

Faunitaxys

*Revue de Faunistique, Taxonomie et Systématique
morphologique et moléculaire*



Volume 8
Numéro 6

Mars 2020

ISSN: 2269 - 6016
Dépôt légal : Mars 2020

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*Revue de Faunistique, Taxonomie et Systématique
morphologique et moléculaire*

ZooBank : <http://zoobank.org/79A36B2E-F645-4F9A-AE2B-ED32CE6771CC>

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La parution de *Faunitaxys* est apériodique

Imprimée sur les presses de SPEED COPIE
6, rue Tréfilerie, F- 42100 Saint-Etienne

Imprimé le 11 mars 2020

On the *Phyllium* Illiger, 1798 of Palawan (Philippines), with description of a new species (Phasmida: Phylliidae)

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Keywords:

Phasmatodea ; Southeast Asia ;
Phasmida ; Philippines ;
Phylliidae ; *saltonae* ;
Phylliini ; *siccifolium* ;
Phyllium ; Taxonomy ;
leaf insect ; description ;
Palawan ; new species.

Abstract. – Prompted by the discovery of an undescribed species of *Phyllium* Illiger, 1798 from within the Natural History Museum, London, United Kingdom collection, the Phylliidae (Leaf Insects) of Palawan, Philippines are here reviewed. The new species *Phyllium* (*Phyllium*) *saltonae* Cumming, Baker, Le Tirant, & Marshall **n. sp.** is currently only known from female and egg specimens and represents the third species of leaf insect on the island. Taxonomically this new species belongs to the *siccifolium* species group of *Phyllium* (*Phyllium*) as per Hennemann, et al., 2009. To conclude, a key to species of Palawan is included and all species are illustrated.

Cumming R. T., Baker E., Le Tirant S. & Marshall J. A., 2020. – On the *Phyllium* Illiger, 1798 of Palawan (Philippines), with description of a new species (Phasmida: Phylliidae). *Faunitaxys*, 8(6) : 1 – 9.

ZooBank : <http://zoobank.org/83C2C984-B464-4FFD-8220-7883A4EE7BC4>

Introduction

The Phylliidae Brunner von Wattenwyl consists of 83 valid species in five genera (Brock, Büscher, & Baker, 2019). These enigmatic members of the Phasmida known as ‘walking leaves’ or ‘leaf insects’ are currently distributed from southern mainland China through southeast Asia, and south to Australia and Fiji. The Phylliidae are placed subordinately among the Euphasmatodea within the Old World clade Oriophasmata based upon recent phylogenomic analyses (Simon et al., 2019). A calibration of time based on several phasmid fossils also suggest a soft upper bound for time of divergence of the Phylliidae at approximately 66 million years ago during the Paleogene as calibrated by a 47 million year old fossil leaf insect *Eophyllium messelense* Wedmann, et al., 2007.

The Palawan archipelago lies between northern Borneo and the island of Mindoro and separates the Sulu Sea from the South China Sea. Interestingly enough, the first written account of leaf insects was from Palawan in 1521 by the Venetian scholar Antonio Pigafetta who joined Ferdinand Magellan on his circumnavigation of the world. While the fleet hauled ashore for repairs, Pigafetta chronicled the fauna of the islands and recorded the following passage about *Phyllium* (Bergreen, 2003).

“In this island are also found certain trees, the leaves of which, when they fall, are animated, and walk. They are like the leaves of the mulberry tree, but not so long; they have the leaf stalk short and pointed, and near the leaf stalk they have on each side two feet. If they are touched they escape, but if crushed they do not give out blood. I kept one for nine days in a box. When I opened it the leaf went round the box. I believe they live upon air.” (Pigafetta: translated in Alderley, 1874).

It would not be for another 480 years that *Phyllium* would again be recorded and noted in literature from Palawan with the first species described from the island with the toponym name of *Phyllium palawanense* Grösser, 2001.

Palawan is biogeographically part of the Sundaic region, on the continental shelf of southeast Asia (exposed during the Quaternary glaciation), and the insect fauna is closely related to that of Borneo (e.g. Vane-Wright, 1990). Two of the three *Phyllium* species on Palawan illustrate this close biogeographic relationship as their morphological sister species can be found on Borneo. *Phyllium gantungense* Hennemann, et al., 2009 is sister species to *Phyllium arthurchungi* Seow-Choen, 2016, and *Phyllium cummingi* Seow-Choen, 2017, both currently only known from Northern Borneo. And *Phyllium palawanense* Grösser, 2001 is sister species to *Phyllium chenqiae* Seow-Choen, 2017 from Northern Borneo.

Comparatively, *Phyllium saltonae* **n. sp.** appears to be more morphologically related to known species of *Phyllium* from the Philippines such as *Phyllium philippinicum* Hennemann, et al., 2009, *Phyllium mindorensis* Hennemann, et al., 2009, and *Phyllium mabantai* Bresseel, et al., 2009, than it does to any known Bornean species.

Materials and Methods

Photographs of the holotype *Phyllium* (*Phyllium*) *saltonae* **n. sp.** were taken by Ed Baker, using a Canon EOS 5DR and Canon 100 mm Macro Lens mounted on a StackShot image system controlled by Helicon Remote. Images were combined in Helicon Focus. All

type material is deposited in the Natural History Museum, London, United Kingdom (NHMUK).

Photographs of the other species illustrated were taken by Royce Cumming in the San Diego Natural History Museum, California, United States using a Canon 5D Mark II and a MP-E 65 mm macro lens and stacked using Zerene photo stacking software, version 1.04, 64-bit. Measurements of type material were taken using digital calipers to the nearest 0.1 mm. Egg orientation terminology follows that of Clark (1978).

Taxonomy

Subgenus *Phyllium* (*Phyllium*) Illiger, 1798

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

Phyllium (*Phyllium*) *gantungense* Hennemann, Conle, Gottardo, & Bresseel, 2009

urn:lsid:Phasmida.speciesfile.org:TaxonName:7056

(Figs. 1A-C, 2A-C, 3A-D, 4A-D, 5B, 6A, 8A, 8D, 9A, 10A)

Discussion. – *Phyllium gantungense* is easily the most common leaf insect species found on Palawan, and has recently entered the phasmid breeding community as a relatively easy to care for species (Fig. 1A-C courtesy of Bruno Kneubühler).

This species is remarkable for its extreme variation observed within females, with abdominal shape ranging from nearly perfectly smooth (Fig. 2A) to intricately lobed (Fig. 2C). As noted by Hennemann, et al., (2009) and Cumming (2017) the abdominal shape (ranging from

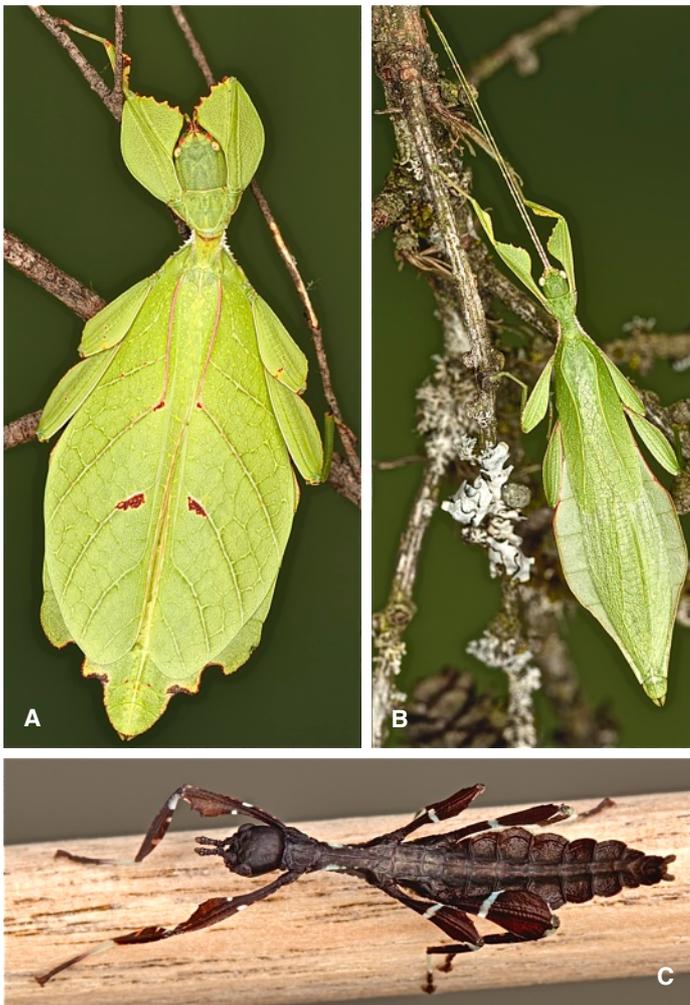


Fig. 1. *Phyllium gantungense* dorsal view, live captive bred individuals, photos courtesy of Bruno Kneubühler. – A: Female. – B: Male. – C: Newly hatched nymph.

smooth to strongly lobed) directly corresponds to the size of the profemoral interior lobe teeth (small serrate teeth to large triangular teeth, Fig. 3A-D). When viewed in a large set, these variations fall within a continuous series, not in discrete forms. In contrast to the variable female morphology, the male morphology is relatively stable with males lacking abdominal variation, with all observed males rather similar (Fig. 4A-D).

Phyllium arthurchungi Seow-Choen, 2016 and *Phyllium cummingi* Seow-Choen, 2017 from Northern Borneo are the sister species to *Phyllium gantungense*. Their shared ancestry is evident by their nearly identical egg morphology and very similar adult morphology. The only morphological feature to easily separate females of *Ph. gantungense* and *Ph. arthurchungi* from each other is the ventral color of their coxae, with *Ph. gantungense* having distinct black markings (Fig. 5B) compared with *Ph. arthurchungi* which lacks these black marking and instead has an orange to red coloration (Fig. 5A).

Body lengths: ♀ 76.4–90.2 mm, ♂ 57.0–61.8 mm (Hennemann, et al., 2009).

Phyllium (*Phyllium*) *palawanense* Grösser, 2001

urn:lsid:Phasmida.speciesfile.org:TaxonName:7112

(Figs. 3E-F, 6B, 7A-D, 8B, 8E, 9B, 10B)

Discussion. – A rare species, only known from a handful of records since its description in 2001. Based on review of photos and specimens exported from Palawan over the last few years, *Phyllium palawanense* has only been observed less than 6% of the time, with all other specimens belonging to the morphologically variable *Phyllium gantungense*.

The adult male *Phyllium palawanense* is not yet described, however a subadult from the Royce Cumming private collection is the first record of a male for this species. Morphologically, the males share the unique mesopraescutum structure (with nodes throughout the surface, not just along the sagittal plane) with the females of this species, a feature which is rather unique among the Phylliidae (female Fig. 6B, subadult male Fig. 7B). This subadult male also exhibits a spade shaped abdomen (Fig. 7A), a clear shared morphology between the female and male.

The only collection records of *Phyllium palawanense* are from “Port Berton, Roxas, Matalangao, 200–350 m.” (paratype female in the collection of Oliver Zompro, Grösser, 2001), a female from the Stephane Le Tirant private collection from “San Vicente, Palawan”, and from “Brooke's Point Municipality, Mt. Mantalingajan” (Royce Cumming private collection). Localities respectively from the far north and south of the island, suggesting a likely distribution throughout. Hopefully future collections on the island reveal the distribution of this species with more clarity, as well as reveal the adult male morphology.

Body lengths: ♀ 74.2–82.8 mm; subadult male 45.0 mm (RC Coll 16-253).

Phyllium (*Phyllium*) *saltonae* Cumming, Baker, Le Tirant & Marshall n. sp.

urn:lsid:Phasmida.speciesfile.org:TaxonName:507800

(Figs. 3G, 3H, 6C, 8C, 8F, 9C, 10C, 11A-D)

ZooBank : <http://zoobank.org/017F0D8F-6DC6-4171-B6CC-524FB85B97F1>

Holotype, ♀. – PHILIPPINES, Palawan, Balabec Islands, 2 V 1997. [NHMUK 013802808].

Paratypes [2 ♀, 7 eggs]

– 1 ♀: “Bred England Essex, Died 9 III 1999, A. J. E. Harman”. ♀ *Phyllium* cf. *siccifolium*. “F1 generation, Originally Philippines Palawan Island. Collected V 1997”. [NHMUK 013802809].

– 1 ♀: “Ex Philippines Palawan Island, Bred from ovum”. “Bred England Essex, Hockley, 27/XII/1998, A. J. E. Harman.” A. Harman, M. Salton Coll. [NHMUK 013802810].

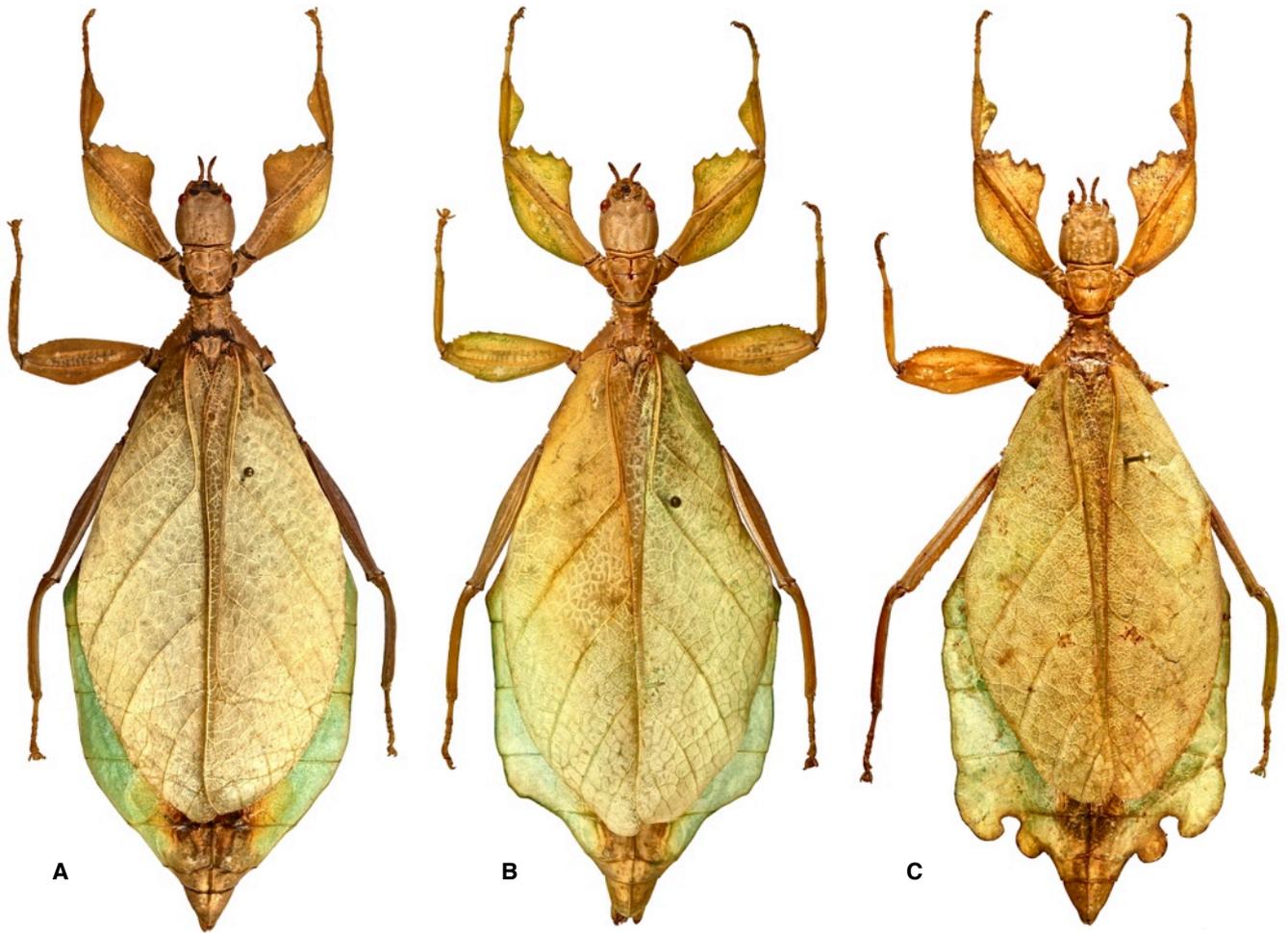


Fig. 2. *Phyllium gantungense* females, dorsal view, weakest abdominal lobes to most pronounced (left to right).
 – A: *Phyllium gantungense* Coll RC. – B: *Phyllium gantungense* Coll RC. – C: *Phyllium gantungense* Coll RC 17-169.

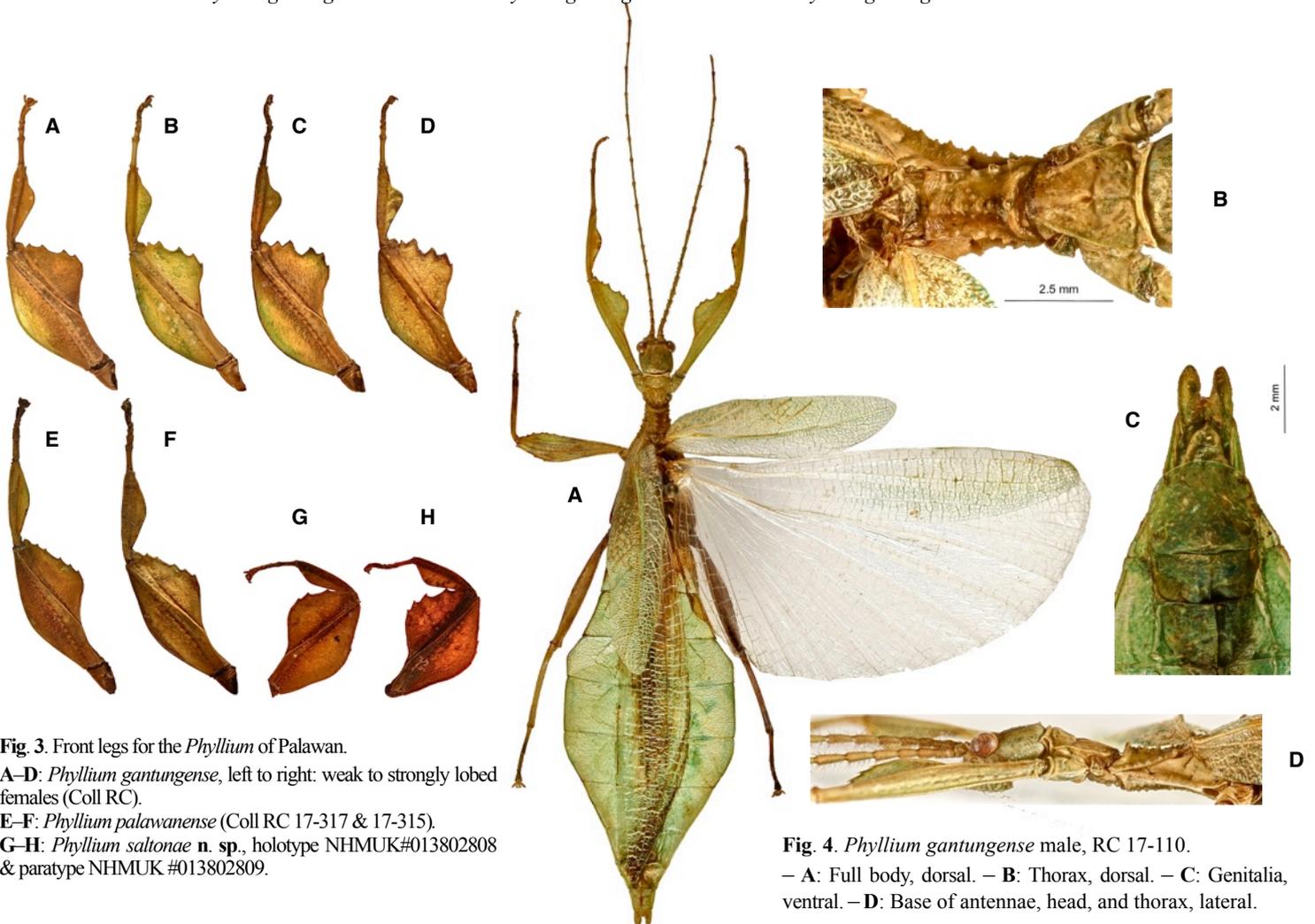


Fig. 3. Front legs for the *Phyllium* of Palawan.
 A–D: *Phyllium gantungense*, left to right: weak to strongly lobed females (Coll RC).
 E–F: *Phyllium palawanense* (Coll RC 17-317 & 17-315).
 G–H: *Phyllium saltonae* n. sp., holotype NHMUK#013802808 & paratype NHMUK #013802809.

Fig. 4. *Phyllium gantungense* male, RC 17-110.
 – A: Full body, dorsal. – B: Thorax, dorsal. – C: Genitalia, ventral. – D: Base of antennae, head, and thorax, lateral.

– Egg, retained in ovipositor of holotype: PHILIPPINES, Palawan, Balabec Islands, 2 V 1997. [NHMUK 013802817].

– Eggs: “Eggs of *Phyllium* cf. *siccifolium*, Ex Philippines, Palawan, V 1997, Ex E. Gowing-Scopes”. A. Harman, M. Salton Coll. [NHMUK 013802811–16].

Discussion. – This undescribed species was located during a review of the Phylliidae collection within the Natural History Museum United Kingdom in January, 2019 by the first author. Most notably, the egg morphology helped to identify the unique nature of this species. Allan Harman received the now holotype ♀ plus eggs from a dealer (as detailed in a note placed with the specimen), and from these eggs reared the two paratype specimens, retaining all material for eventual donation to the NHMUK as an unidentified *Phyllium* species. Knowledge of the egg structure, as detailed below, was essential for recognition of this new species as the females are not at first review overly unique and might have been overlooked initially.

While reviewing the *siccifolium* species group we attempted to identify apomorphic features of *Phyllium saltonae* n. sp. and the other species group members. Unfortunately, with this species group rather large (presently with twenty eight species, Brock, Büscher, & Baker, 2019) and not subdivided based on a robust phylogeny we were unable to locate apomorphic features. Instead we present a differentiation section below which discusses in depth the three most likely sister species based on morphology in order to attempt to place this new species systematically. Upcoming molecular based phylogenies will help to bring clarity to the *siccifolium* species group and allow us to give a clearer systematic context to this species and clade members. Unfortunately, until then we are restricted to placing this new species within the *siccifolium* species group and identifying possible sister species based on a combination of morphological features but not upon single morphological feature.

Differentiation. – The female *Phyllium saltonae* n. sp. is most morphologically similar to *Phyllium philippinicum* Hennemann, et al., 2009, *Phyllium mindorense* Hennemann, et al., 2009, and *Phyllium mabantai* Bresseel, et al., 2009. Each species is discussed below independently to help place this new species taxonomically.

Phyllium philippinicum shares several similarities with *Phyllium saltonae* n. sp. such as antennae with ten antennomeres, a similar abdominal shape in more broadly lobed *Phyllium saltonae* n. sp., and an adult size range which is very similar with *Phyllium philippinicum* ranging from 77.5–88.0 mm and *Phyllium saltonae* n. sp. from 74.5–88.2 mm. There are several consistent features which allow differentiation of these two species. One feature to differentiate *Phyllium philippinicum* from *Phyllium saltonae* n. sp. is the arrangement of teeth on the profemoral interior lobe, with *Phyllium saltonae* n. sp. having a larger looping gap between the middle teeth versus *Phyllium philippinicum* which has small teeth uniformly spaced throughout the profemoral interior lobe. Also, there are only 25–29 teeth on the pars stridens of antennomere III in *Phyllium saltonae* n. sp. versus *Phyllium philippinicum* which has 40 teeth on the pars stridens of antennomere III. One additional feature which allows for differentiation is the length and spination of the mesopleurae on the thorax. *Phyllium saltonae* n. sp. has mesopleurae which are longer, reaching to the anterior rim of the mesopraescutum and with a lateral margin which is more granular throughout the length, lacking prominent well defined tubercles. *Phyllium philippinicum* comparatively has mesopleurae which are shorter, with the anterior margin not reaching the anterior rim of the mesopraescutum, and lateral margins with distinct tubercles not surrounded by small granulation.

Phyllium mindorense, is also morphologically very similar in regards to abdominal shape, adult size, shape of the femoral lobes, and the anterior mesopraescutum rim which lacks a prominent spine in the center. An easy feature to differentiate these two species are the antennae which are different both in number of teeth on the pars stridens and number of total antennae segments with *Phyllium saltonae* n. sp. having 25–29 teeth on

the pars stridens and ten antennal segments, and *Phyllium mindorense* with 34 teeth on the pars stridens and nine antennomeres. One additional feature which allows for differentiation is the length of the mesopleurae, with the mesopleurae longer, reaching to the anterior rim of the mesopraescutum in *Phyllium saltonae* n. sp., versus not reaching the anterior rim of the mesopraescutum in *Phyllium mindorense*.

With *Phyllium mabantai* being a rather variable species in abdominal shape and profemoral lobe form, there are many features of certain forms which are paralleled closely between the two species. Of particular similarity are the pro-, meso-, and metafemoral lobes and their corresponding serration. Both species also have a similar number of teeth on the pars stridens of antennomere III, with 25–29 teeth in *Phyllium saltonae* n. sp. and 23–27 teeth in *Phyllium mabantai*. The only reliable feature which can be used to differentiate females of these two species is the number of antennomeres, as *Phyllium saltonae* n. sp. has ten antennomeres but *Phyllium mabantai* only has nine antennomeres.

Morphologically, the easiest to differentiate are the eggs of *Phyllium saltonae* n. sp. as the combination of a lateral surface with irregular “bald” impressions and long feather-like pinnae surrounding the entire capsule are a unique combination. “Bald” lateral impressions are a feature seen in several other species, such as the common *Phyllium hausleithneri* Brock, 1999 from West Malaysia and other closely related species, however, these species eggs lack long feather-like pinnae surrounding the entire capsule, generally only having these long pinnae on the dorsal, anterior, and posterior surfaces, not also present on the ventral surface.

The only other species which also have the combination of lateral surfaces with irregular “bald” impressions and long feather-like pinnae surrounding the entire capsule are *Phyllium mindorense* and *Phyllium palawanense*. From both species, *Phyllium saltonae* n. sp. can immediately be differentiated by the operculum which is raised above the anterior margin of the capsule (Fig. 8C), versus the other two which have the operculum lower which allows the long feather-like pinnae of the lateral margins to line up uniformly with those on the operculum pinnae (Fig. 8B). The lateral “bald” impressions also help to differentiate the three species, as *Phyllium saltonae* n. sp. is the only one which does not have clear lateral arrangements of these “bald” impressions which are clearly seen in *Phyllium mindorense* and *Phyllium palawanense* (Fig. 8B), instead *Phyllium saltonae* n. sp. has the “bald” impressions irregular, in no detectable pattern (Fig. 8C).

Morphological description of the female.

Coloration. – Currently only the three females from the type material have been observed, all of which are discolored with only slight hints of green still present. This species is likely a vibrant green in life.

Head. – *Capsule* slightly longer than wide, *vertex* nearly smooth, with only slight texture and few granules throughout the surface smaller than the prominent posteriomedial tubercle which is the most prominent feature on the vertex. Frontal convexity stout, notably shorter than the length of the first antennomere, and with a moderate number of clear setae throughout the surface. – *Antennae* consisting of ten segments, with the terminal segment approximately the same length, as the preceding three segments combined (Fig. 9C). Antennomeres I–VII with few transparent setae, and the terminal three antennomeres with finer and more numerous setae uniformly covering their surface. Antennal segment III pars stridens with 25–29 teeth. – *Compound eyes* not strongly protruding from the head capsule. – *Ocelli* absent. Antennal fields not significantly wider than the first antennomere and not protruding back farther than the frontal suture.

Thorax. – *Pronotum* with anterior margin which is slightly concave, and lateral margins that are slightly convex and converge to a straight posterior margin that is about half the width of the anterior rim (Fig. 6C). The pronotum surface lacks nodes but instead has a lumpy surface texture. The surface has a prominent pit in the center, and a prominent furrow across the anterior rim, and two parallel furrows posterior of the central pit running to the posterior rim. The pronotum has a moderate anterior rim, lateral rims which are moderately rimmed, and the posterior which lacks a rim. – *Pro- and mesosternum* with slight granulation evenly throughout the surface. – *Metasternum* somewhat variable, can be nearly smooth with only slight granulation, or can have a



Fig. 5. Adult female ventral showing coxae color. – **A:** *Phyllium arthurchungi* Seow-Choen, 2017, photo credit Albert Kang, taken January, 2018 in Tawau Hills Park, Borneo. – **B:** *Phyllium gantungense* Hennemann, et al., 2009, photo credit Tim Van molle.

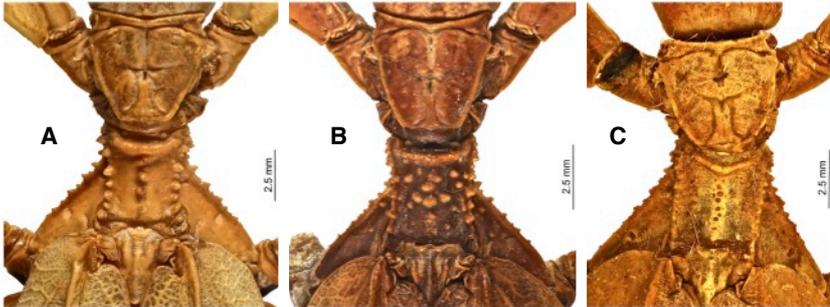


Fig. 6. *Phyllium* female, thorax, dorsal view. – **A:** *Phyllium gantungense* RC 17-324. – **B:** *Phyllium palawanense* RC 17-317. – **C:** *Phyllium saltanae* n. sp. holotype NHMUK #013802808.

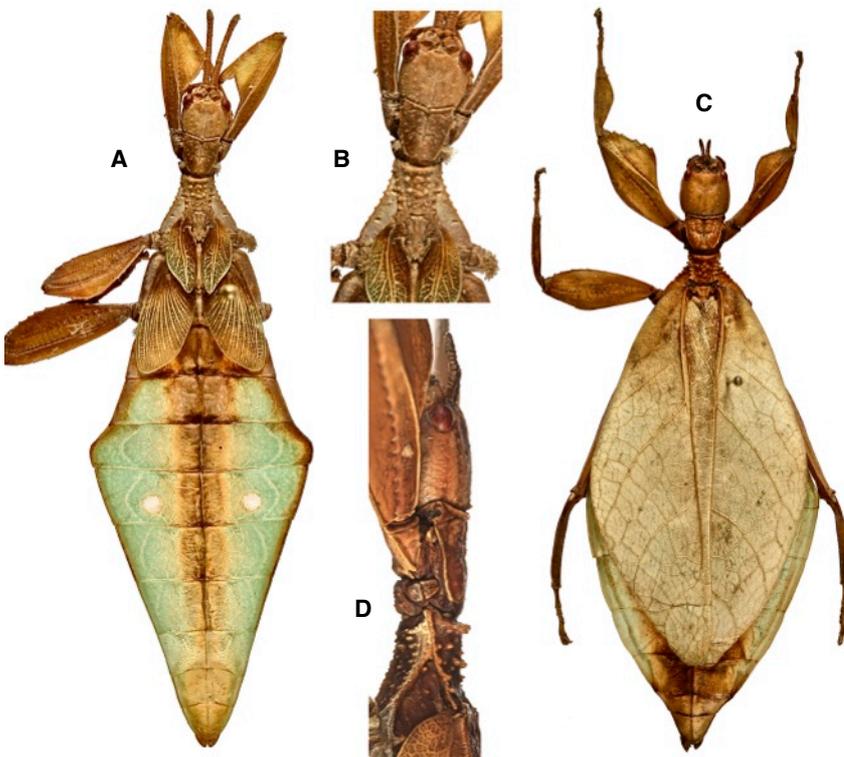


Fig. 7. *Phyllium palawanense* dorsal view. – **A:** Subadult male, Coll RC 16-253. – **B:** Subadult male thorax detail, Coll RC 16-253. – **C:** Female, Coll RC 17-315. – **D:** Female, lateral view of thorax, Coll RC 17-317.

granulation very similar to that found on the pro- and mesosternum. – *Mesopraescutum* longer than wide, with lateral rims with ten to twelve small nodes of uniform size, spread evenly throughout the length. Mesopraescutum anterior rim prominent but without a large medial tubercle and the remainder of the rim without clear nodes but slightly lumpy, not smooth (Fig. 11D). Mesopraescutum crest along the sagittal plane (excluding the anterior rim) slightly raised, not prominent, with five to seven small nodes unevenly spaced and the remainder of the surface relatively smooth (Fig. 6C). – *Mesopleurae* starting nearly at the anterior edge with straight sides and evenly diverging; lateral margin with ten to twelve granular nodes which are variable in size (Fig. 6C). Face of the mesopleurae lacking nodes and folds, but with two faint divots, one on the posterior third and one nearly on the anterior margin. – *Tegmina* long, reaching the anterior margin of abdominal segment VIII.

Alae. – Rudimentary, only 8–9 mm in length.

Abdomen. – Abdominal segments II through the anterior two thirds of IV diverging uniformly, posterior third of IV through VI parallel or slightly subparallel in the more slender forms. Segments VI through X converging with each segment slightly rounded, creating a gentle undulating margin. Terminal abdominal segment slightly wider than long with a broad rounded apex. – *Subgenital plate* long and slender, starting at the anterior margin of segment VIII and extending halfway to two thirds the way into segment X, ending in a fine point. – *Gonapophyses* long and slender, reaching the posterior margin of the terminal abdominal segment X (Fig. 10C). – *Cerci* relatively gently cupped, with a surface which is notably granular and an apex which is strongly pointed.

Legs. – *Profemoral exterior lobe* arcing from end to end with only a slight bend in the center, not strongly angled, exterior lobe slightly wider than the interior lobe. Distal half of the profemoral exterior lobe with one to three small rounded teeth, remainder lacking distinct teeth. – *Profemoral interior lobe* gently obtuse angled and marked with four to five teeth which can be dulled or weakly serrate. The proximal most teeth are closest together with the remaining teeth widely spaced with a gap at least twice that of the proximal gap. – *Mesofemoral interior lobe* arcs from end to end and has three to five serrate teeth distributed on the distal half only. Interior and exterior lobes are of a similar width and similarly angled with the thickest portion slightly off center towards the distal end. Mesofemoral exterior lobe with one to two small serrate teeth on the distal third of the arc. – *Metafemoral interior lobe* wider than exterior lobe, and arcs end to end and has seven to eight rounded serrate teeth pointing distally. – *Metafemoral exterior lobe* is thin and smooth, hugging the metafemoral shaft, lacks teeth. Protibiae lacking an exterior lobe. – *Protibial interior lobe* spans the entire length in a rounded scalene triangle with the thickest portion on the distal half and a width about twice the width of the protibiae shaft itself. – *Mesotibiae and metatibiae* simple, lacking exterior and interior lobes. Measurements of holotype and female paratype series given in table 1.

Description of Egg (Figs. 8C & 8F).

Of moderate size for the genus with prominent feather-like pinnae on all margins of the capsule and encircling the operculum cap. General shape of capsule ovular when viewed laterally and rectangular when viewed from the dorsal surface. Lateral surfaces are flat and parallel to each other. Lateral surfaces with numerous irregular shaped networks of bald impressions, the spaces in between appearing as a network of short moss-like pinnae. Lateral longitudinal feather-like pinnae which surround the entire egg varying little in length, with those on the anterior and posterior margins only slightly longer than those on the lateral margins. Micropylar plate ovular and uniform in shape, not teardrop shaped like in most *Phyllium* species, plate about half as wide as tall and covering the central half of the length of dorsal egg surface. Micropylar cup moderate in size and slightly displaced towards the posterior; entire micropylar plate with a hairy textured margin. Dorsal surface around the micropylar plate covered in radiating short simple pinnae. Ventral surface with the short, simple pinnae

similar to those on the dorsal surface surrounding the micropylar plate, but the ventral surface also has a sagittal row of feather-like pinnae primarily running along the posterior half of the capsule. Operculum circular and flat, with short, simple pinnae and with the outer margin set with a row of the same long feather-like pinnae seen along the longitudinal lateral margins of the egg-capsule. General colour tan, the impressions on the lateral egg surfaces slightly lighter in color.

Measurements including the feather-like pinnae [mm]:

- lateral length (including operculum) 5.6
- lateral length (excluding operculum) 4.8
- width of dorsal surface 2.4
- width of lateral surface 4.4
- length of micropylar plate 2.3

Etymology. – This new species is a patronym dedicated to Mary Salton, in gratitude for 40 years of assistance to Allan Harman and to many years of service to the Phasmid Study Group (PSG: <http://phasmidstudygroup.org>).

Biogeography of Palawan

The projected arrival of the Palawan Microcontinental Plate near northern Borneo and the Philippines was during the Late Miocene (~10 Ma) as it moved south from Eurasia (Hall, 1998). As Palawan approached Borneo and the Philippines, it created a route for the sharing of organisms between the two regions. This bridge has been coined Huxley's Filter Zone as it was first noted by well-known biogeographers Thomas Huxley in 1868 with his observations primarily based on birds and mammal distributions of the region and its relation to Wallacea (Huxley, 1868; Esselstyn et al., 2010). Esselstyn et al., 2010 notes that Palawan and the surrounding islands contain a mix of lineages from both Borneo and the oceanic

Philippines and depending on what authors you ask and what model organism you are reviewing the ratio of their origins vary.

In relation to the phylliid diversity of Palawan, it is likely that we are only observing a limited view of the diversity and we would not be surprised if several more species still remain to be discovered. Presently, the diversity we are aware of illustrate a mixed phylliid origin, with two of the three known species with sister species from Northern Borneo. The sister species to *Phyllium saltonae* n. sp. based on our current knowledge of species likely originated in the Philippines (Fig. 13). Morphologically, we believe that the most likely sister species to *Phyllium saltonae* n. sp. to be *Phyllium mindorensis* from Mindoro island, largely based on egg morphology similarity. With all species of phylliid resembling dicot leaves beautifully and looking very similar in many regards, it is difficult to ascertain what features are derived from a common ancestor and what are simply homoplasies from the selective pressure to look like leaves as adults. Instead, we emphasize the significance of molecular analyses and egg morphology to help elucidate the evolutionary history of these cryptic creatures. Eggs, because they are devoid of the predation pressure to masquerade as leaves, when observed across a wide range of species, have a diverse variety of morphological features. The diverse egg morphology frequently allows species differentiation and easy separation into subgenera and species groups. Presently, the first large-scale analysis of molecular evidence within the Phylliidae is underway. Hopefully this will reveal additional evidence to allow identification of sister species which in turn will allow better biogeographic review of the Huxley Filter Zone.

Acknowledgments

The authors thank Allan Harman (United Kingdom) for his forethought in preserving the specimens and eggs of this unique species once they died so that now they can be studied and formally described. Thank you to Bruno Kneubühler (Switzerland) and

Feature	HT-NHMUK - 013802808	PT-NHMUK-013802809	PT-NHMUK-013802810
Length of body*	74.5	82.7	88.2
Length/greatest width of head	6.7 / 5.9	7.1 / 6.5	8.1 / 6.2
Pronotum	4.8	5.7	5.5
Mesonotum	5.8	6.9	7.4
Length of tegmina	46.2	51.6	50.5
Length of alae **	–	–	8 - 9
Greatest width of abdomen	30.5	31.7	33.3
Profemora	14.6	17.0	16.5
Mesofemora	12.8	14.8	16.6
Metafemora	16.2	19.1	19.8
Protibiae	9.4	11.3	10.5
Mesotibiae	9.2	10.2	10.3
Metatibiae	12.1	14.5	14.4
Antennae	4.7	4.2	4.0

Table 1. Measurements of *Phyllium* (*Phyllium*) *saltonae* n. sp., holotype and paratype females. All measurements made to the nearest 0.1 mm.

* Including cerci and head, excluding antennae.

** Only measured on paratype specimen NHMUK 013802810.

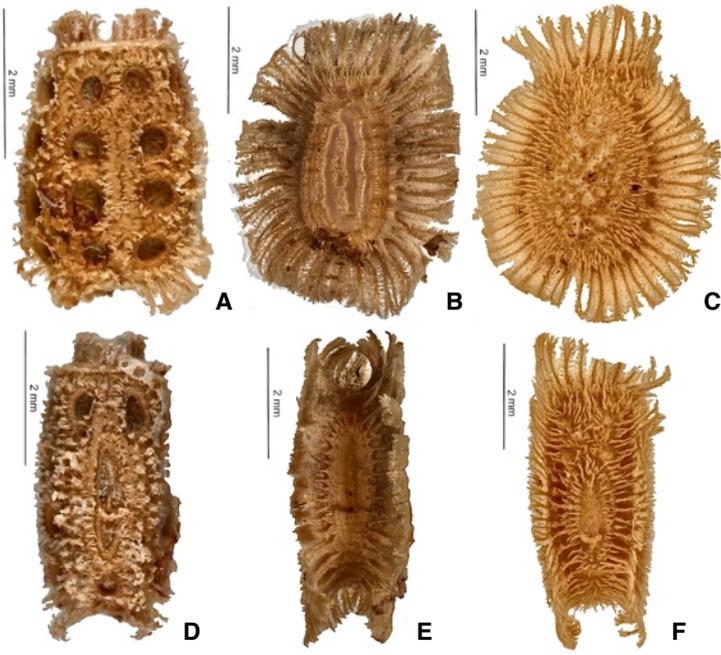


Fig. 8. *Phyllium* of Palawan eggs. – A-C: lateral view, micropylar plate to the right. – D-F: micropylar plate view. – A & D: *Phyllium gantungense*. – B & E: *Phyllium palawanense* (RC Coll 18-032). – C & F: *Phyllium saltonae* n. sp. paratype NHMUK #01380811.

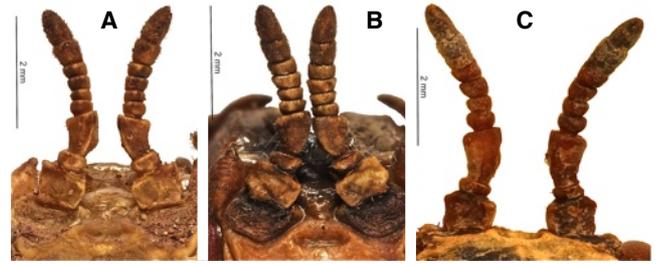


Fig. 9. *Phyllium* female, antennae, dorsal view. – A: *Phyllium gantungense* RC 17-169. – B: *Phyllium palawanense* RC 17-315. – C: *Phyllium saltonae* n. sp. paratype NHMUK #013802809.

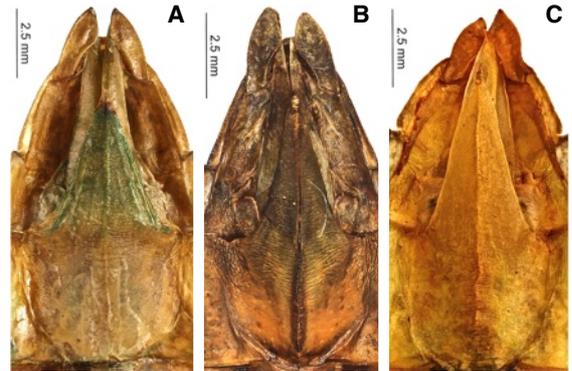


Fig. 10. *Phyllium* female, genitalia, ventral view. – A: *Phyllium gantungense* RC 17-324. – B: *Phyllium palawanense* RC 17-315. – C: *Phyllium saltonae* n. sp. paratype NHMUK #013802809.

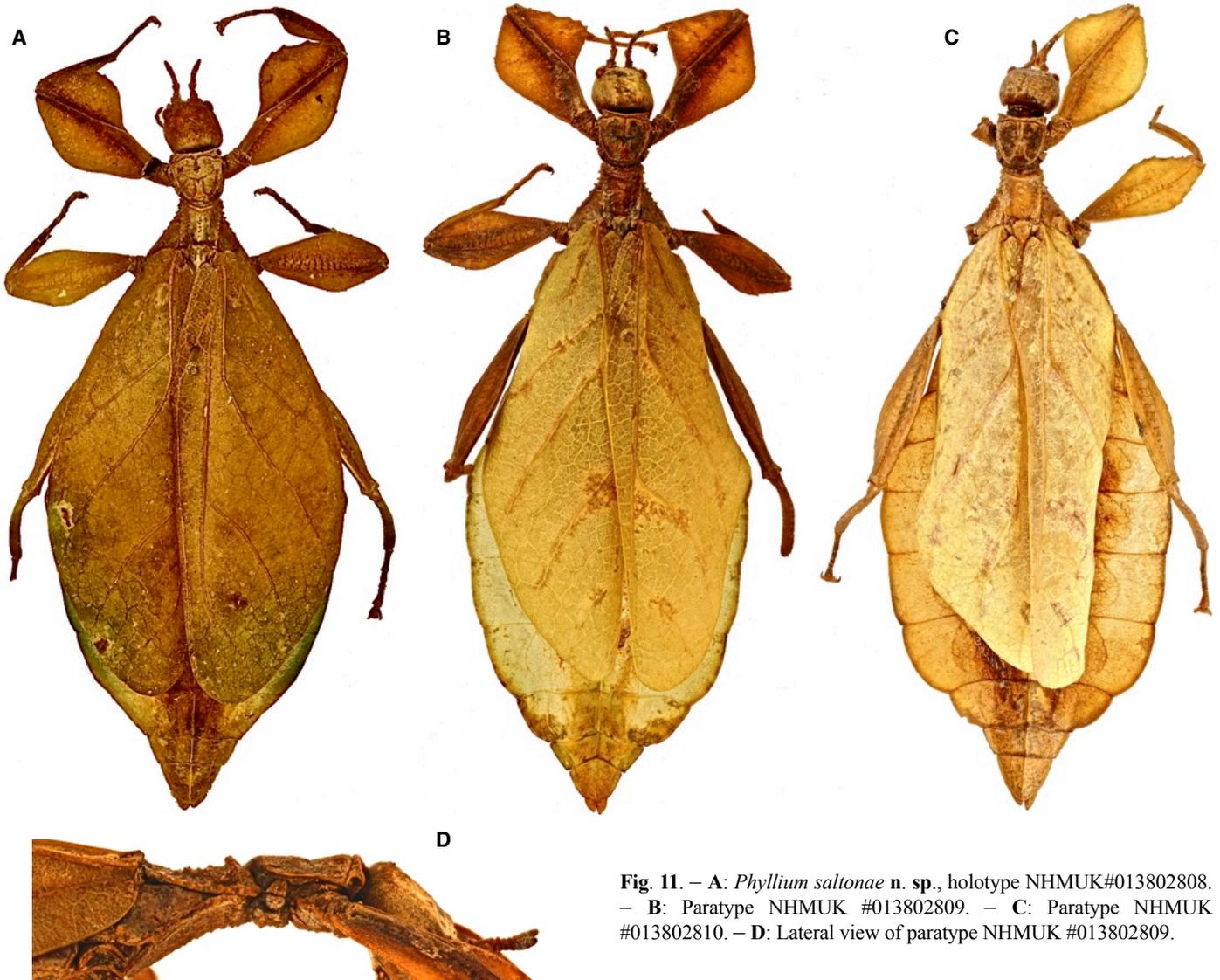


Fig. 11. – A: *Phyllium saltonae* n. sp., holotype NHMUK#013802808. – B: Paratype NHMUK #013802809. – C: Paratype NHMUK #013802810. – D: Lateral view of paratype NHMUK #013802809.

Key to known species of *Phyllium* from Palawan, Philippines

Keys are broken into female and egg morphology. With adult male *Phyllium palawanense* and male *Phyllium saltonae* n. sp. currently unknown, a key to males is not yet possible.

Female

1. Meso- and metacoxae with distinct black marking on ventral surface (Fig. 5B) *Ph. gantungense* Hennemann et al., 2009
- Meso- and metacoxae without distinct black marking on ventral surface (Fig. 5A) 2
2. Mesopraescutum without distinct crest along sagittal plane, nodes spread without detectable pattern throughout surface (Fig. 6B); antennae with nine segments (Fig. 9B); pars stridens of antennomere III with 34–36 teeth *Ph. palawanense* Grösser, 2001
- Mesopraescutum with distinct crest along sagittal plane, nodes running along the sagittal plane only (Fig. 6C); antennae with ten segments (Fig. 9C); pars stridens of antennomere III with 25–29 teeth *Ph. saltonae* n. sp.

Egg

1. Capsule lateral surface with eight large circular impressions (arranged in a two by four pattern) (Fig. 8A); longitudinal margins of the capsule lacking long feather-like pinnae *Ph. gantungense* Hennemann et al., 2009
- Capsule lateral surface without eight large circular impressions, surface instead with shallow smooth excavations throughout the surface (Fig. 8B & 8C); longitudinal margins of the capsule with distinct feather-like pinnae (Fig. 8B & 8C) 2
2. Lateral surface with longitudinal smooth impressions (Fig. 8B); pinnae of the lateral margins the same length as those on the operculum, creating a uniform, seamless appearance between the capsule and the operculum (Fig. 8B); pinnae of the operculum only on the lateral margins, not fully encircling the operculum (Fig. 8E) *Ph. palawanense* Grösser, 2001
- Lateral surface with irregular, spotty, smooth impressions (Fig. 8C); pinnae of the lateral margin shorter than the pinnae on the operculum, giving the operculum a distinct raised appearance (Fig. 8C); pinnae of the operculum encircling the entire operculum rim (Fig. 8F) *Ph. saltonae* n. sp.

Tim Van molle (Belgium) for allowing us to use photos of the live *Phyllium gantungense*. Albert Kang (Malaysia) for allowing us to use photos of the live *Phyllium arthurchungi* female in the wild. Thank you to Jim Berrian (San Diego Natural History Museum, San Diego) for years of support and access to the museum's camera. To conclude we thank our two peer reviewers who gave us valuable feedback and suggestions on how best to improve this text, thank you Thies Büscher (Germany) and Francis Seow-Choen (Singapore).

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Fig. 12. River in the forest of Palawan, Philippines.

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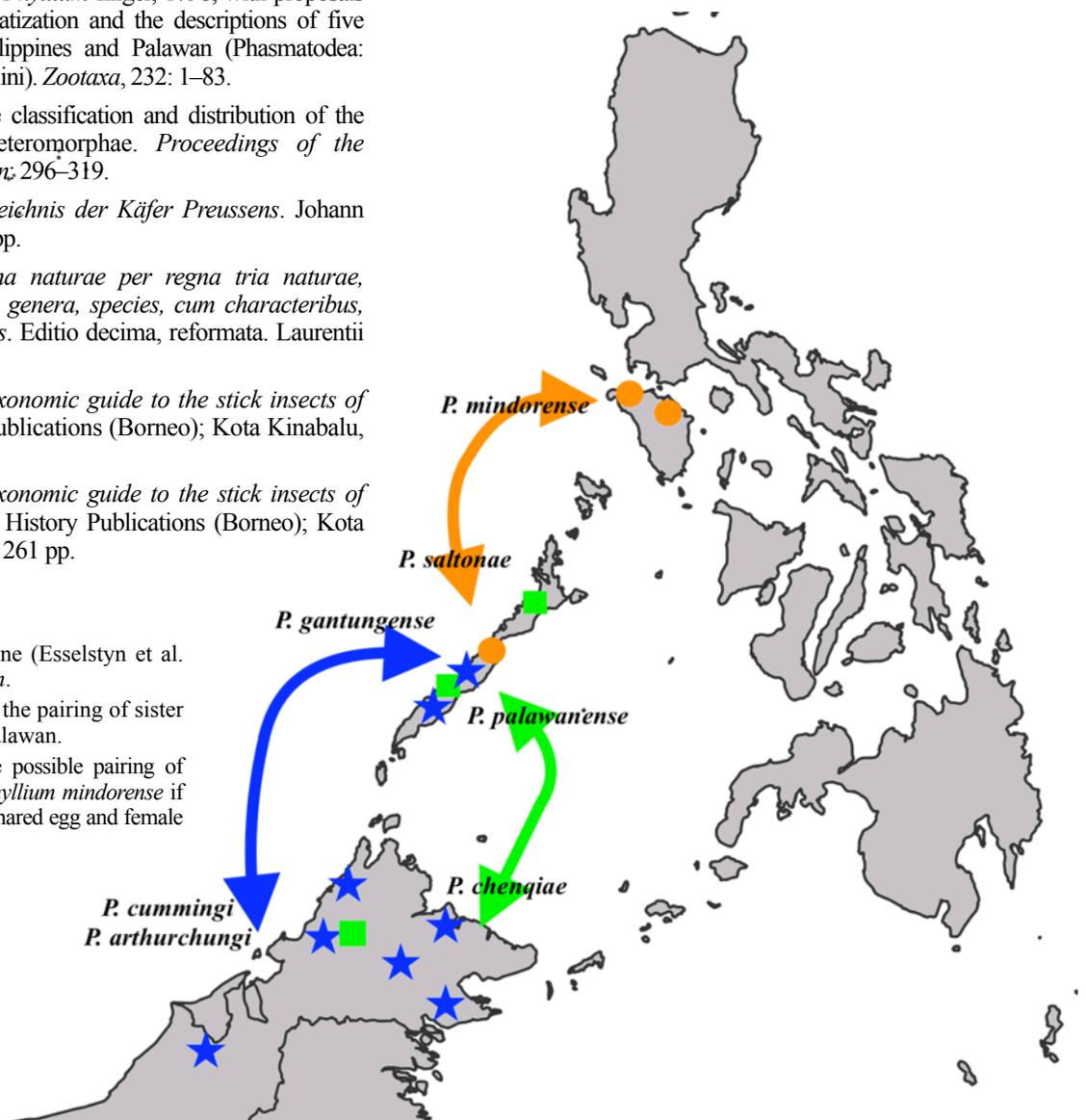


Fig. 13. The Huxley Filter Zone (Esselstyn et al. 2010) as illustrated by *Phyllium*.
 – Blue and Green arrows show the pairing of sister species between Borneo and Palawan.
 – The Orange arrow shows the possible pairing of *Phyllium saltonae* n. sp. with *Phyllium mindorense* if the two are sister species as the shared egg and female morphology suggest.

Résumé

Cumming R. T., Baker E., Le Tirant S. & Marshall J. A., 2020. – Etude des *Phyllium* Illiger, 1798 de Palawan (Philippines), avec la description d'une nouvelle espèce (Phasmida: Phylliidae). *Faunitaxys*, 8(6) : 1 – 9.

Suite à la découverte d'un *Phyllium* Illiger, 1798, non décrit au sein de la collection du Museum d'Histoire naturelle de Londres (Royaume-Uni), les Phylliidae (insectes feuilles) de Palawan (Philippines) sont ici passés en revue. La nouvelle espèce *Phyllium* (*Phyllium*) *saltonae* Cumming, Baker, Le Tirant et Marshall n. sp. n'est actuellement connue que de spécimens femelles et d'oeufs, et représente la troisième espèce de l'île. Elle appartient au groupe d'espèces *siccifolium* de *Phyllium* (*Phyllium*) selon Hennemann et al., 2009. Pour conclure, une clé pour les espèces de Palawan est incluse et toutes les espèces sont illustrées.

Mots-clés. – Phasmatoidea, Phasmida, Phylliidae, Phylliini, *Phyllium*, insecte feuille, Palawan, Asie du Sud-Est, Philippines, *saltonae*, *siccifolium*, taxonomie, description, espèce nouvelle.

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SOMMAIRE

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Illustration de la couverture : River crossing in the forest of Palawan, Philippines (Local Photographer).

Crédits:

Bruno Kneubühler : 1

Royce Cumming : 2, 3A-F, 4, 6A-B, 7, 8A-B, 8D-E, 9A-B, 10A-B

Ed Baker : 3G-H, 6C, 8C, 8F, 9C, 10C, 11

Tim Van molle : 5B

Albert Kang : 5A

Mari Felipe (Philippines) : 12 & couverture.