. Abdomen broad, leaf-like. Body
length 61 to 62 mm .... Phyllium (Phyllium) monteithi sp. n.
Forewings short, hindwings dark brown. All femora with exaggerated
lobes. Abdomen narrow, tapered sharply towards tip. Body length 28
to 30 mm .......... Nanophyllium pygmaeum Redtenbacher 1906

Although not yet found in Australia, the male of Chitoniscus
lobiventris (35 to 38 mm) has lobed abdominal segments 6-8, which
readily distinguish it from the male of N. pygmaeum. In addition,
C. lobiventris has transparent hindwings, which are known in N.
pygmaeum.

Phyllium (Phyllium) monteithi sp. n.
Figs 1-3

Holotype.— Male (Fig. 1) Robust greenish yellow smooth insect
with a fairly broad leaf-like abdomen. Fore and hindwings long.
Body length 62 mm.

Head: Smooth, only slightly longer than broad. Eyes large.
Antennae hairy; brown with 20 segments; longer than fore legs. First
segments short, then much longer, final four shorter.

Thorax: Pronotum shorter, more slender than head; conspicuous
median depression; a few tubercles present laterally, including bold
tubercles beneath coxae. Mesonotum smooth, a little shorter than
pronotum; broadening towards hind part of segment as typical in
Phyllium males (only slightly transverse). Metanotum much longer
than mesonotum, broadening to abdomen.

Abdomen: Smooth, long, leaf-like; much wider than thorax, broad-
ening gradually to middle of 4th segment, then tapered from 7th to
anal segment; segments of similar length. Cerci broad, tapered at
tip. Subgenital plate tapered to sharply pointed tip, not reaching
end of anal segment.

Wings: Forewings elongate, leaf-like, pale greenish. Hindwings long,
almost reaching end of abdomen. Pre-anal part of hindwings trans-
lucent, as are hindwings.

Legs: Leaf-like. Inner margin of fore femora broadened, with 4
dentations. Mid and hind femora more slender than fore, typical in
Phyllium (Phyllium), with several small dentations. Foretibial
leaf-like, lobed.
Fig. 1. *Phyllium* (*Phyllium*) *monteithi* holotype male.

Fig. 2. *Phyllium* (*Phyllium*) *monteithi* paratype female (after Monteith 1971, also figured in Key 1974).

Fig. 3. *Phyllium* (*Phyllium*) *monteithi* egg views a) dorsal b) lateral c) from top, with operculum removed.
Table 1. Measurements (mm).

<table>
<thead>
<tr>
<th></th>
<th>Male (holotype)</th>
<th>Female (Paratypes)</th>
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<tr>
<td>Body length</td>
<td>62</td>
<td>75 to 76</td>
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<tr>
<td>Head</td>
<td>3.5</td>
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<tr>
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<td>26</td>
<td>4</td>
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<td>Mesonotum</td>
<td>2.5</td>
<td>3.8</td>
</tr>
<tr>
<td>Metanotum</td>
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<td>7</td>
</tr>
<tr>
<td>Median segment</td>
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<td>2</td>
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<tr>
<td>Forewings</td>
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<td>48 to 49</td>
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<tr>
<td>Hindwings</td>
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<td>N/A</td>
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<td>14</td>
</tr>
<tr>
<td>Mid femora</td>
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<tr>
<td>Hind tibiae</td>
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<td>11.5</td>
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<tr>
<td>Cerci</td>
<td>1</td>
<td>2.5</td>
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</table>

Male paratypes body lengths range 61 to 62 mm (n = 5) other measurements approximately as holotype male.

Paratype.—Males: (5 specimens). Same as holotype except for minor size and color variation, being mainly leaf-green.

Paratype.—Females (Fig. 2): (4 specimens). Broad body with long coriaceous forewings. Body length 75 to 76 mm. Head: Smooth, only slightly longer than broad. Eyes small. Antennae short, with 10 segments. Thorax: As in male, but much broader. Abdomen: As in male, but much broader, 8th segment more sharply tapered. Cerci broad, tapered at tip. Operculum tapered to sharply pointed tip, not reaching end of anal segment. Wings: Fore wings long, leaf-like, almost reaching end of 7th abdominal segment. Legs: As in male. Egg (Fig 3a-c): Various shades of light brown. Capitulum conical, with ridges. Capsule uneven, with numerous ridges and a series of several central pits. Capsule length 5 mm, height 3.7 mm, width 2.5 mm. Micropylar plate long (length 2.7 mm) fairly broad, slightly broadened at base. Outer margin with numerous short processes.

The abdomen of monteithi in both sexes is rather broader than zomproi. Similarly, the legs of monteithi are noticeably broader, particularly the fore legs. The general appearance of the eggs of the above-mentioned species indicates an affinity with the uneven shape of monteithi and the less conspicuous micropylar plate, easily distinguishing it from zomproi. The eggs of both species differ considerably from those of the Asian type species P. (P.) siciolium, whose capsule is largely covered by pinnae (Brock 1999b).

Holotype.—♀, Australia: Mt. Lewis, near Julatten, north Queensland, i.1990, J. Hasenpusch (QMBA).

Paratypes.—♀, Australia: Windsor Tableland, NE Mt Carbine, north Queensland, 3.xii.1986, A. & M. Walford-Huggins (QMBA); ♀, Australia: Mt. Windsor Tableland, north Queensland, 27.xii.1976, A. Walford-Huggins (UQIC); ♀, Australia: Kuranda, north Queensland, 3.iii.1983, R. Straatman (ANIC); [labelled Phyllium siciolium]; ♀, Australia: Mt. Lewis, nr end of road w. of Mossman, north Queensland, 28.xii.1989, M.S. & B.J. Moulds (AMSA); ♀, Australia: Kuranda, Black Mountain Road, north Queensland, 20.xii.1987, attracted to light, J. Hasenpusch (J Hasenpusch coll.); ♀♀, Australia: Innisfail, north Queensland, 1935, H. Smith (QMA); ♀♀, Australia: Atherton Tableland, north Queensland, 17.v.1965, S. Elder (QDPC); ♀♀, Australia: Cairns district, north Queensland (UQIC); ♀♀, Australia: Gadjarra State Forest, nr Lake Tinaroo, north Queensland, 2.xi.1964 [and 8 eggs, some damaged] (QDPC).

Distribution.—Several records from various parts of a 140 km stretch in northeastern Queensland between Mossman and Innisfail, including rainforest localities up to 40 km inland. Photographs have been taken of a female seen in Cairns Botanical Gardens (discussion with Peter Shanahan, 1997). Another male was found in Kuranda by Jack Hasenpusch, but was not preserved.

Etymology.—Named after Geoff Monteith, curator of insects at Queensland Museum, Brisbane, who has a great passion for Australian insects.

Foodplants.—Possibly including Cryptocarya mackinnoniana (Lauraceae), following observations by members of the public.

Behavior.—Males emit an unpleasant-smelling fluid from their mouthparts when handled, a common form of defensive reaction in phasmids.

**Nanophyllium pygmaeum** Redtenbacher 1906

Fig. 4

Holotype ♀, New Guinea: Katau, 1876, D’Albertis (MCSN) [examined].

Katau or Binaturi River is in the Gulf of Papua region of New Guinea, close to the northeast Australian coast.
**Non-type material examined.** — Possibly this species: ♂, Australia: 3 km ENE Mt Tozer, nr Iron Range National Park, northeast Queensland, 28.vi.1986, reared from young nymph, died 19.i.1987 (ANIC) [30mm] (shown in Fig. 4); possibly this species: ♀, nymph, Australia: Iron Range National Park, northeast Queensland, vi.1971, G. Monteith (QMBA).

As mentioned in the literature summary above, more material is needed to confirm whether or not the Australian species is *N. pygmaeum*.

Other specimens from Irian Jaya mentioned above have been excluded from measurements in the keys, because there is doubt that they belong to this species. However, the male and probable female from Nabire, Irian Jaya (P. D. Brock collection) are illustrated (Figs 5-6) and will feature in a further paper covering some leaf insects of Papua New Guinea and Irian Jaya (Brock, in progress).

**Foodplants.** — Host plant unidentified. In captivity accepted *Pyranotus* sp. (Rosaceae) (Rentz 1988).

**Chitoniscus lobiventris** (Blanchard 1853)

*Fig. 7*

**Holotype.** — ♂, Fiji: Viti, Lebouka (MNHN) [examined].

**Non-type material examined.** — [from countries other than Fiji] ♀ Australia: Cairns, Queensland, viii.1903, Perkins (CMUZ) (shown in Fig. 7); ♀ Solomon Islands: Kolombangara, 28.ii.1983, M. Bigger (BMNH) [det. as *Chitoniscus* sp., ♀ lobiventris, J.A. Marshall, 1986]; ♂, Solomon Islands: Kolombangara, 20.x.1983, M. Bigger (BMNH) [det. as *Chitoniscus* sp., ♀ lobiventris, J.A. Marshall, 1986].

Whilst this single record from Australia is from 1903, R.C.L. Perkins donated a significant collection to CMUZ (including other Australian species) and the curator would be surprised if Perkins had made a mistake with the locality (Foster, pers. comm.). As with some other *Chitoniscus* species, distribution is widespread.

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**Fig. 5. Nanophyllum sp. male - Nabire, Irian Jaya**

**Fig. 6. Nanophyllum sp. ♀ female - Nabire, Irian Jaya.**

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**Conclusion**

Although the relatively few records indicate that leaf insects are uncommon in Australia, they have been recorded from very widespread localities (Fig. 8), indicating that at least *P. monteithi* is well established in remote rainforest locations. Many Australian phasmds are only known from a handful of records, even some species well known as culture stocks.

One of the main taxonomic problems in the Phasmda is that variation can be extreme and this is particularly true of the leaf insects. Without examination of eggs and/or rearing a series of specimens, it is sometimes difficult to realize the extent of variation within individual species.

**Acknowledgements**

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Fig. 8. Distribution map showing Australian leaf insects.


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