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A tiny new species of leaf insect (Phasmatodea, Phylliidae) from New Guinea

THOMAS VAN DE KAMP^{1,2} & FRANK H. HENNEMANN³

¹ANKA / Institute for Photon Science and Synchrotron Radiation (IPS), Karlsruhe Institute of Technology (KIT), Hermann-von-Helmholtz-Platz 1, D-76344 Eggenstein-Leopoldshafen, Germany. E-mail: thomas.vandekamp@kit.edu

²State Museum of Natural History Karlsruhe, Erbprinzenstr. 13, D-76133 Karlsruhe, Germany

³Reiboldstrasse 11, D-67251 Freinsheim, Germany. E-mail: hennemann@phasmatodea.com. Website: www.phasmatodea.com

Abstract

The female and egg of the new Papuan leaf insect *Phyllium (Phyllium) riedeli* n. sp. are described and illustrated. The species belongs in the *siccifolium* species-group of the subgenus *Phyllium* and, with a body length of 56.3 mm, represents the smallest leaf insect so far described for the genus. The type-specimens are stored in the State Museum of Natural History Karlsruhe, Germany (SMNK). A checklist and key is provided for the New Guinean representatives of *Phyllium (Phyllium)* Illiger, 1798.

Key words: Phasmatodea, leaf insects, *Phyllium (Phyllium) riedeli* n. sp., West Papua

Introduction

The family Phylliidae is well-known for containing the so-called leaf insects, which have always fascinated entomologists due to their remarkable camouflage. The Phylliidae comprises two tribes—the Nanophylliini with the genus *Nanophyllium* Redtenbacher, 1906 and the Phylliini with the three genera *Chitoniscus* Stål, 1875, *Microphyllium* Zompro, 2001 and *Phyllium* Illiger, 1798. Currently, the family contains 53 described extant species, 40 of which are placed in the genus *Phyllium*. From these 40 known species 29 belong in the subgenus *Phyllium (Phyllium)* Illiger, 1798 and 12 in the subgenus *Phyllium (Pulchriphyllium)* Griffini, 1898. *Eophyllium messelensis*, known from a 47-million-year-old fossil male, already exhibits many of the morphological characters found in modern leaf insects (Wedmann *et al.* 2007).

Comprehensive studies on the Phylliidae were done by Klante (1976), Größer (2001, 2008) and Zompro & Größer (2003). Brock & Hasenpusch (2003) revised the Australian species. The head morphology of *Phyllium (Ph.) siccifolium* (Linnaeus, 1758) was described in detail by Friedemann *et al.* (2011). The eggs of leaf insects were examined e.g. by Clark (1978), Viscuso & Longo (1983) and Hausleithner (1984). Hennemann *et al.* (2009) published an extensive survey of the genus with a revision of Philippine species, which questioned the validity of the so far established systematic groups and provided a reclassification as well as clarification of several identifications.

This paper describes and discusses a tiny new leaf insect found in West Papua (New Guinea), which is in accordance to the classification presented by Hennemann *et al.* (2009) placed in the *siccifolium* species-group of the subgenus *Phyllium (Phyllium)*. The description is based on a single adult female and four eggs.

Methods

A single female of *Ph. (Phyllium) riedeli* n. sp. was collected alive in 2010 in the highlands of West New Guinea. After collection, the specimen survived for 13 days in captivity and dropped four eggs before its death. The eggs were incubated at room temperature and were regularly sprayed with water, but no hatchlings emerged. After one

year, the eggs were placed next to the holotype and designated paratypes of *Ph. (Phyllium) riedeli* n. sp.. The left hindleg of the holotype was removed immediately after its death and fixed in 100% ethanol to provide molecular samples for possible future phylogenetic studies.

The holotype was photographed with a Canon EOS 50D camera equipped with a Tamron AF 90mm 2.8 Di Macro 1:1 SP lens and a Canon Macro Twin Lite MT-24EX flash. Photographs of the eggs were taken with a JVC KY70 camera attached to a Leica Z6 APO Macroscope. The in-focus components of 50 images were combined automatically with the software Auto-Montage® (Synchrosopy). Scanning electron microscopy images of the antennae were taken with a Zeiss EVO LS 15 at 15kV and a chamber pressure of 30–45 Pa. The background of some images was corrected using Adobe® Photoshop® CS6. Measurements were taken using a digital caliper and are given to 0.1 mm. The eggs examined and illustrated were fully developed and were laid by the holotype. The terminology used to describe egg structures generally follows that of Clark-Sellick (1997). Fig. 6 is based on a public domain map of New Guinea available at Wikimedia Commons (<http://commons.wikimedia.org>).

Abbreviations

HT	Holotype
PT	Paratype
SMNK	State Museum of Natural History Karlsruhe, Germany
SMNS	State Museum of Natural History Stuttgart, Germany
ZSMC	Zoologische Staatssammlung München, Germany

Phyllium Illiger, 1798

Phyllium (Phyllium) Illiger, 1798

Type species: *Gryllus (Mantis) siccifolius* Linnaeus, 1758: 425, by monotypy.

Differing from the subgenus *Ph. (Pulchriphyllium)* by the lack of exterior lobes on the tibiae of both sexes, ± round cross-section of antennomeres IV–VIII of ♀ as well as the longer tegmina, which at least reach to abdominal segment III, and ventrally unarmed antennomeres of ♂. Eggs differ by the raised hairy, umbrella- or feather-like appendages, lack of longitudinal lamellae of the capsule and flat operculum.

For full details, as well as diagnoses of the genus and subgenus and keys see Hennemann *et al.* (2009).

Phyllium (Phyllium) riedeli n. sp.

HT, ♀: Papua Province, Indonesia, S03° 57.161' E138° 57.357', 1875m, *Nothofagus* forest, 11.XII.2010, beaten (SMNK).

PT, 4 eggs: laid by the HT in captivity (SMNK).

Differentiation. The ♀ of *Ph. (Ph.) riedeli* n. sp. is the smallest adult ♀ known in the genus so far, with a body length of only 56.3 mm. The shape of the abdomen, which is gradually tapered from segment IV onwards, shape of the profemora, lack of exterior lobes on the tibiae and ventrally unarmed antennomeres clearly place this new species in the subgenus *Phyllium (Phyllium)*.

Since *Ph. (Ph.) riedeli* n. sp. is from New Guinea, it is most certainly endemic to that island and hence unlikely to occur elsewhere, especially throughout the Wallacea. This is also the case for the other four New Guinean members of the subgenus i.e. *Ph. (Ph.) caudatum* Redtenbacher, 1906, *Ph. (Ph.) elegans* Gröber 1991, *Ph. (Ph.) telnovi* Brock, 2014 and *Ph. (Ph.) zomproi* Gröber, 2001. An exception is *Ph. (Ph.) caudatum*, which also occurs in New Britain and the Solomon Islands. Consequently, *Ph. (Ph.) riedeli* n. sp. is here only differentiated from the species occurring in New Guinea.

The most closely related and similar species appears to be *Ph. (Ph.) caudatum*. From this species ♀ of *Ph. (Ph.) riedeli* n. sp. can be distinguished by: the smaller size, less granulose head capsule, less spiny mesothorax,

broader and apically rounded tegmina, shape of the subgenital plate, smaller teeth of the interior lobe of the profemora, more slender and less expanded exterior lobe of the profemora and smaller interior lobes of the protibiae.

From *Ph. (Ph.) zomproi* ♀ differ by: the much smaller size, gradually tapered abdominal segment VI–X, presence of a distinct posteromedian tubercle on the head, lower number of teeth on the pars stridens of antennomere III (25 in *Ph. riedeli* n. sp., 48–50 in *Ph. zomproi*), less spiny mesothorax, shape of the subgenital plate, much more slender and less rounded interior and exterior lobes of the profemora and shorter but more distinctly rounded interior lobe of the protibiae. From *Ph. (Ph.) elegans* ♀ differ by: the much smaller size, much more slender abdomen, which is gradually tapered from segment VI onwards with segments VII and VIII not lobed, shorter and broader apically rounded tegmina, shape of the profemora and shape of the subgenital plate.

Ph. (Ph.) telnovi seems to be closely related but is only known from the ♂. However, with a body length of 50 mm the ♂ of this species is by far too large to represent the opposite sex of *Ph. (Ph.) riedeli* n. sp.. Also, the distinct armature of the interior lobe of the profemora and fairly large spines of the mesothorax clearly show it to be distinct.

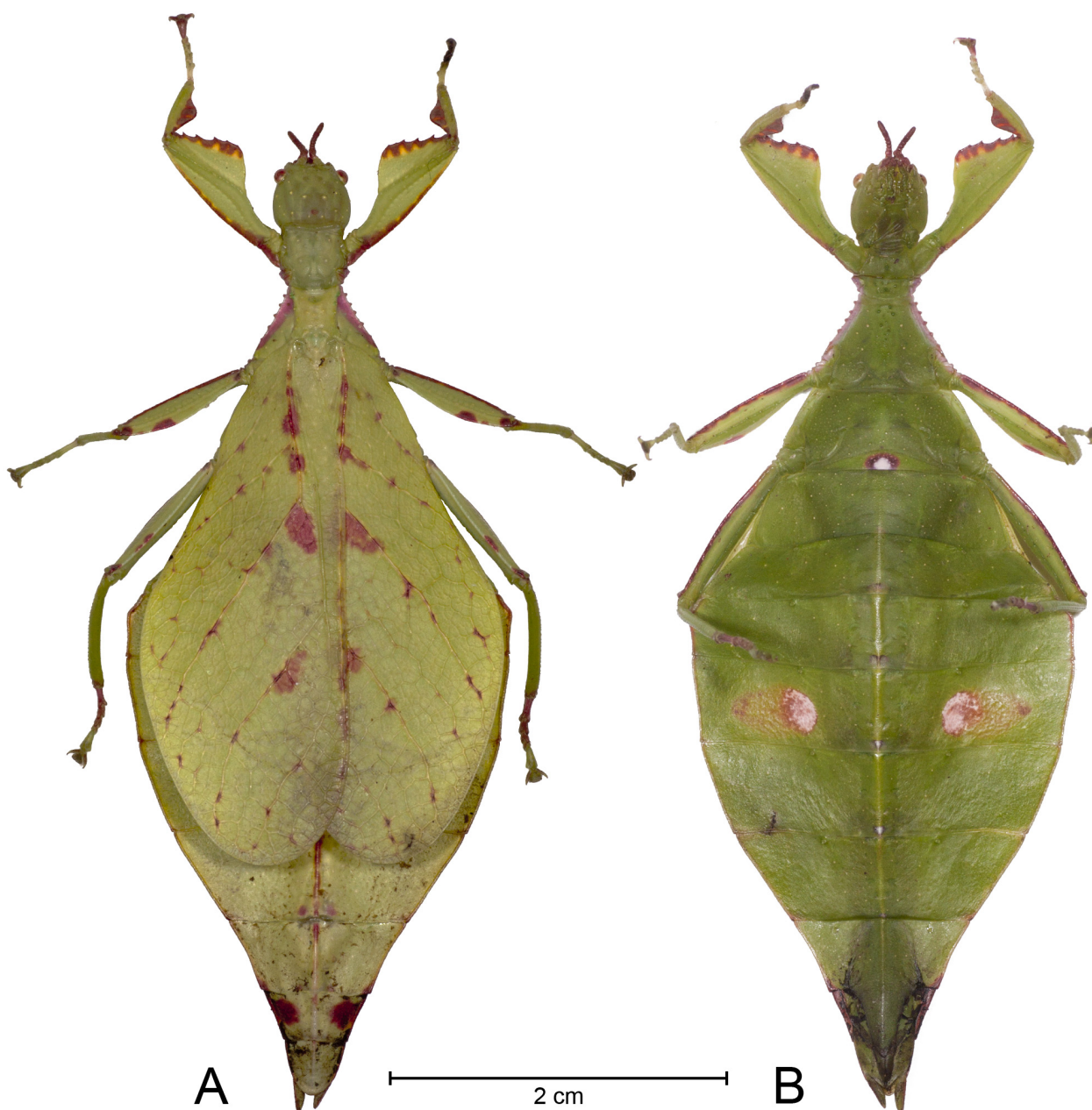


FIGURE 1. Female holotype of *Phyllium (Ph.) riedeli* n. sp.. **A:** Dorsal aspect; **B:** ventral aspect.

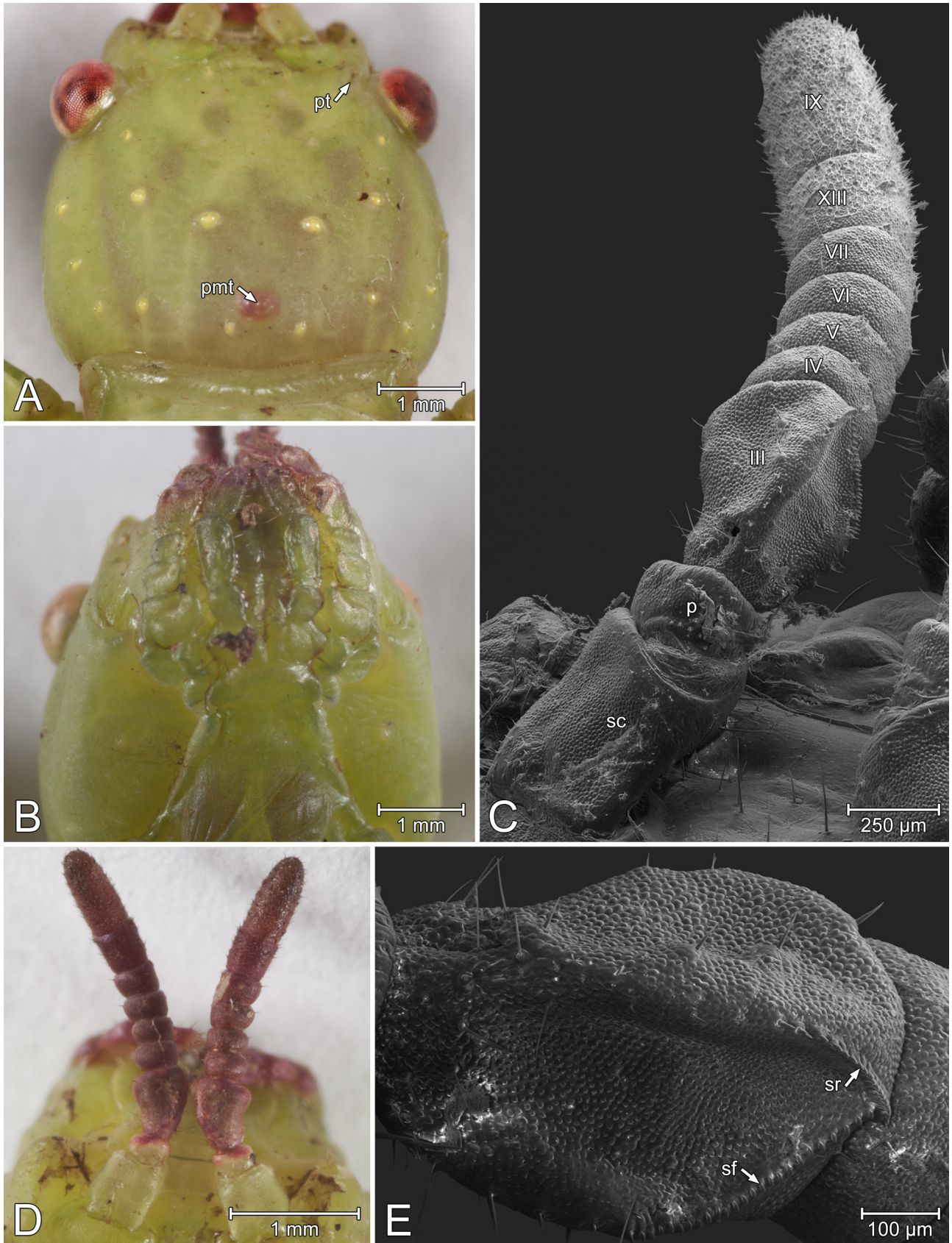


FIGURE 2. Head morphology of *Phyllium (Ph.) riedeli* n. sp.. **A:** Head capsule, dorsal aspect; **B:** head capsule, ventral aspect; **C:** SEM photograph of left antenna; **D:** antennae, dorsal aspect; **E:** SEM photograph of antennomere III. III–IX = antennomeres; p = pedicellus; pmt = posteromedian tubercle; pt = protuberance; sc = scapus; sf = stridulatory file; sr = stridulatory ridge.

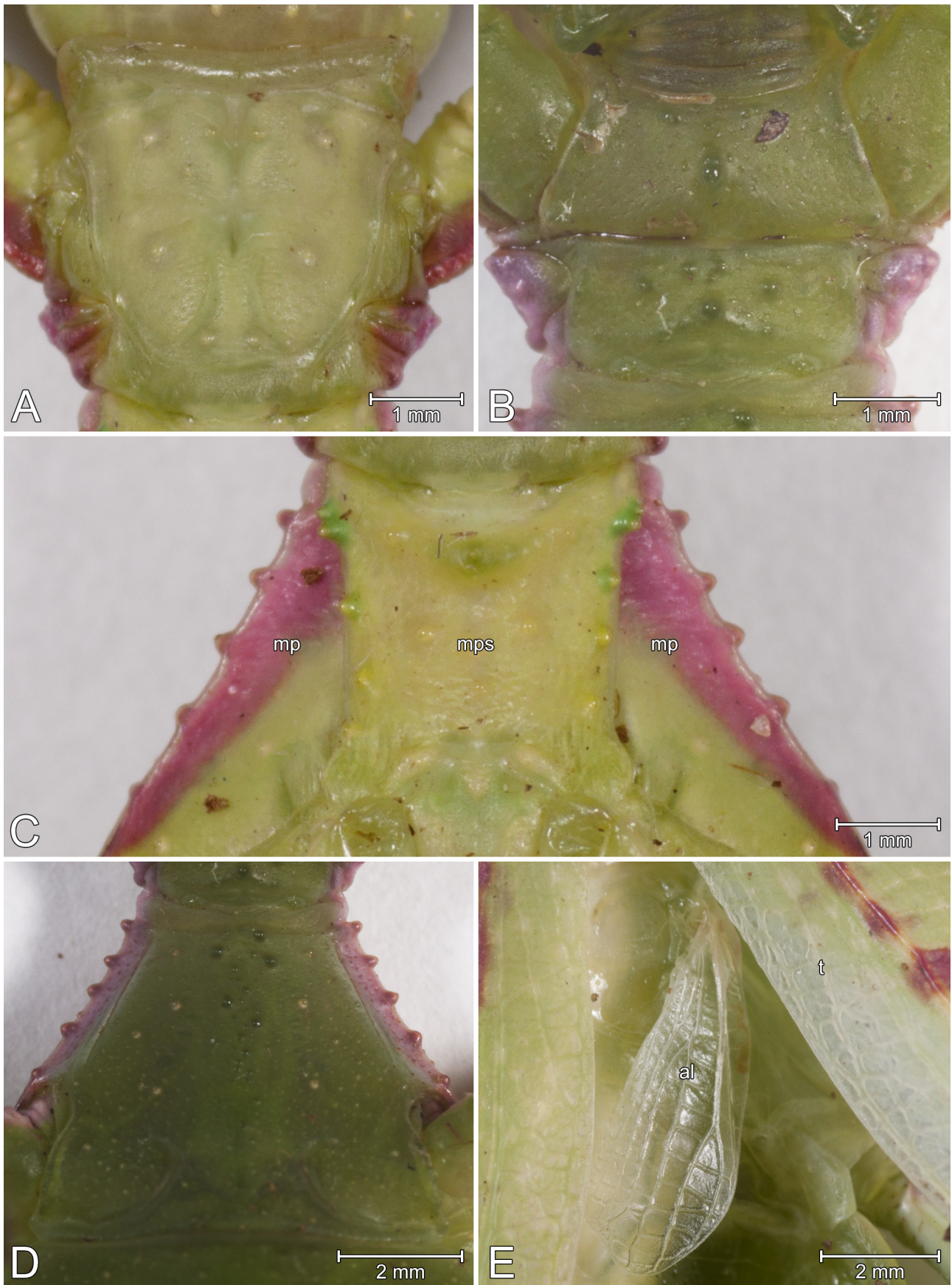


FIGURE 3. Thorax of *Phyllium (Ph.) riedeli* n. sp.. **A:** Pronotum, dorsal aspect; **B:** prosternum, ventral aspect; **C:** mesopraescutum and mesopleurae, dorsal aspect; **D:** mesosternum, ventral aspect; **E:** rudimentary ala. **al** = ala; **mp** = mesopleura; **mps** = mesopraescutum; **t** = tegmen.



FIGURE 4. Genitalia and legs of *Phyllium (Ph.) riedeli* n. sp.. **A:** Genitalia, ventral aspect; **B:** meso- and metacoxa, ventral aspect; **C:** profemur and protibia, dorsal aspect. **fel** = profemoral exterior lobe; **fil** = profemoral interior lobe; **til** = protibial interior lobe; **mcx** = mesocoxa; **mtcx** = metacoxa; **pf** = profemur; **ptb** = protibia; **sp** = subgenital plate.

Ph. (Ph.) riedeli n. sp. may also be distinguished from all other species of *Phyllium* by the unique shape of the eggs.

Etymology. The species is dedicated to the entomologist and weevil specialist Alexander Riedel.

Description. The description of the colouration is based on the appearance of the HT immediately after its death. The eggs used for the description were laid by the HT in captivity.

♀ (**Fig. 1**). Small-sized for the subgenus (body length 56.3 mm) with a moderately broad abdomen (maximum width 23.0 mm) gradually tapered towards the apex from segment IV onwards. Exterior lobes of the profemora (**Fig. 4C**) narrow and rounded, interior lobes dentate and roundly triangular.

Colouration. Living HT mostly green with pale dark red speckles on tegmina. Ventral body surface generally darker. Alae (a) transparent (**Fig. 3E**). Antennae (from antennomere II onwards), tips of labial and maxillary palpi and tubercle (pmt) on posteromedian head capsule pale dark red (**Fig. 2D**). Compound eyes with reddish/dark

brown pattern (Fig. 2A). Mesopleurae (mp) pale dark red, anterior-most spiniform tubercles of meso-praesutum (mps) dark green (Fig. 3C). Fine light green median line extending from posterior abdominal segment II to VIII. Distinct white spot with brown frame on the posteromedian ventral abdominal segment I. Similar, but smaller triangular-shaped spots at segments V and VI. Large light spots in the center of each side of abdominal segment V, best visible ventrally but also dorsally below the tegmina. Abdomen with a thin, brownish frame extending from abdominal segment IV towards the apex. Segment IX dorsally with dark red spots extending to the lateral margins. Ventral coxal surfaces green (Fig. 4B), dorsal surface of procoxae and protrochanters brown. Interior lobes (fil) of profemora (Fig. 4C) with yellowish/brownish-red pattern at dentate side. Dorsal part of the exterior lobes (fel) of profemora brownish-red (coxal margin) to green (tibial margin). Protibial interior lobes (til) brownish-red with three yellowish lines perpendicular to the tibia (Fig. 4C). Propaetarsi pale dark red. Exterior lobes of mesofemora with a brownish spot on the proximal margin and three pale dark red spots of different sizes distally (proximodistal sequence: large, small, medium). Interior lobes of mesofemora exhibit a similar colour pattern as the profemora. Mesotibiae with a pale dark red spot near the proximodorsal margin. Colour pattern of metafemora very similar to mesofemora, but with a larger gap between the second and third distal spot of the exterior lobe. Metatibiae similar coloured to mesotibiae, but with reddish distal margin. Metatarsomeres I to IV reddish.

Morphology. Head capsule (Figs 2A,B) broad with convex cheeks. Vertex smooth except for several granules, a distinct posteromedian tubercle (pmt) and small protuberances (pt) between compound eyes and antennal bases. Antennae (Figs 2C,D) moderately slender and elongate (3.4 mm), longer than postocular section of head capsule (2.7 mm) and consisting of nine segments. Apical antennomere (IX) cylindrical with rounded apex, about 2x longer than wide and \pm 2x as long as VIII. Stridulatory file (pars stridens) on antennomere III with 25, stridulatory ridge (plectron) with 19 teeth (Fig. 3E). Pronotum (Fig. 3A) roughly squarish with slightly concave anterior margin and moderately convex lateral and posterior margins. Anterior margin of pronotum thickened, in particular around the openings of the prothoracic defensive glands. Prosternum smooth, except for some minor granules (Fig. 3B). Meso-praesutum (mps) almost as long as wide (length-width ratio 1.1 : 1), gently narrowing towards posterior (Fig. 3C). Lateral margins armed with few spiniform tubercles of variable sizes, the larger ones located near the anterior margin. Disc with $8 \pm$ prominent tubercles. Mesopleurae (mp) strongly and gradually diverging; their lateral margins with five distinct spiniform tubercles (Fig. 3C). Anterior mesosternum sparsely and irregularly granulose (Fig. 3D). Tegmina (length 31.2 mm, max. width 12.3 mm) extending over 1/3 of abdominal segment VII. Alae (al) rudimentary (length 6.7 mm, max. width 2.6 mm), roughly 1/5 the length of tegmina (Fig. 3E). Abdominal segments II–IV gradually widened, IV widest segment, first 1/3 gradually diverging. V–X gradually tapering towards the apex. Anal segment (X) \pm as long as wide with rounded apex. Subgenital plate (sp) rather short, slightly projecting over the posterior margin of abdominal segment IX (Fig. 4A). Profemora (Fig. 4C) with a narrow and rounded exterior lobe (fel). Interior lobe (fil) dentate, roundly triangular and distinctly wider than exterior lobe. Protibiae (Fig. 4C) without exterior lobe, interior lobe (til) roundly isosceles triangular (angle $> 90^\circ$). Exterior and interior lobe of meso- and metafemora gently rounded, with the exterior lobe narrower than the interior lobe. Protarsus about 5/4 the length of the protibia, probasitarsus roughly 2x longer than wide.

Measurements [mm]: Length of body 56.3, length of head 5.0, length of pronotum 3.9, length of mesonotum 4.5, length of tegmina 31.2, greatest width of tegmina 12.3, length of alae 6.7, greatest width of abdomen 23.0, length of profemora 8.4, length of mesofemora 7.8, length of metafemora 9.1, length of protibiae 5.2, length of mesotibiae 5.9, length of metatibiae 6.6, length of antennae 3.4.

Eggs (Fig. 5). Remarkably large when compared to the size of the female. Overall colouration light brown. Lateral surfaces smooth and slightly glossy. Ventral surface with a single longitudinal median lamella (vml) (length 2.9–3.2 mm) consisting of loosely agglutinate hairy or moss-like appendages. Polar area with two very prominent feather-like appendages (pa) (height 1.2–1.8 mm) apparently consisting of thin tightly agglutinate hairy filaments. Dorsal surface generally flat and smooth, with two similar larger and roughly triangular appendages (da; height 1.9–2.2 mm) longitudinally flanking the micropylar plate (mp). Micropylar plate elliptical with pointed ends and slightly impressed (Fig. 5B). Micropylar cup (mc) at the posterior end of micropylar plate. Operculum (op) almost circular and slightly convex, with a crown (c) of small hairy appendages (Fig. 5C). Medially with a single lamella similar to the one at egg's the ventral side.

Measurements including feather-like structures and lamellae [mm]: length (including operculum) 5.6–5.9, length 4.8–5.3, width 2.3–2.6, height 4.1–4.3, length of micropylar plate 2.4–2.6.

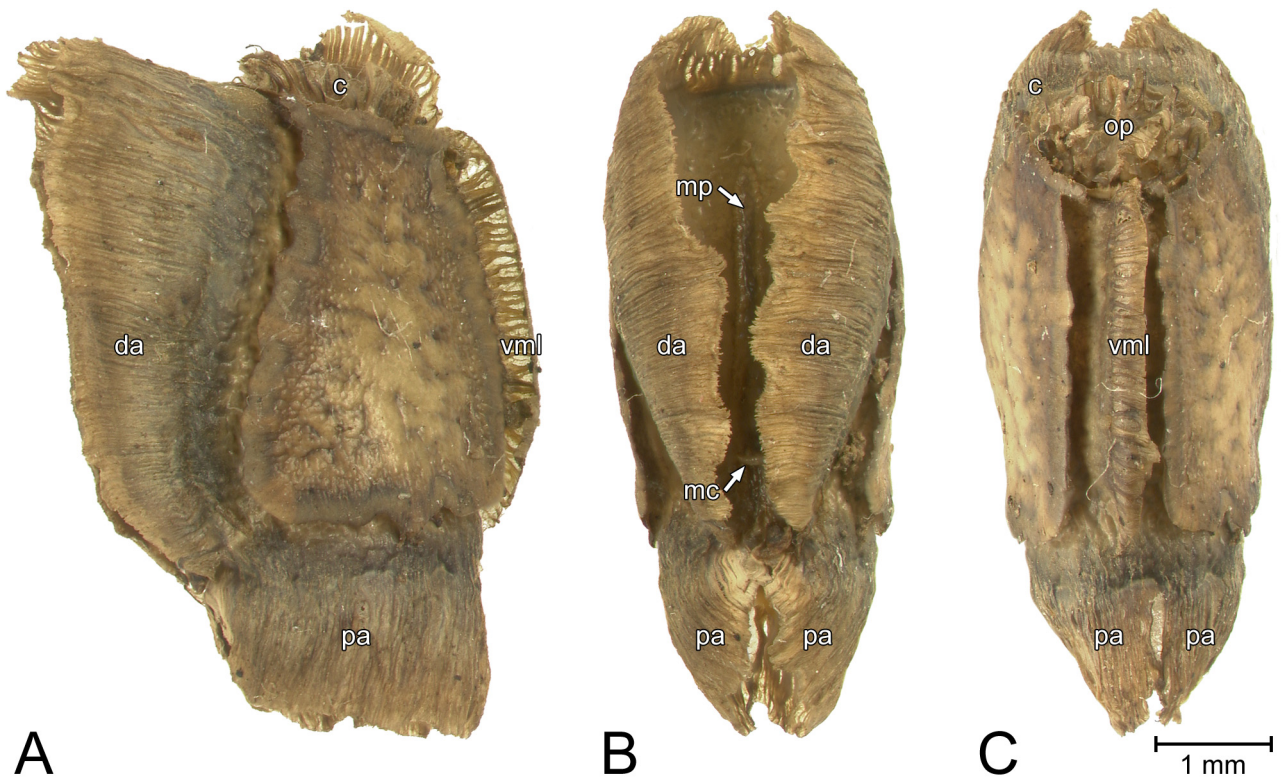


FIGURE 5. Egg of *Phyllium (Ph.) riedeli* n. sp.. **A:** Lateral aspect; **B:** dorsal aspect; **C:** ventral aspect. **c** = opercular crown; **da** = dorsal appendage; **mc** = micropylar cup; **mp** = micropylar plate; **op** = operculum; **pa** = polar appendage; **vml** = ventromedian lamella.

Distribution and ecology. So far only known from the type locality in the mountain ranges of central West Papua, having been collected in mountainous *Nothofagus* forest (family Nothofagaceae) at almost 2000 m above sea level.

Discussion

Small leaf insects are known mainly from the genera *Nanophyllium*, *Microphyllium* and *Chitoniscus*. Apart from *Ph. (Ph.) riedeli* n. sp., the only other species of the genus with females of a reported body length below 60 mm is *Ph. (Pu.) suzukii* with 57.3 mm (Größer 2008), while the females of most species achieve lengths between 70 and 100 mm. The fossil male of *Eophyllium messelensis* has a body length of 63.1 mm, which is comparable to the males of most extant *Phyllium* species. Given that *Eophyllium* is the assumed sister group of the extant leaf insects (Wedmann *et al.* 2007), it seems that the small body size has been acquired within the extant crown group of the Phylliidae.

The eggs of *Ph. riedeli* n. sp. are of remarkable size when compared to size of the female and relatively larger than e.g. those of *Ph. (Ph.) siccifolium* (Linnaeus, 1758) (length including operculum ca. 5 mm), whose females achieve a body length up to 98 mm (Größer 2008). The occurrence of a flat operculum and feather-like appendages is only known from the *siccifolium* species-group of the subgenus *Phyllium (Phyllium)*, which confirms the placement of *Ph. (Ph.) riedeli* n. sp. in this species-group. Eggs of the *celebicum* species-group exhibit a conically raised operculum and only short, moss-like appendages, while eggs of the subgenus *Pulchriphyllium* generally lack hairy structures (see Table 10 in Hennemann *et al.* 2009). A longitudinal median lamella and feather-like appendages on the dorsal surface and polar area are shared with other species of the *siccifolium* species-group, but the splitting of the lateral appendages into a distinct dorsal and polar part and the triangular shape of the latter are unique for *Ph. (Ph.) riedeli* n. sp.. While the ventral longitudinal median lamella and the appendages of the operculum are similar to the ones observed in other species, the hairs of the lateral appendages appear to be more

dense and numerous. The lateral surfaces of the egg are smoother than in all other eggs described for the *siccifolium* species-group with the exception of *Ph. (Ph.) caudatum* Redtenbacher, 1906.

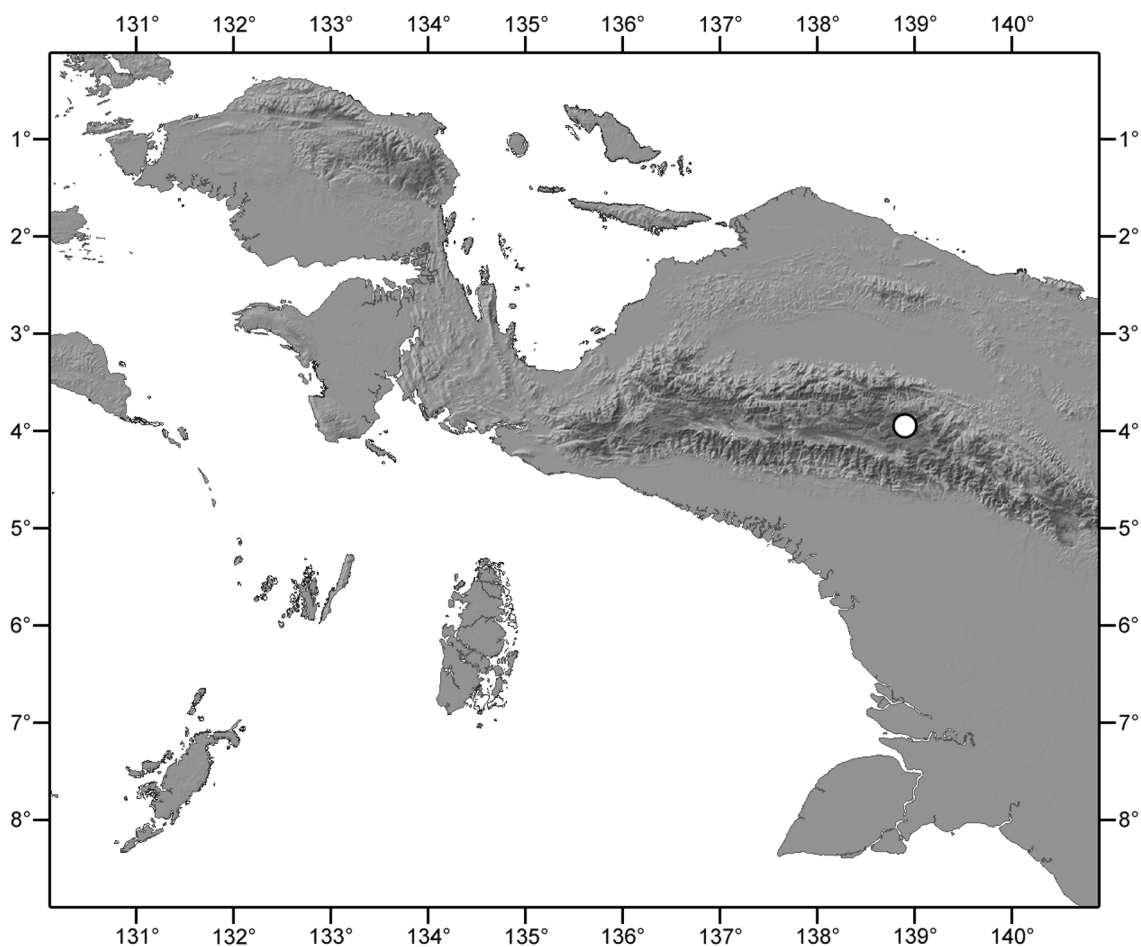
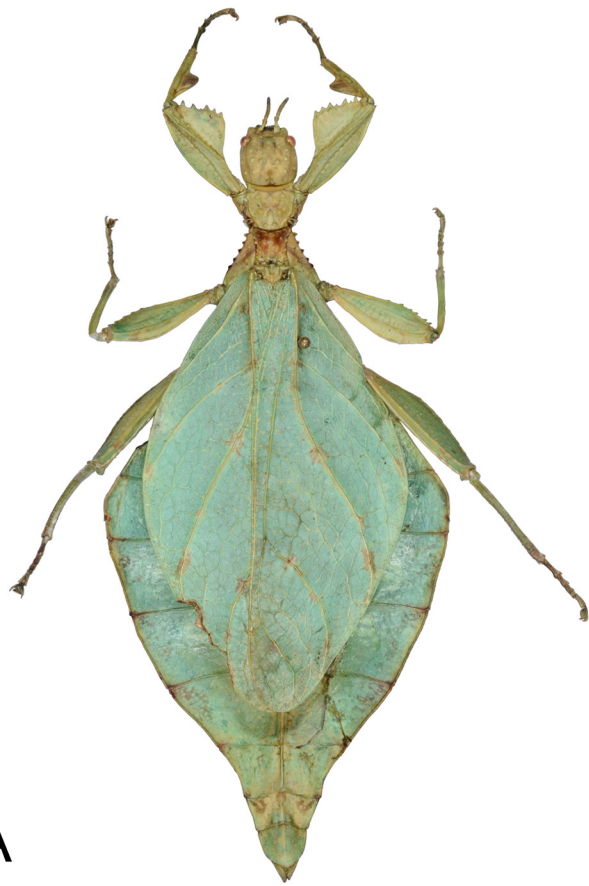


FIGURE 6. Type locality of *Phyllium (Ph.) riedeli* n. sp..

The leaf insects of New Guinea are still fractionally known and one new species, *Ph. (Ph.) telnovi* Brock, 2014 has just recently been described. Three species of *Phyllium (Phyllium)* Illiger, 1798 are currently only known from a single sex, i.e. *Ph. (Ph.) elegans* Gröber, 1991 and *Ph. (Ph.) riedeli* n. sp. only from ♀ and *Ph. (Ph.) telnovi* Brock, 2014 only from a single ♂. In addition to these, six species of the subgenus *Phyllium (Pulchriphyllium)* Griffini, 1898 are known from New Guinea, i.e. *Ph. (Pu.) asekiense* Gröber, 2002, *Ph. (Pu.) brevipenne* Gröber, 1992, *Ph. (Pu.) chitoniscoides* Gröber, 1992, *Ph. (Pu.) exsectum* Zompro, 2001, *Ph. (Pu.) frondosum* Redtenbacher, 1906, and *Ph. (Pu.) schultzei* Giglio-Tos, 1912 (Hennemann *et al.*, 2009: 80). Discovery of the yet unknown sexes of these species will be necessary for a more complete distinction and knowledge of their relationships. Furthermore, additional material from precise localities may help in defining the ranges and distributions of species on this very large island. The description of three new species of the subgenus from New Guinea within only 24 years makes the discovery of further still unknown species quite likely, especially if lesser prospected areas will be investigated in more detail in the future.

Below is a checklist of the five species of *Phyllium (Phyllium)* Illiger, 1798 currently known to occur in New Guinea:

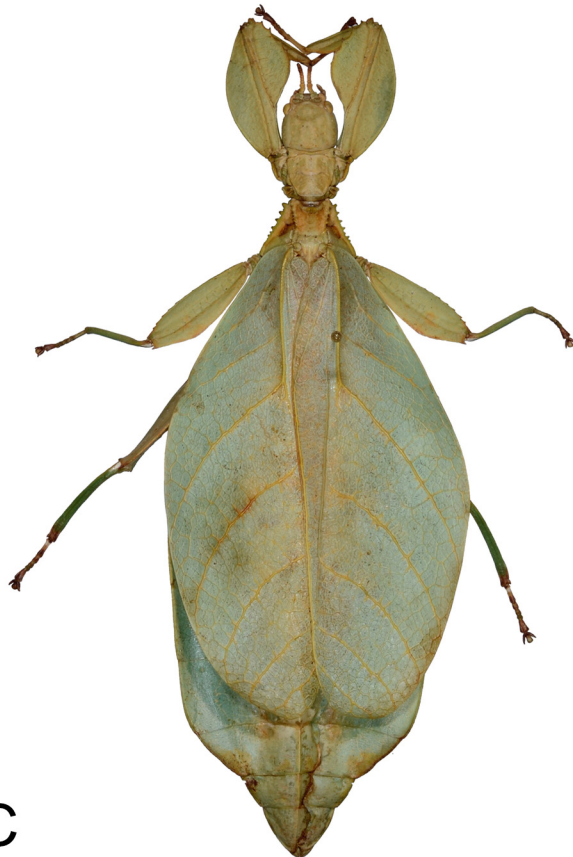
1. *Phyllium (Phyllium) caudatum* Redtenbacher, 1906: 177.
2. *Phyllium (Phyllium) elegans* Gröber, 1991: 279, figs 1 (♀) and 2 (egg).
3. *Phyllium (Phyllium) riedeli* n. sp.
4. *Phyllium (Phyllium) telnovi* Brock, 2014: 146, plates 2–3 (♂).
5. *Phyllium (Phyllium) zomproi* Gröber, 2001: 101, figs 129–132 (♀, ♂ nymph and egg).



A



B



C



D

FIGURE 7. **A:** *Phyllium (Ph.) caudatum* Redtenbacher, 1906 ♀ 77.0 mm (coll. FH, No. 0076-1); **B:** *Phyllium (Ph.) elegans* Gröber, 1991 ♀ holotype 81.2 mm (ZSMC); **C:** *Phyllium (Ph.) zomproi* Gröber, 2001 ♀ 85.5 mm (coll. FH, No. 0380-1); **D:** *Phyllium (Ph.) siccifolium* (Linnaeus, 1758) ♀ 95.0 mm (coll. FH, No. 0567-4).

Keys to the species of *Phyllium* (*Phyllium*) of New Guinea

♀

1. Body length > 75 mm 2
- Very small, body length < 60 mm (Figs 1–4) *riedeli* n. sp.
2. Abdomen broad, either angular in outline or ± lobed 3
- Abdomen slender, segments V–X more or less gradually tapered (Fig. 7A) *caudatum*
3. Abdominal segments VII–VIII ± lobed; prosternum with a spiniform process; exterior lobe of profemora narrower than interior lobe (Fig. 7B) *elegans*
- Abdominal segments VII–VIII not lobed; no spiniform process on prosternum; exterior lobe of profemora ± equal in width to interior lobe (Fig. 7C) *zomproi*

♂*

1. Abdomen broad, <2x longer than head and thorax combined 2
- Abdomen very elongate and slender, >2x longer than head and thorax combined and segments V–X gradually tapered *caudatum*
2. Exterior lobe of profemora rounded and almost as wide as interior lobe; interior lobe with 5–6 small, roughly equally sized teeth *zomproi*
- Exterior lobe of profemora very slender and much narrower than interior lobe; interior lobe with two large and three small intervening teeth *telnovi*

* The ♂ of *Ph. (Ph.) zomproi* is only known from a subadult nymph, which was illustrated by Größer, 2001: 104, fig. 132 and Größer, 2008: 146, fig. 181. The key features here used are however most likely also true for the adult insect, which is seen by comparison of adults and immature specimens of other species in the genus.

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References

- Brock, P.D. (2014) A new species of leaf insect (Phasmida: Phylliidae) from West Papua, Indonesia. In: Telnov [Ed.], *Biodiversity, Biogeography and Nature Conservation in Wallacea and New Guinea. Vol. II.* pp. 145–147. [pl. 2–3]
- Brock, P.D. & Hasenpusch, J. (2003) Studies on the leaf insects (Phylliidae) of Australia. *Journal of Orthoptera Research*, 11 (2), 199–205.
[http://dx.doi.org/10.1665/1082-6467\(2002\)011\[0199:SOTLIP\]2.0.CO;2](http://dx.doi.org/10.1665/1082-6467(2002)011[0199:SOTLIP]2.0.CO;2)
- Clark, J.T. (1978) The eggs of leaf insects (Insecta: Phasmida). *Zoological Journal of the Linnean Society*, 63, 249–258.
<http://dx.doi.org/10.1111/j.1096-3642.1978.tb02562.x>
- Clark-Sellick, J.T. (1997) Descriptive terminology of the phasmid egg capsule, with an extended key to the phasmid genera based on egg structure. *Systematic Entomology*, 22, 97–122.
<http://dx.doi.org/10.1046/j.1365-3113.1997.d01-30.x>
- Friedemann, K., Wipfler, B., Bradler, S. & Beutel, R.G. (2011) On the head morphology of *Phyllium* and the phylogenetic relationships of Phasmatodea (Insecta). *Acta Zoologica*, 93 (2), 184–199.
<http://dx.doi.org/10.1111/j.1463-6395.2010.00497.x>
- Größer, D. (1991) Bemerkungen zur Gattung *Phyllium* in Neuguinea, mit einer Neubeschreibung (Phasmatodea: Phylliidae). *Entomologische Zeitschrift*, 101 (15), 278–282.
- Größer, D. (2001) *Wandelnde Blätter. Ein Katalog aller bisher beschriebenen Phylliinae-Arten und deren Eier mit drei Neubeschreibungen.* Edition Chimaira, Frankfurt am Main, 119 pp.
- Größer, D. (2008) *Wandelnde Blätter. Ein Katalog aller bisher beschriebenen Phylliinae-Arten und deren Eier mit drei Neubeschreibungen.* 2nd Edition. Edition Chimaira, Frankfurt am Main, 175 pp.
- Hausleithner, B. (1984) Eier der Gattung *Phyllium* (Phasmatoptera: Phylliidae). Ein Beitrag zur Systematik der „Wandelnden Blätter“. *Entomologische Zeitschrift*, 94 (17), 241–245.
- Hennemann, F.H., Conle, O.V., Gottardo, M. & Bresseel, J. (2009) On certain species of the genus *Phyllium* Illiger, 1798, with proposals for an intra-generic systematization and the descriptions of five new species from the Philippines and Palawan (Phasmatodea: Phylliidae: Phylliinae: Phylliini). *Zootaxa*, 2322, 1–83.
- Klante, H. (1976) Die „Wandelnden Blätter“. Eine taxonomische Revision der Gattung *Phyllium* Ill. (Insecta, Orthoptera,

- Phasmatoptera). *Zoologische Beiträge*, 22, 49–76.
- Redtenbacher, J. (1906) *Die Insektenfamilie der Phasmiden. I. Phasmidae, Areolatae*. Verlag W. Engelmann, Leipzig, pp. 180. [pl. 1–6]
- Viscuso, R. & Longo, G. (1983) The egg of leaf insect *Phyllium pulchrifolium* Serv. (Phasmatodea: Phyllidae): morphology and ultrastructure. *Archives de Biologie*, 94 (4), 441–457.
- Wedmann, S., Bradler, S. & Rus, J. (2007) The first fossil leaf insect: 47 million years of specialized cryptic morphology and behavior. *Proceedings of the National Academy of Sciences of the United States of America*, 104 (2), 565–569. <http://dx.doi.org/10.1073/pnas.0606937104>
- Zompro, O. & Größer, D. (2003) A generic revision of the insect order Phasmatodea: The genera of the areolate stick insect family Phylliidae (Walking Leaves) (Insecta, Orthoptera). *Spixiana*, 26 (2), 129–141.