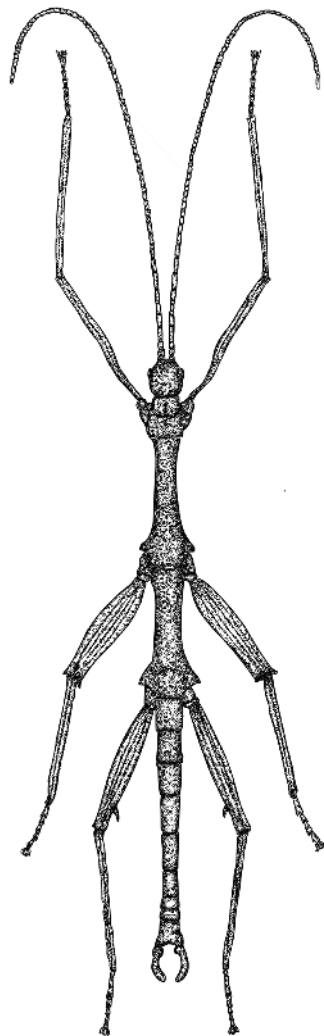


# PHASMID STUDIES

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# Observations on phasmid populations in Southeast Queensland, Australia following drought and subsequent rain events in the summer of 2019/2020

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## Abstract

The effects of prolonged drought followed by significant rainfall on localised populations of phasmids is discussed through evaluation of observations made prior to and during the drought period, then subsequently, during and after rain events in mid-January to mid-February 2020.

## Key words

Phasmid, stick insect, drought, fire, conservation, climate change, rain, flood, Southeast Queensland, threatened species, survival, rainforest, Gondwana world heritage area.

## Introduction

I have been observing phasmids in the Southeast Queensland region surrounding Brisbane since the summer of 2014. The population size of some species fluctuates, sometimes dramatically, while others seem to remain stable. By observing stick insects in several key locations and different habitat types over many years, I have been able to gain some insight into the impacts of long-term weather patterns on them. In doing so, I have documented which species can maintain good population densities during apparent adverse conditions and observed those which may struggle and subsequently, or in some cases not, successfully recover. Generally, the region experiences a marked summer season from November through March and cooler temperatures with much lower humidity during the other months



Figure 1. Mating pair of *Acrophylla titan* in shaded, riparian habitat on *Backhousia myrtifolia* a common foodplant for many species. This image shows the amazing camouflage that even huge specimens have during the day. 4 Jan. 2020



of the year. See 'Notes on the climate of Southeast Queensland' for more information. Breeding cycles are no doubt influenced by climatic conditions and vegetation (resource) availability and suitability. Individual insects that survive to adulthood may be reacting to subtle climatic cues that are not obvious to humans, and these may be triggers or inhibitors for breeding. Eggs can also succumb to overly dry or wet conditions. A significant number of hatching failures in a localised area could see populations severely impacted for years.

The extreme climatic conditions that the region has experienced in the summer season of 2019/20 offers an insight into phasmids' responses to prolonged drought, temperature fluctuations and heavy rainfall. I will present some recent phasmid observations from this season and draw some comparisons to previous years' efforts. I'll also add some thoughts and discussion on the possible future state and stability of certain species which may be affected by climate change and altered fire regimes in years to come. Some of these may be listed as species of concern by the IUCN or perhaps even as-yet, undescribed and therefore unassessed, (Brock, P.D. et, al., 2019). To my knowledge, there have been no studies undertaken on the possible effects of climate change on phasmid populations, locally, or internationally. As macroinvertebrates dependent on healthy, plentiful vegetation and stable, suitable climatic conditions, members of the Phasmida can be viewed as useful bio-indicators of ecological health. They also provide an engaging focal point for general studies on wildlife and the environment. People of all ages find phasmids fascinating and they can be an exciting and accessible way to engage children in natural history, possibly leading to increased awareness of broader environmental issues in future generations.



Figure 2. A lateral view of the same pair of *Acrophylla titan*. 5 Jan. 2020

### Notes on the climate of Southeast Queensland

Southeast Queensland, surrounding the state capital Brisbane, has a subtropical climate which experiences occasional extremes of heat, humidity, cold weather, fire, flood and drought. Broadly speaking, the temperature and humidity will rise throughout the months of September and October and will begin to decrease around March and April. Mid to late summer, around late December, through to mid-March, is generally considered the best time to observe insects. Storms and low-pressure systems throughout this time can temporarily increase humidity levels above normal. This will often initiate

emergence events for some insects, initiate breeding among others or perhaps accelerate feeding and growth. December 2019 was the driest December on record for Australia. This followed on from a prolonged period of hot, dry weather with below-average rainfall in the previous summer of 2018/2019, continuing into the subsequent cooler months of 2019 (Australian Government, Bureau of Meteorology 2020). There is a wealth of climatic data online with which one can see a trend of heating and drying within the past six years. This may be a naturally occurring long-term weather cycle, one which native flora and fauna has adapted to deal with over millennia. It may also have been exacerbated by human-induced climate change, something which may threaten the long-term stability and survival of ecosystems. Fire is an integral part of many Australian landforms and ecosystems. Some species of plants and trees depend on it for long-term survival and there are also species of animals which benefit either directly or indirectly (Queensland Government, 2013). However, mismanagement or poor understanding of fire and its effects can have detrimental consequences for the environment and humans alike. The role of fire and the recent, destructive bushfires seen across the country have brought these issues to the fore, socially and politically, having resulted in the deaths of hundreds of millions of animals such as kangaroos, koalas and the like (Thompson, A. 2020). Following the drought and fires, many areas on the east coast of Australia, including Southeast Queensland, experienced heavy rainfall. Some areas had more than 75% of their seasonal average, in the space of a few days, (Australian Government, Bureau of Meteorology 2020). This led to localised flooding, an explosion of plant life and rapid vegetation recovery.



Figure 3. Pair of *Anchirole austrotessulata*. From December 2015 when abundant numbers were found. Twenty on a single tree was common. There are at least five individuals in this photo. 13 Dec. 2015

## Methods

During the Austral summer months, November through March, I regularly undertake nocturnal trips to search for phasmids at approximately 20 locations within 150km of greater Brisbane. I try to search in as many different locations as possible given time constraints, while also revisiting local sites more frequently, to closely monitor known, nearby populations as control groups. I find this gives a good balance of being able to discover new species, establish and expand known population centres and provides opportunities to observe infrequent behaviour in locally found specimens, such as moult-



ing and breeding. At well-known local sites, it is easier to monitor population density fluctuations, be it due to climatic conditions or direct human interference through land management practices. The habitats most frequently explored are both wet and dry sclerophyll forests, subtropical rainforests and cool-temperate rainforest. Local areas closer to home may consist more of disturbed or secondary-growth areas bordering on larger patches of state forest or national park land. My usual approach to locating specimens is simply to walk slowly with a powerful headtorch, scanning low vegetation and concentrating somewhat on known foodplants with good connectivity to larger trees. Also, smaller bushes with mature, overhanging canopies (usually *Eucalyptus* species) can be productive, especially after stormy weather, as individuals can be knocked down from the trees to a lower refuge, where they will generally stay if there is suitable browse available.



Figure 4. Adult females of *Extatosoma tiaratum* (bottom left) and *Acrophylla titan* (top right) found adjacent in a *Backhousia myrtifolia*. Also present were *Eurycnema goliath* and *Anchiale austrotessulata*. 24 Dec. 2017

### Observations in the 2019/2020 summer season and comparisons to previous years

At beginning of November 2019, I began to search local areas for some of the usual species one would expect to find. At this time of year, under normal conditions, there are usually some juvenile *Anchiale austrotessulata* to be found on favoured foodplants. Approximately 5-10 individuals on a medium-sized bush or small tree would not be uncommon. Favoured foodplants for this species include bottle brushes, *Callistemon* sp., myrtles, *Backhousia* sp. and wattles, *Acacia* sp. I have also observed adult individuals of larger species, such as *Acrophylla titan* and *Eurycnema goliath* around this time of year. Usually, found singly or occasionally, in the case of *E. goliath*, several individuals in proximity to each other. Six specimens of this species were found in a single Deep Yellow-wood tree, *Rhodosphaera rhodanthema* (Anacardiaceae). However, during this period of early November 2019, not a single specimen of any species was found. Other large invertebrates such as those in the Orthoptera, Coleoptera and Lepidoptera were also largely absent. In the last week of November 2019, a single female *Extatosoma tiaratum* was observed in the same, aforementioned *Rhodosphaera rhodanthema* tree. This find constituted the first phasmid seen during the 2019/20 summer season. A week later, the same individual was observed moulting and a sequence of photos was taken. The host tree was badly affected by the drought conditions in the coming weeks as temperatures rose, and no rain fell. This caused the

tree and many others to shed leaves and smaller, upper branches as a survival strategy. As such, available food and cover for the *E. tiaratum* individual disappeared and the insect was not seen again. Since the rain events in January/February, the tree has recovered somewhat. It is worth noting that *Rhodospaera rhodanthema* is not a well-known foodplant for phasmids, but I have found it particularly favoured by *E. tiaratum*. I have noted on many trees of this species that leaves have been tightly rolled by Lepidoptera caterpillars, but no other notable invertebrates seem to thrive on it.

Visits were made to Springbrook National Park when access was available. Some other national parks and/or areas within them were closed sporadically or permanently throughout the drought period due to high fire risk and remained so until mid-February 2020, when most were re-opened. Few specimens were found at Springbrook. Reliable rainforest-specialist species which are sometimes present in impressive numbers, such as *Candovia annulata*, *C. granulosa* and in drier areas, *A. austrotessulata*, were virtually absent. The exception being a single mating pair of *C. annulata* and a pair of juvenile *Candovia strumosa* with mites attached, found in somewhat unusual (for this species), dry, stony habitat. Other notable species from the area that have been found in previous years include *Ctenomorpha marginipennis*, *Onchestus gorgus*, *Extatosoma tiaratum* and others, (Brock & Coupland 2020, in press).

The next, sole individual I was able to find locally, under extremely dry conditions was an adult female *Acrophylla titan*. The individual was found at night amongst sparse vegetation on the bank of a dry creek. Returning a few days later in daylight, I found that a male had joined her. This was at the height of the drought period, approximately two weeks before any significant rain finally fell and despite searching, the individual/s were not found subsequently.

Heavy rain fell in the region commencing on the last week of January 2020 and continued sporadically for two weeks. Heavy falls were often throughout the night and as such, searching for insects was not practical, or possibly even safe if access to areas was affected by rising creek levels. After the rains, I recommenced nocturnal searches, in the hope that the fresh vegetation growth would stimulate the recovery of phasmid populations. Starting with local, well-known areas, to gauge invertebrate numbers, before heading further afield. I found a single pair of *A. austrotessulata* on 11 February. The in-



Figure 5. Two female *Eurycnema goliath* on a *Rhodospaera rhodanthema*. This tree had six individuals in close proximity and also *Acrophylla titan* and *Extatosoma tiaratum*. 8 Nov. 2018



dividuals were in close proximity on a Brisbane Golden Wattle (*Acacia fimbriata*, Fabaceae) bush, but not mating. Notably, the male had deformed wings, possibly due to extremely dry conditions when the individual hatched causing the wings to form incorrectly. No further phasmids were found in other local areas in the next two weeks.

On the night of 22 February, I revisited a local area and found a mating pair of an as-yet undescribed species in the genus *Pachymorpha*. I have found and photographed individuals of this species mating, as well as singly at the same site (measuring approximately only 3m by 1m) for three years in a row. It seems that this is a stable population, albeit within a very limited space. The specimens are always found on Fishbone fern (*Nephrolepis exaltata*, Nephrolepidaceae), a native plant species, regarded as an environmental weed. No other individuals of this or any other species were found in the larger area of the site, which has been very productive in previous years. *E. tiaratum* has been particularly well represented here in the past, found feeding on introduced Guava trees (*Psidium* sp., Myrtaceae) and native *Rhodosphaera rhodanthema*. At a nearby site, I was able to locate a single, sub-adult female *Didymuria violescens*. It was found on the same tree and exact branch I had found one last year at around the same time (+/- two weeks), a remarkable coincidence perhaps, given the variability of the prevailing conditions and the short lifespan of this species. The individual was the first member of the Tropidoderini tribe found in the season. Locally found species in this tribe include *D. violescens*, *Podacanthus viridiroseus* and *Tropidoderus childrenii*. These three species are all specialist *Eucalyptus* feeders and their appearance is very much like that of a *Eucalyptus* or 'gum tree' leaf. This makes them almost impossible to find at rest during the day, but at night, a subtle colour difference against browse in torchlight and general position among foliage make them stand out well. Their apparent lack of presence following drought conditions is almost certainly intrinsically linked to the stress and dieback of *Eucalyptus* trees and their foliage. Approximately 10 sub-adult and nymph *Anchiale austrotessulata* were also found at this site on various food plants including a large Cinnamon Myrtle (*Backhousia myrtifolia*, Myrtaceae) ('spice form' thereof) tree, a bottlebrush (*Callistemon* sp.) bush and a she-oak (*Casuarina* sp., Casuarinaceae) tree. In previous years at this time and site, I have found around three times this number of individuals.



Figure 6. A moulting, female *Extatosoma tiaratum*. The tracheae can clearly be seen, as they were just released. The tree the insect is on, is the same as that in Figure 5, but one year later. 4 Dec. 2019



## Discussions on climatic impacts to sensitive habitat areas and species

Southeast Queensland has some truly wonderful, biodiverse rainforest habitats in upland areas around the aptly named Scenic Rim region. At the highest elevations, these forests contain ancient, endemic Gondwanan remnants such as the Antarctic Beech tree, (*Nothofagus moorei*, Nothofagaceae), mountain frog species in the genus *Philoria* and the Albert's Lyrebird, *Menura alberti*, all of which are considered vulnerable or threatened, at either state (Queensland) or federal level. This is partly due to the large-scale destruction and fragmentation of their habitats over decades, but also since these unique habitats are particularly at risk from rising temperatures and reduced rainfall (Queensland Government 2020). These moist forests also act as a refuge to some remarkable, specialised phasmid species, some of which are only known from such areas. These include the spectacular *Onchestus gorgus*, which has been found with beautiful, moss-mimicking colouration at the highest elevations among moist, cloud forest. In the same habitat are members of the slow-moving, cryptic genus *Pachymorpha*, *Candovia robinsoni* and *C. granulosa*. In slightly lower altitudes within subtropical rainforest, are newly described individuals in the *Micropodacanthus* and *Parapodacanthus* genera and the also recently described, *Gibbernecrosia kooymani* which is the sole member of the genus (Brock & Coupland, 2020, in press). Due to the closure of many of the usual national park areas I would visit during the season, I was not able to observe or document any of these species during the 2019/2020 season. Notably, there were severe fires at Lamington National Park, very close to an area of rainforest where several of these species have been found in reasonable numbers and with some reliability in previous years. It has not been reliably reported as to the extent of the fire's encroachment on the wetter, rainforest vegetation and assessment is surely warranted. As such, how populations of these phasmid species and others have fared in sensitive rainforest areas since the drought, is yet to be reported.

At lower altitudes and around Brisbane, the predominantly dry eucalyptus-dominated forests have suffered greatly in the drought. It is widely believed that the number of dead or severely affected trees is well in the millions. Since heavy rain fell, epicormic shoots have been observed on trees that would appear otherwise dead. This is however not indicative of the long-term recovery and survival of the tree, as epicormic growth is a last resort to keep the tree alive. These shoots are usually short lived and



Figure 7. *Onchestus gorgus*, female, showing startle display. Rescued off a road on Springbrook mountain, Queensland. Populations of this species may require moist conditions to survive long-term. 6 May 2019



Figure 8. Usually a common, widespread species in the typically Australian tribe Tropidoderini a female *Podacanthus viridiroseus*. Individuals in genera within the Tropidoderini have been virtually absent in the usual locations this season. 2 Jan. 2019

not well structurally supported by the tree. Early epicormic growth is not ideal for phasmids as it does not offer much nutrition or cover, with individuals potentially being more exposed to predation and hot sun. As the shoots thicken and form small branches, they may become more suitable for supporting these large insects, but of course, they have to be present in the first place, to take advantage. The recovery of trees and foodplants on a larger scale will no doubt take many years, during which there will need to be sufficient seasonal rainfall to support regrowth and recovery. This all has a knock-on effect to ecosystems and the fauna contained within.

## Conclusions

There is clearly a strong correlation between challenging weather conditions and the densities of phasmid populations. Extended dry seasons compounded by high temperatures can cause mass dieback of trees in all habitat types. Flora and fauna are pushed to the limits of survival and may take many years to rebuild population density and genetic diversity. This would of course be dependent on the seasonal weather patterns returning to stable, agreeable conditions for several years in a row. The presence of a few individuals found over the season would suggest that although populations have clearly been impacted, some stick insects are able to persevere through hard times. No doubt, there are many insects which have found refuge high in the canopies of trees where food and cover has been sufficient, but the number of these individuals must surely have been reduced compared to previous years. Widespread thinning-out of canopy level vegetation would leave large, adult phasmids exposed to predatory birds such as Pacific Baza, Channel-billed Cuckoo and Pied Currawong. Stick insects can, however, possess highly adaptive survival mechanisms, such as having eggs which are attractive to ants. The capitulum on the egg is sensed as a source of nutrition and ants will transport them into underground, protective nests, where fire and drought will have little direct effect. The nymphs are then able to hatch and escape the nest unharmed when conditions suit. If there is some fresh vegetation on which nymphs



Figure 9. A *Pachymorpha* sp. n. female. This was found in altitudinal rainforest at Binna Burra, Lamington National Park. The area has since been closed to visitors following destructive bushfires in the area. Although it is unclear as to the extent of the fire on rainforest communities and species within, these areas would have certainly experienced unseasonably dry conditions in the past year. The discovery of two, undescribed *Pachymorpha* sp. at a local Brisbane site in late February 2020 may suggest resilience in this genus for dry weather. 5 Jan. 2019



can feed once above ground, they stand a chance of surviving. In wetter forests, eggs may be dispersed from the trees high above, onto a moist substrate, where they may be then somewhat buried by rain-drops or subsequent falling leaves. This will provide some protection and relatively stable humidity to aid development. As to the immediate effects of bushfires on phasmids, it would likely depend on the severity of the blaze and the supporting vegetation's ability to recover given the conditions following the fire. The correct timing of effective fire management is critical to support maximum biodiversity (Queensland Government 2013). If it is a low, slow burn, such as favoured by traditional peoples, there should be a good chance that tree-dwelling animals will survive, as the mid-level vegetation and crowns of trees would not be affected. Most species that are known to feed on 'eucalypt trees' would find refuge high in the foliage, where vegetation is thickest, and they can make best use of camouflage. In the case of severe, crown-scorching fires, it is likely that all forms of life will be affected and may take years or even decades to return. Although stick insects have been seemingly reduced in numbers this season, other invertebrates have flourished following the rain events. Moths and butterflies (Lepidoptera) have been particularly abundant, taking advantage of the rapid, new foliage growth. Large caterpillars of several species of the hawk moths (Sphingidae) have been observed in significant numbers and it is likely that these species will produce multiple generations this year, given the preferable conditions. Cicadas (Cicadoidea) have also been quite numerous, as have certain species of 'true' bug (Hemiptera). However, there has been a notable absence of katydids and crickets (Orthoptera) and beetles (Coleoptera), suggesting that some families of invertebrates with longer lifecycles may have 'held out' until conditions stabilise. This is comparable with the observations on phasmids, some species of which can delay hatching, such as *E. tiaratum*, which is known to prolong hatching up to 19 months (Brock & Hasenpusch 2009).

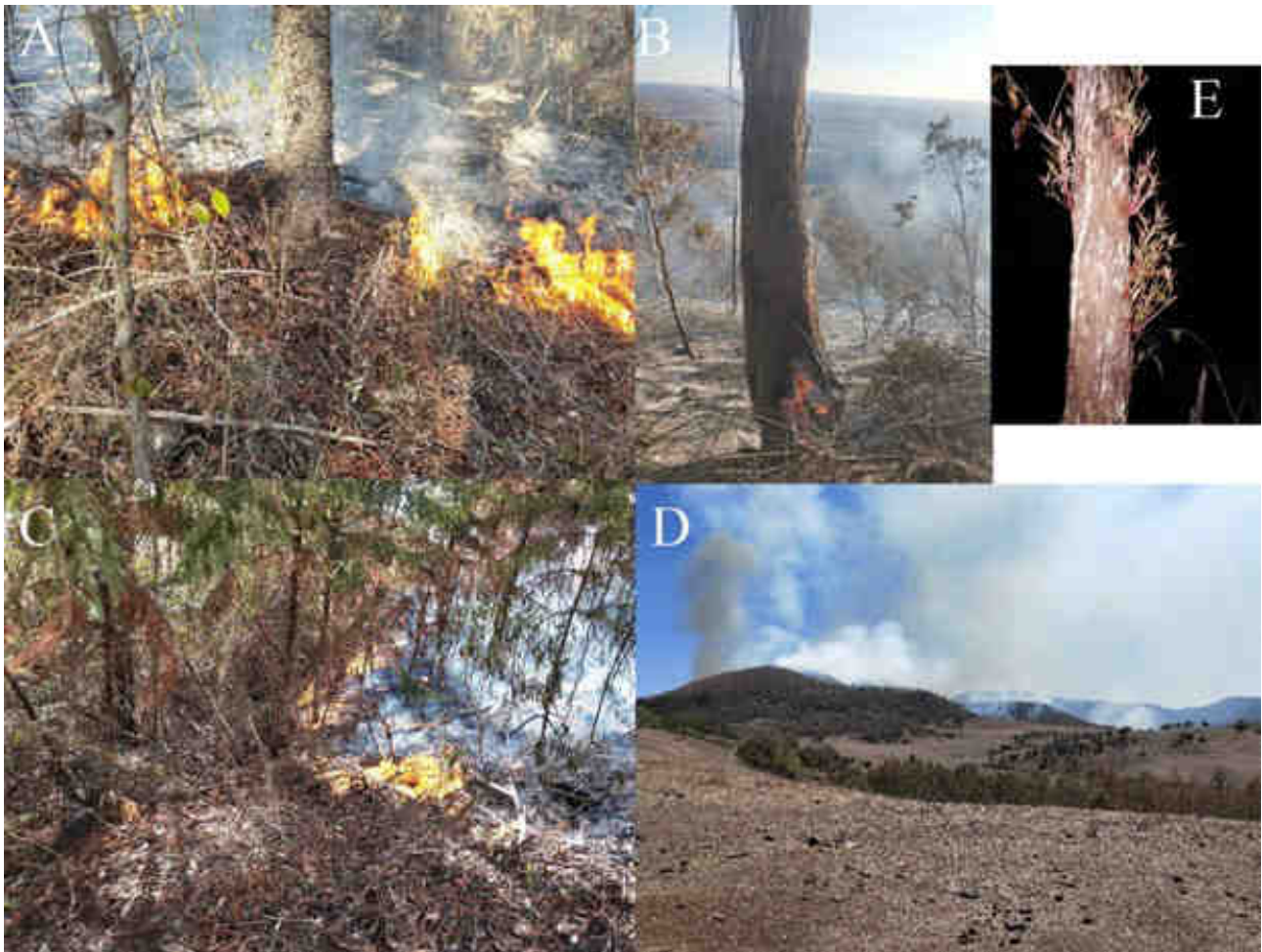


Figure 10. A photo collage showing the effects of bushfire. Image A is a slow-moving brush fire in dry grass and leaves. B shows a fire impacting the base of a mature tree with burnt ground behind. C is a fire impacting on Hoop Pine (*Araucaria cunninghamii*, Araucariaceae) saplings. D shows the huge areas surrounding Main Range National Park on fire. This fire burned for many weeks and destroyed much fragile and specialised habitat and vegetation. E shows epicormic shoot growth on a Brushbox (*Lophostemon* sp.) tree. Photos A, B, C, D by Kieran Aland.

It may be advisable to revise some of the IUCN statuses of Australian phasmid species in coming years, should a continuing trend of heating and drying occur. Those species which are confined to higher altitude, wetter forest would be forced to deal with unprecedented, drier conditions that may not support egg or nymph development, or preferred vegetation growth for browse and cover. Likewise, species found in drier eucalypt-dominated, fire-prone forests would certainly be adversely affected by more frequent fires of a severe nature, such as those seen throughout the past months.

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# Studying the phasmids of Springbrook Mountain, Binna Burra and surrounds, southeast Queensland

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## Abstract

Studies on phasmids of Springbrook National Park, Binna Burra, Lamington National Park and surrounding areas have revealed the presence of 19 confirmed species of stick insects, which are described and figured (including 3 further new species). Photographs and notes on all species are provided, in nature, and photographs of eggs, including previously unrecorded details, such as foodplants. A checklist includes reference to species most likely to occur, but yet be confirmed in this vast area.

## Key words

Phasmida, new species, *Acrophylla cookorum* sp. n., *Pachymorpha springbrookensis* sp. n., *Micropodacanthus tweedae* sp. n., Australia

## Introduction

In recent years, the authors have mainly made independent searches of the area, observing and photographing phasmids in Springbrook National Park, Binna Burra, Lamington National Park and surrounding areas of SE Queensland. PDB visited in February 2016 and February 2017, RMC has regularly visited during the summer seasons since 2013, searching for phasmids by torchlight at night. As little is published on these species, an account of the fauna is warranted. Having seen huge adults blown down in windy conditions, it is apparent that some of the largest phasmids live high in the trees, probably in the canopy, and therefore are seldom observed.

The Australian phasmid fauna has recently been studied in more detail (Brock & Hasenpusch (2007, 2009)), but there remain several new taxa to describe, with DNA barcoding now featuring (Velonà et al, 2015; Forniet et al (in progress)). Preliminary work on the Springbrook area has already resulted in two recent new species descriptions (Brock & Monteith, 2018 and Brock, Hasenpusch & Petrović 2019) and three further new descriptions are included in this work (along with reference to a fourth). In a useful overview of the biodiversity of phasmids, Bradler & Buckley, 2018, again refer to many of the Australian species (and associated phasmids from New Zealand, New Guinea, Seychelles, New Caledonia and Fiji) in the group ‘Lanceocercata’, calling them the “marsupials” among phasmids. Although technically this term is just a synonym of the Family Phasmatidae, in reality much of the higher classification of phasmids needs re-evaluating. In terms of existing classification, this simply means that *Pachymorpha* belongs to Phasmatidae. It is no surprise they are not related to Diapheromeridae, where they were formerly placed.

The rich and diverse mountain ranges of Springbrook National Park (rising to 1000 m.) and Lamington National Park, surrounding the Binna Burra estate, are well known to tourists. The parks are home to many scenic lookouts, waterfalls, spectacular, towering rainforests and walking trails. The city of Gold Coast is only a short distance to the east and provides a gateway for many visitors. The area is well known to entomologists and naturalists, for its high biodiversity and many species which now have restricted ranges within the greater region. The mountain ranges are remnants of the Tweed Shield volcano’s eroded northern caldera, with Wollumbin (Mount Warning) the remainder of the volcano’s core. The ranges are part of the UNESCO Gondwana Rainforests of Australia World Herit-

age Area, celebrating 25 years of inclusion in 2019, having been incorporated with the more southerly, New South Wales forests in 1994 (Kitching et al, 2010).

The areas studied are prone to periods of drought, prolonged rainfall, intense summer storms with cyclone-strength winds and bushfires. Recently, in September 2019, the heritage listed guesthouse properties at Binna Burra were destroyed by an uncontrollable bush fire following an extended dry season, exacerbated by hot weather and high winds. Fires mainly affect the drier, predominantly sclerophyll forests, with the more fragile rainforest vegetation communities being spared, largely due to higher soil moisture and more water contained in the vegetation itself. Human intervention can also play a role. However, even rainforest has been known to burn on occasion and can be very slow to recover, if at all. These extreme climatic conditions must surely play a role in shaping the lives and population densities of phasmid species in the area, but to what extent, we cannot say. Much of their biology, especially that of the more elusive species is understudied. With changing climates and weather patterns in the coming years likely to alter the ecosystems as we know them and increasing pressure on fauna and flora within protected areas, it is important to document and describe these spectacular, little-known insects, adding undeniable ecological value to the wonderful areas they currently inhabit.

### Searching for phasmids

Some daytime searches were made on foodplants with limited success. Most species are adept at hiding in plain sight during the day, or simply retreating into thicker vegetation at the base of the foodplant where they can avoid the daytime heat and predators. A few individuals were simply found at random, possibly having been blown down and taken up a daytime refuge in a more or less obvious location. These specimens, if able, would likely ascend to more suitable vegetation under cover of darkness given the chance. Most phasmids were observed by methodical, nocturnal searches of low to mid-level vegetation by torchlight, along established paths. Most of the photographs included in this paper are taken in nature, exactly as found, demonstrating the incredible range of camouflage and adaptation to the environment required in order for these insects to blend in with their surroundings.

### Simplified photographic key to genera, concentrating mainly on female characters (but males figured where possible)

#### WINGLESS

Body elongated.



*Candovia* page 20

Body robust.



*Pachymorpha* page 47

**SHORT WINGED i) robust body with short cerci**

[applies to female only, with only wing cases; male long winged]. Head pointed in both sexes. Usually brown or green.

Head not pointed. Usually brown



*Extatosoma* page 65



*Onchestus* page 45

Thorax humped (female)



*Gibbernecrosia* female (left), male (right), page 27



**SHORT WINGED ii) body elongated or plump, with long cerci**

[applies to female only; male long winged]. Brown, elongate; cerci very long (female body length 134-200 mm)

[applies to female only; male long winged]. Brown, grey, black, mottled or greenish; cerci leaf-like (female body length 130-172 mm)



*Ctenomorpha* page 40



*Anchiale* page 39



Green (male - brown), medium-sized with plump abdomen; cerci slender (female body length 75-110 mm)



*Didymuria* female (left), male (right) page 52

**LONG WINGED iii) female body length often approaching or in excess of 200 mm**

Abdomen elongate but robust, bright green body

Abdomen elongate but robust, brown; cerci long or short



*Eurycnema* page 42



*Acrophylla* page 29

**LONG WINGED iv) female body length less than 143 mm, often much smaller**

Medium-sized (female body length 79 mm, leaf green, head, central longitudinal band of pronotum and mesonotum brown); mesonotum with 8 spine-like conspicuous tubercles of even size



*Micropodacanthus* page 56

Medium-sized (female body length 89-90 mm, leaf green); mesonotum short and narrow, brown, with four pairs of spine-like tubercles of equal size, the front pair curved forwards



*Parapodacanthus* page 61

Medium-sized to large (female body length 105-142 mm, pale green); mesonotum broadened towards tip, green, heavily granulated; serrated laterally



*Tropidoderus* page 62



***Candovia annulata***  
**Banded-legged Stick-insect**

**Widespread and common**

**Body length** male 53–60 mm., female 80–82 mm.

**Female** Body green or brown (light to dark). Mesonotum with several white dotted, almost equally spaced, tubercles laterally. Head with whitish bands; all femora with whitish band towards tip; other bands are less distinct. In dark woodlands where these insects are at low density, a much darker form occurs with a pale head, thorax very dark, abdomen upperside orange with black marks. The whole underside is typically pale green.

**Male** Body much darker than in female. Head with whitish bands; all femora with whitish band towards tip.

**Habitat** Moist subtropical and temperate woodlands, gardens and parks, particularly woodland tracks and edges.

**Foodplants** Leaves of numerous trees and bushes, including *Rubus* and ferns. Distribution SE Queensland, northern New South Wales.

**Similar species** Unlikely to be confused, due to the banded femora.

**IUCN** [www.iucnredlist.org/species/78681507/78683925](http://www.iucnredlist.org/species/78681507/78683925)



*Example localities:* Apple Tree Park, Ankida, Best of All Lookout, Purling Brook Falls, Binna Burra, Rosins Lookout Conservation Park (Beechmont)

*Main Season:* November to March, occasional in almost any month



*Candovia annulata* mating pair, dark form, which occurs in some dark woodlands [PDB]





*Candovia annulata* mating pair, one of the typical, plain forms at woodland edges [PDB]

***Candovia granulosa***  
**Granulated Stick-insect**

**Body length** male 44–51 mm., female 63–71 mm.

**Female** Body dark brown (rarely greenish) and stocky, abdomen heavily ridged. Thorax and abdomen heavily granulated. When viewed laterally, centre of abdominal segments raised at tip; operculum not quite reaching end of abdomen. Cerci short.

**Male** Body robust, mid to dark brown or occasionally green.

**Habitat** Moist subtropical and temperate woodlands, often around edges.

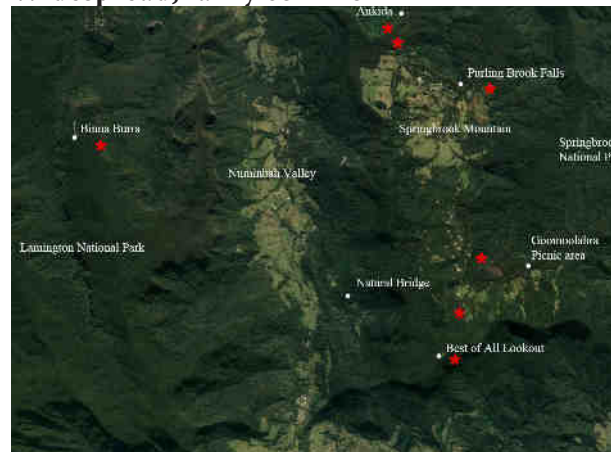
**Foodplants** Leaves of numerous trees and bushes.

**Distribution** SE Queensland, northern New South Wales.

**Similar species** *Candovia robinsoni*.

**IUCN** [www.iucnredlist.org/species/78682836/78683935](http://www.iucnredlist.org/species/78682836/78683935)

**Widespread, fairly common**



**Example localities:** Ankida, Best of All Lookout, Purling Brook Falls, Canyon area, Binna Burra

**Main Season:** November to April





*Candovia granulosa* mating pair [PDB]



*Candovia granulosa* female, in plump egg-laying condition [RMC]

***Candovia robinsoni***  
**Robinson's Stick-insect**

**Widespread, fairly common**

**Body length** male 40–42 mm., female 52–62 mm.

**Female** Body plump, fairly plain green insects with orange mouthparts; less commonly body greenish-brown, possibly mottled with dark flecks. Thorax granulated (less sparsely than in *granulosa*). The abdomen is carinate, with several lines. End of anal segment subtruncate, slightly emarginated in centre. Operculum tapering sharply to almost pointed tip, just exceeding end of 9th abdominal segment.

**Male** Slender dark brown, slightly mottled with darker flecks. Slightly raised area between eyes, dark central longitudinal line on this elevation only, crescent shaped anteriorly; orange mouthparts. Thorax elongate, mainly smooth with few sparse granulations. Poculum compact, reaching over half length of 9th abdominal segment; anal segment shorter than 9th abdominal segment, emarginated in centre; cerci short and slender, rounded at tip.

**Habitat** Temperate rainforest and gardens.

**Foodplants** Numerous, including *Lomandra* (Lomandraceae), *Acer palmatum* (Aceraceae), *Doryphora sassafras* (Monimiaceae), *Hypericum* (Clusiaceae), *Magnolia* (Magnoliaceae) and *Rosa* (Rosaceae).

**Distribution** SE Queensland, northern New South Wales. A few noted in Binna Burra and whilst believed to be *robinsoni*, require close examination.

**Similar species** *Candovia granulosa*, also a cryptic, as yet undescribed DNA bar-coded, lookalike species from Mt Wollumbin [= Mt Warning].

**IUCN** [www.iucnredlist.org/species/78683327/78683950](http://www.iucnredlist.org/species/78683327/78683950)



*Example localities:* Best of All lookout, Binna Burra

*Main Season:* January to April





*Candovia robinsoni* female [RMC]



*Candovia robinsoni* mating pair [RMC]

***Candovia strumosa***  
**Richmond River Stick-insect**

**Body length** male 50–58 mm., female 59–73 mm.

**Female** Body green, grey, brown to black; paler forms sometimes with black marks, including head and centrally at end of abdominal segments, but can be flecked all over. Eyes green with black horizontal stripe. Mesonotum with several large, sparse tubercles. End of 6th abdominal segment raised and swollen in centre. Operculum reaching in excess of 9th abdominal segment; cerci short. Mid legs rather short.

**Male** Body green, often with orange and black marked areas between eyes and at end of abdominal segments. Pronotum with black central and side marks.

**Habitat** Moist subtropical and temperate woodland edges, gardens and parks.

**Foodplants** Leaves of numerous trees and bushes, including *Rubus* and ferns.

**Distribution** SE Queensland, New South Wales.

**Similar species** None.

**IUCN** [www.iucnredlist.org/species/78683860/78683960](http://www.iucnredlist.org/species/78683860/78683960)

**Widespread and common**



*Example localities:* Ankida, Apple Tree Park, Binna Burra, Rosins Lookout Conservation Park (Beechmont), Mount Tamborine

*Main Season:* November to March



*Candovia strumosa* female [PDB]



*Candovia strumosa* male [PDB]

***Candovia* sp. n.**

**Rare**

**[Description in progress]** Body mainly green, sometimes brownish; mouthparts orange.

No Map.

**Habitat** Montane rainforests, high altitude, c.1100 m.

*Example localities:* Mt Warning [=Mt Wollumbin]

**Foodplants** Check with Braxton Jones.

*Main Season:* Observed in February, but likely to be adults in other months

**Distribution** New South Wales, including Mt Warning (=Mt Wollumbin) at high elevation.

**Similar species** *Candovia robinsoni*.

**IUCN** Not applicable, species yet to be formally described (Forni et al, in press), but found to be a species new to science.





*Candovia* sp. n. female [PDB]

### *Gibbernecrosia kooymani* Kooyman's Stick-insect

**Body length** male 49 mm., female 64–65 mm.

**Female** Body stocky, green or brown, head rounded. Antennae longer than forelegs. Mesonotum over three times length of pronotum, with numerous tubercles, particularly on large, raised central hump. Metanotum short, combined length including median segment just over half length of mesonotum. Fore wings absent. Hind wings short, not reaching end of 2nd abdominal segment. Abdomen elongate, but robust. Operculum with slightly rounded tip, reaching end of 9th abdominal segment. Cerci short, stout.

**Male** Mesonotum with few central tubercles; metanotum short. Fore wings absent. Hind wings only reaching end of 4th abdominal segment. Abdomen elongate, opoculum short of end of 9th abdominal segment. Cerci short, stout.

**Habitat** Montane rainforests. Foodplants *Neolitsea dealbata* [Hairy-leaved Bolly Gum] (Lauraceae), *Backhousia myrtifolia* [Grey Myrtle], *Syzygium* sp. [Lilly Pilly] (both Myrtaceae).

**Distribution** SE Queensland (Binna Burra, Lamington NP), northern New South Wales (Nr. Mt. Jerusalem NP; Mt Wollumbin [= Mt Warning]).

Rare

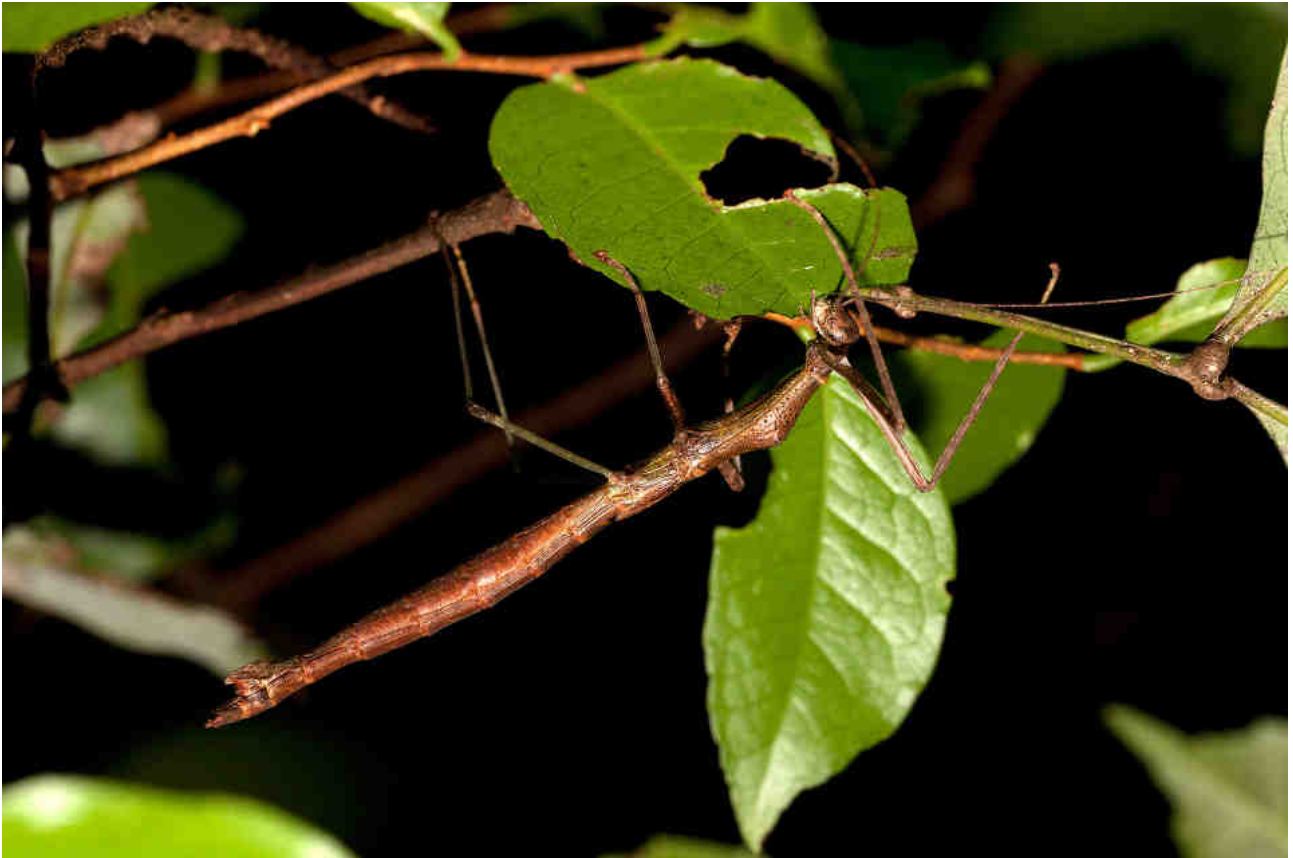


Example localities: Binna Burra, Wollumbin National Park

**Main Season:** December to February, but likely to be adults in other months

**Similar species** None.

IUCN Species described after assessments made in 2017/18, but provisionally warrants Red List status, probably Near Threatened



*Gibbernecrosia kooymani* female [RMC]



*Gibbernecrosia kooymani* male [PDB]

***Acrophylla cookorum* Brock & Coupland sp. n.****Cook's Stick-insect****Rare****Types**

Holotype female, AUSTRALIA, Queensland, Springbrook, Apple Tree Park, 28.166°S, 153.259°E, 08.ii.2016, P.D. & H. Brock & G. Monteith, 580 m, DNA project PB0204 (QM, T246604)

Paratypes 1 male, 1 female, AUSTRALIA, Queensland, "Leumeah", Tallebudgera Valley, 06.i.2000, D. & L. Cook (QM, T246605 / T246606); 1 female, same data except 10.i.2000 (QM, T246617)

**Body length** male 93 mm., female 150–158 mm.

**Description** Large brown body and legs mottled brownish with lighter areas and some darker marks, stockier than some *Acrophylla* species with greenish spines on mesothorax and metathorax; also green serrations on mid and hind femora. Hindwings black and white tessellated; pre-anal part of hindwings with reddish base (on underside mainly red) followed by black marks.



*Example localities:* Apple Tree Park, Tallebudgera Valley, Purling Brook falls area, Binna Burra

*Main Season:* January to February at least, probably other months

**Female** (applies to holotype and paratypes, with only slight differences in size). Head: slightly longer than wide, with 8 pale longitudinal lines, some 'comb-like'; three ocelli present. Eyes with 4 longitudinal black bands. Antennae just shorter than fore femora, with c.24 segments; basal segment much broader and twice length of next segment. Thorax: rather mottled, pronotum about same width as head, but shorter; several dark marks present. Mesonotum less than 3.5 x length of pronotum, with c.20 well-spaced green spines dorsally and c.10 green-like tubercles on lateral border, with c.18 beneath; dark 'V' shaped 'comb-like' mark at end of segment. Metanotum shorter than mesonotum. Abdomen: again rather mottled; 6th segment with foliose expansion (at least in holotype, but not all specimens); then narrowed to next segment; end of abdomen slightly rounded, segment slightly longer than 9th. Pointed tip of boat-shaped operculum just exceeding end of abdomen (swollen dark patch at base of 8th segment). Cerci small; leaf-like, much shorter than anal (10th) segment. Wings: forewings leaf-like and half-length of hindwings; whitish diagonal mark present on some specimens. Hind wings black and white tessellated; pre-anal part of hindwings with reddish base (on underside mainly red) followed by black 'U' shaped mark on holotype, but this varies and may be black and whitish spotted. Legs: long, typically spiny serrations as in other *Acrophylla* species; spines larger on femora (notably fore femora).

**Male** Much smaller and slenderer than the female and darker brown with green mesonotum (spines larger in proportion than in female), otherwise the colour and characters are similar (abdomen lacks foliose expansion on segment 6); less elongate than other male *Acrophylla* species, the more robust nature evident by the structure at the end of the abdomen, with the anal segment rounded and swollen, split into two lobes, with teeth beneath. Poculum reaching half-length of 9th abdominal segment. The antennae are, as usual, longer than the female, but not reaching end of forelegs. Forewings have a narrow white border, at least in some specimens.

**Measurements (in mm)**

Holotype female: Body length 158, head 10, antennae 28, pronotum 8, mesonotum 27, metanotum and medium segment combined 24 mm, forewing 28, hindwing 58, femora: fore 39, mid 23, hind 32, tibiae: fore 40, mid 21, hind 30, cerci 3.





*Acrophylla cookorum* **sp. n.** mating pair [RMC]

Paratypes: female (2). Body length 150-155, head 9-10, antennae 33, pronotum 6, mesonotum 25-27, metanotum and medium segment combined 20-24 mm, forewing 27-28, hindwing 54-56, femora: fore 40, mid 31, hind 35, tibiae: fore 42, mid 25, hind 31, cerci 3; male (1). Body length 93, head 5, antennae 53, pronotum 2.8, mesonotum 12, metanotum and medium segment combined 8.4 mm, forewing 14, hindwing 57, femora: fore 26, mid 21, hind 26, tibiae: fore 31, mid 17, hind 24, cerci 2.2.

Eggs: capsule length 3.7, width 2.2, height 2.8.

**Habitat** Montane rainforests and gardens.

**Foodplants** Thought to include *Eucalyptus* (Myrtaceae).

**Etymology** Named after collectors of the three paratypes, D & L Cook, keen naturalists and observers from Tallebudgera Valley, at the base of Springbrook.

**Distribution** SE Queensland.

**Similar species** Other *Acrophylla* spp., including another undescribed species from SE Queensland. Cerci are intermediate in size between species groups *A. titan* (long, wavy cerci) and *A. wuelfingi* (short cerci) and the eggs have a lumpy, uneven shape unlike close relatives. They are not too dissimilar to *A. enceladus*, but the micropylar plate is not so elongate (molecular results are awaited which may assist). The genus *Anchiale* tend to be mainly slenderer, but also appear to be closely related.

**IUCN** Not applicable, species described after assessments made in 2017/18.



*Acrophylla cookorum* **sp. n.** female (holotype): head & thorax, dorsal view [PDB]



*Acrophylla cookorum* **sp. n.** female (holotype): end of abdomen, dorsal view [PDB]



*Acrophylla cookorum* **sp. n.** female (holotype): head & thorax, lateral view [PDB]



*Acrophylla cookorum* **sp. n.** female (holotype): head & thorax, ventral view [PDB]





*Acrophylla cookorum* **sp. n.** female startle display (holotype) [PDB]





*Acrophylla cookorum* **sp. n.** male, dorsal view (paratype) [PDB]



*Acrophylla cookorum* **sp. n.** male (paratype): head & thorax, lateral view [PDB]



*Acrophylla cookorum* **sp. n.** male (paratype): end of abdomen, dorsal view [PDB]



*Acrophylla cookorum* **sp. n.** male (paratype): end of abdomen, lateral view [PDB]



*Acrophylla cookorum* **sp. n.** male (paratype): head & thorax, ventral view [PDB]



*Acrophylla cookorum* sp. n. eggs: lateral (left) and dorsal (right) views [PDB]



*Acrophylla cookorum* sp. n. egg: operculum and shape of capitulum, from above [PDB]

### *Acrophylla enceladus* Giant *Acrophylla* Stick-insect

**Body length** male 140–150 mm., female 175–185 mm.

**Female** Body brown; pronotum and mesonotum with numerous large spine-like tubercles (shorter on pronotum). Forewings long and leaf-like, fairly plain with some darker mottled areas; just under half length of hindwings. Pre-anal part of hindwings colourful, with various dark marks (although paler blotches extensive) and reddish inner margin. Hindwings often slightly longer than end of 7th abdominal segment; black and white chequered. Operculum reaching beyond end of abdomen; cerci long (but shorter than combined length of 9th and 10th abdominal segments), broad and leaf-like, extending beyond operculum tip. Legs shorter than other *Acrophylla* species and not noticeably armed with spines (all femora only slightly serrate).

**Male** Similar, but much slenderer and hindwings less conspicuously chequered. Operculum about reaching end of 9th abdominal segment.

**Habitat** Eucalypt and savannah woodlands and parks. Foodplants *Corymbia citriodora* and *Eucalyptus* spp. (both Myrtaceae).

**Distribution** New South Wales, SE Queensland, north to Cape York.

**Similar species** Other *Acrophylla* spp.

**IUCN** [www.iucnredlist.org/species/78790996/78792112](http://www.iucnredlist.org/species/78790996/78792112)

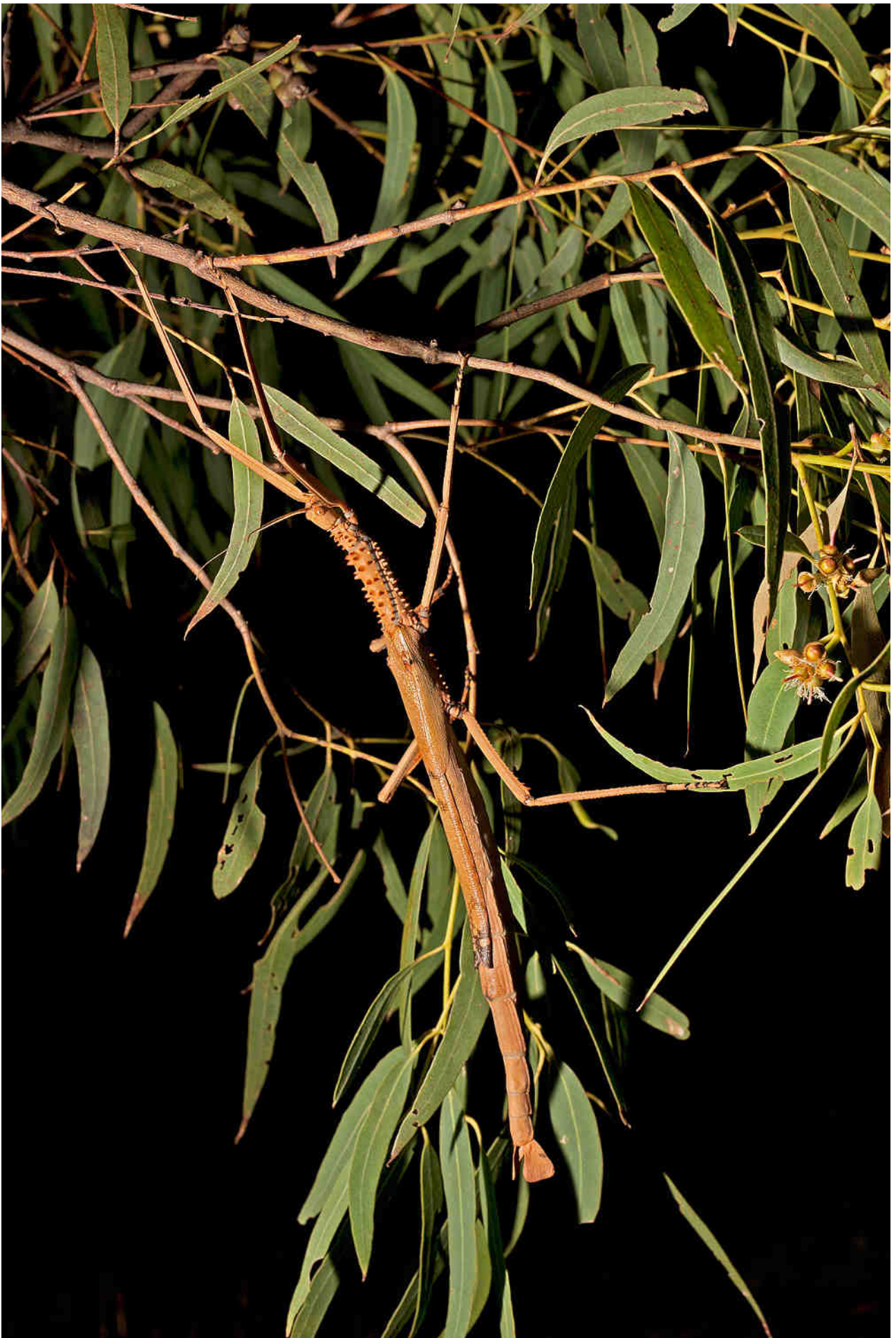
#### Widespread but seldom recorded



*Example locality:* Springbrook Road, drier vegetation, near Ankida

*Main Season:* December to March





*Acrophylla enceladus* female [RMC]



***Acrophylla titan***  
**Titan Stick-insect**

**Body length** male 135–150 mm., female 200–260 mm.

**Female** Body mottled greyish to pinkish-brown. Mesonotum with several bold conical tubercles, which also feature laterally and ventrally. Legs long, fore femora and tibiae spiny; fore femora strongly serrate. Forewings long, Forewings long and leaf-like, with large yellowish blotches, which also feature on pre-anal part of hindwings (also reddish inner margin). Forewings also often with variable-sized large whitish blotch. Hindwings usually reaching at least start of 6th abdominal segment; dark brown and white chequered. Operculum extending beyond end of abdomen; cerci long (about length of 9th and 10th abdominal segments) and ragged.

**Male** Similar, but much slenderer and hindwings less conspicuously chequered. Forewings with whitish margin. Poculum pointed in centre; about reaching end of 9th abdominal segment.

**Habitat** Eucalypt temperate woodlands, gardens and parks.

**Foodplants** Many trees, including *Callitris columellaris* (Cupressaceae), *Rhododaphne* (Anacardiaceae), *Acacia* spp. (Fabaceae), *Callistemon rigidus* and *Eucalyptus* spp. (both Myrtaceae).

**Distribution** New South Wales, SE Queensland (rarer in central and northern Queensland) and Victoria.

**Similar species** Other *Acrophylla* spp.

**IUCN** [www.iucnredlist.org/species/78791411/78792127](http://www.iucnredlist.org/species/78791411/78792127)

**Widespread**



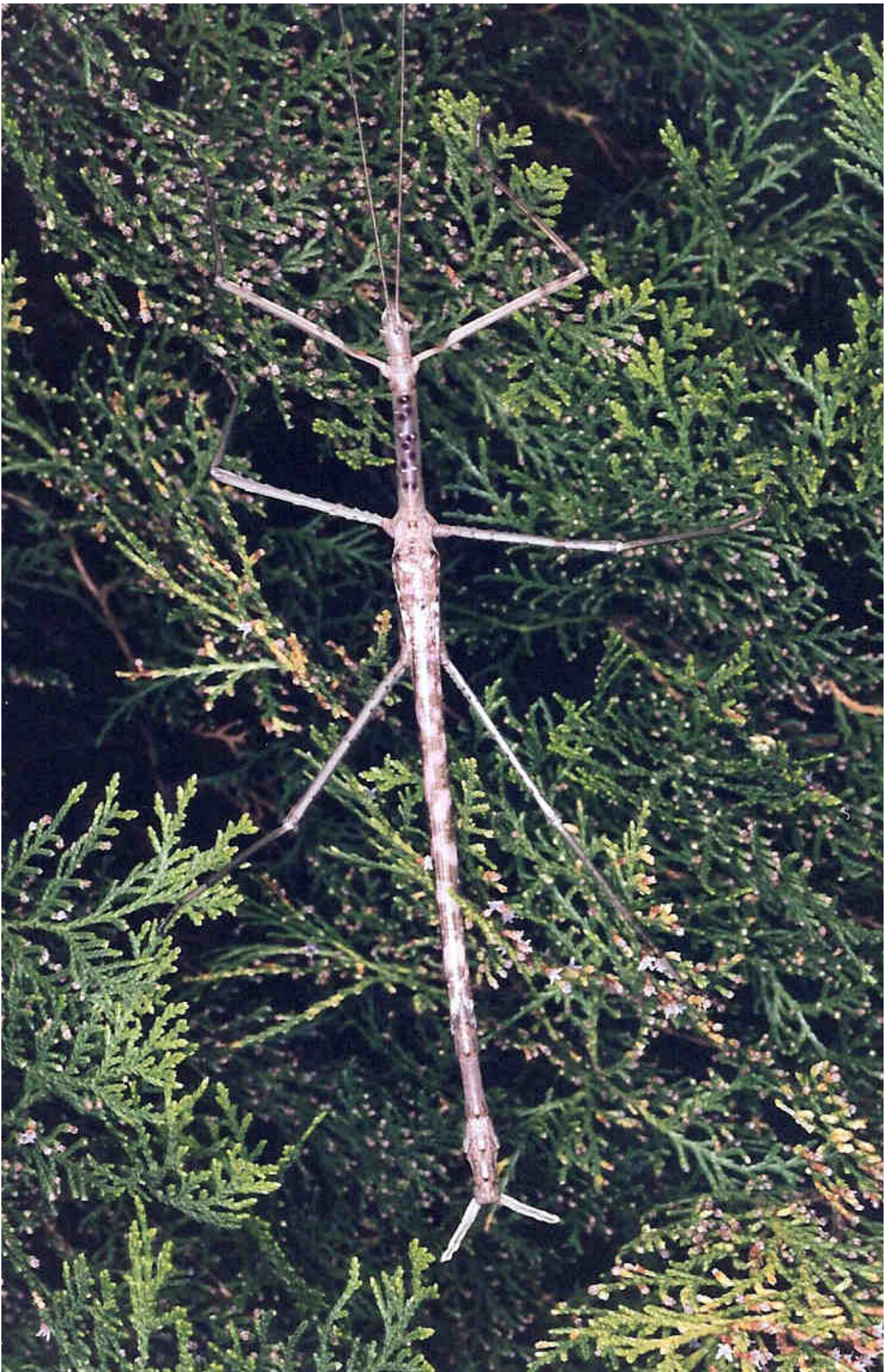
Example locality: Apple Tree Park, Purling Brook area

Main Season: November to March



*Acrophylla titan* female [PDB]





*Acrophylla titan* male [PDB]



## *Anchiale austrotessulata* Tessellated Stick-insect

**Widespread and common, sometimes in pest numbers**

**Body length** male 82–90 mm., female 130–172 mm.

**Female** Body light to dark brown; sometimes green. If occurring in pest numbers (kentromorphic or high density phase) some are black mottled with yellow and white, with a reddish underside. Mesonotum with distinct, but sparse black-tipped tubercles. Pre-anal part of wings plain or reddish, remainder black and white chequered. Wings short; usually not reaching end of 3rd abdominal segment. Operculum exceeding tip of abdomen, but shorter than long, leaf-like cerci. Legs plain, but often rather mottled.



*Example locality: Mary Leu surrounds*

*Main Season: November to April*

**Male** Body usually brown, Mesonotum with two rows of black-tipped tubercles. Forewings with whitish lateral border. Wings as in female but longer, reaching about end of 6th abdominal segment.

**Habitat** Eucalypt shrubland and forests, gardens and parks.

**Foodplants** Many trees, including *Eucalyptus*, *Callistemon* and *Syncarpia* spp. (all Myrtaceae), *Acacia* spp. (Fabaceae) and *Casuarina* spp. (Casuarinaceae) also pines.

**Distribution** New South Wales, SE and central Queensland.

**Similar species** Other *Anchiale* spp. (including rather understudied species abundant in New South Wales and Queensland).

**IUCN** [www.iucnredlist.org/species/78796229/78796267](http://www.iucnredlist.org/species/78796229/78796267)



*Anchiale austrotessulata* mating pair [PDB]



***Ctenomorpha marginipennis***  
**Margined-winged Stick-insect**

**Widespread**

**Body length** male 91–121 mm., female 134–200 mm.

**Female** Body elongate, dark brown; sometimes dark green. Mesonotum with granulations and tubercles dorsally and laterally. Fore femora with several bold serrations. Wings short; black or dark brown with a slightly chequered base. Forewings brown with chequered black and pale (or black streaked) base and may be slightly longer than hindwings, or rather shorter. The hindwings may reach well beyond 2nd abdominal segment, but sometimes barely extend beyond 1st segment. Operculum reaches end of abdomen. Remarkably long, narrow leaf-like cerci are of variable length, but always longer than combined length of 9th and 10th abdominal segments. Specimens in cooler climates, including Tasmania, tend to be considerably shorter in body length.

**Male** Body elongate, brown or reddish-brown. Eyes with pale stripe; ocelli pale, sometimes yellowish. Mesonotum with a variable number of larger black tubercles (often several); underside paler with some dark tubercles. Lacking bold serrations on fore femora. Forewings brown, with whitish lateral border. Wings full-length, pre-anal part with continuation of white margin; whitish with brown, notably towards outer margin. Poculum with rounded tip, not reaching end of 9th abdominal segment. Cerci long, but usually just short of combined length of 9th and 10th abdominal segments.

**Habitat** Heaths and eucalypt forests, gardens and parks.

**Foodplants** Many trees, including *Eucalyptus* and *Leptospermum* spp. (both Myrtaceae), *Acacia* spp., *Daviesia leptophylla* and *Pultenaea daphnoides* (Fabaceae) and *Prunus* spp. (Rosaceae).

**Distribution** New South Wales, SE Queensland (rarer in central and northern Queensland), South Australia, Tasmania, Victoria.

**Similar species** *Ctenomorpha gargantua* (a much longer species found in parts of northern Queensland).

**IUCN** [www.iucnredlist.org/species/79002758/79002987](http://www.iucnredlist.org/species/79002758/79002987)



*Example locality:* Apple Tree Park

*Main Season:* Late October to February



*Ctenomorpha marginipennis* female [RMC, top] showing typical, elongated body form from Springbrook [PDB, beneath] shows a more robust-looking specimen, from Mount Lofty, Adelaide. Specimens from cooler climates, including Tasmania, are similar in appearance





*Ctenomorpha marginipennis* male [PDB] specimens often seen like this, with lost limbs

### *Eurycnema goliath* Goliath Stick-insect

**Body length** male 121–160 mm., female 172–204 mm.

**Female** Body robust, body green. Head yellow with green bands. Mesonotum yellowish, with bold green longitudinal central stripe; segment smooth or with a variable number of bold bluish-green tubercles (often just a few, for example lecto-type with six larger tubercles). The underside, often banded yellow and green, has four or five pairs of tubercles, along with metanotum. Abdomen with white and mauve narrow bands dividing segments. All femora spiny. Inner margin of hind tibiae with about seven large spines, the 4th and 5th spines more than 2 x length of others. Wings transparent with green veins and red inner margin. Underside of long forewings and pre-anal part of hindwings bright red. The extent of whitish streaks on sides of pronotum, base and sides of forewings (partial, not reaching tip) and hindwings, varies. Operculum reaching well beyond end of abdomen. Long, leaf-like cerci are long; although variable in length (about 2-2.5 x longer than wide) are always shorter than tip of operculum.

**Male** Body similar in colour, sometimes with more white lines on pre-anal part of hindwings, or reddish marks on the upperside of forewings. Operculum reaching end of 9th abdominal segment. Cerci long, 4 x longer than wide.

**Habitat** Woodlands and rainforests, gardens and parks.

### Widespread



*Example locality:* Private property along Springbrook Road, lower elevation

*Main Season:* September to April

**Foodplants** Mainly *Eucalyptus*, *Callistemon* (Myrtaceae) and *Acacia* spp. (Fabaceae), *Rhodospaera rodanthema* (Anacardiaceae).

**Distribution** New South Wales, SE and more rarely in northern Queensland. Historic records from Tasmania.

**Similar species** *Eurycnema osiris* (a more elongate species found in parts of northern Queensland, Northern Territory and Western Australia).

IUCN [www.iucnredlist.org/species/79003367/79003460](http://www.iucnredlist.org/species/79003367/79003460)



*Eurycnema goliath* male [RMC]





*Eurycnema goliath* large female nymph, changes colour from brown to green on final moult [RMC]



*Eurycnema goliath* female [RMC]



## *Onchestus gorgus* Gorgon Stick-insect

**Body length** male 72–76 mm., female 88–102 mm.

**Female** Body robust, mid to dark brown, but background can sometimes influence colour, with whitish and part orange specimens seen; others with a hint of green. Head with numerous tubercles. Thorax and abdomen rugged, mesonotum with several conspicuous tubercles, also laterally; centre often with well-spaced pair of curved spines. Abdomen with central ridges, larger central tufts at end of segments 4–6. Fore femora spiny. Outer margin of mid and hind femora and tibiae with large sub-basal crest and larger subapical crest. Forewings long, reaching in excess of 1st abdominal segment; hindwings short, just about reaching end of 3rd segment; black with variable, sometimes minimal white chequered patterning. Pre-anal part of hindwings with black base and whitish spots. Operculum broad and boat-like, reaching end of abdomen; cerci short, hidden beneath abdomen.

**Male** Body similar but slender. Poculum reaching end of 9th abdominal segment. Cerci short and fairly slender, visible beyond tip of abdomen.

**Habitat** Woodlands and rainforests and gardens. Foodplants Mainly *Eucalyptus* (Myrtaceae) and *Acacia* spp. (Fabaceae).

**Distribution** New South Wales and SE Queensland.

### Local



*Example localities:* Purling Brook Falls, Best of All Lookout, Binna Burra

*Main Season:* November to April



*Onchestus gorgus* female, defence display [PDB]. The wings are repeatedly flicked open, producing a rasping sound on the leg flanges. The body sways from side to side at the same time, startling a potential predator, before it quickly walks away



**Similar species** *Onchestus rentzi* (a slightly longer winged species found in parts of SE and northern Queensland; the head of rentzi females usually with pair of large tuft-like protuberances).

IUCN [www.iucnredlist.org/species/79003644/79004117](http://www.iucnredlist.org/species/79003644/79004117)



*Onchestus gorgus* mating pair [PDB, left], female, colour form blending in with background [RMC, right]



*Onchestus gorgus* male [PDB]

***Pachymorpha springbrookensis* Brock & Coupland, sp. n.****Springbrook Pachymorpha Stick-insect      Local****Types**

Holotype female, AUSTRALIA, Queensland, Springbrook, Best of Best Lookout, Repeater Stn, 28.333°S, 153.267°E, 08.ii.2016, P.D. & H. Brock & G. Monteith, 1,000 m, DNA project PB0203 (QM, T246607).

Paratypes (8 males, 4 females): 2 males DNA project PB0200 & PB0202, same data as holotype, except 11.ii.2016 (QM, T246608 / T246609); 1 male, AUSTRALIA, Queensland, Springbrook, Repeater Station Road, 28.334°S, 153.267°E, 09.ii.2016, P.D. & H. Brock & G. Monteith, 880 m, DNA project PB0201 (QM, T246610); 1 female, AUSTRALIA, Queensland, Binna Burra area, 28°13'S, 153°11'E, 02-03.xii.1995, G. Monteith (QM, T246611); 1 male, AUSTRALIA, Queensland, Upper Tallebudgera Valley, below Springbrook, 08.i.-17.iii.1985, Monteith, Cook & Thompson, 550 m, RF Pitfall traps (QM, T246612); 2 males & 1 female, Queensland, Echo Point, Lamington, 28°16'S, 153°10', 27.xii.1991-24.iii.1992, G. Monteith, 1,000 m, RF Pitfall/intercept traps (QM, T2466113/ T246614/ T2466115); 2 males & 2 females, AUSTRALIA, New South Wales, Mt Warning (= Mt Wollumbin) area, 28.402°S, 153.283°E, 14.ii.2017, P.D. Brock, B. Jones & N. Tweed, DNA project PB0192-0195 (NHMUK)



*Example localities:* Best of All Lookout, Springbrook, Repeater Road, Binna Burra, Tallebudgera Valley, Mt Warning (= Mt Wollumbin)

*Main Season:* November to March

**Body length** male 31–40 mm., female 40–50 mm.

**Description** Small, stocky, rugged (tubercles and punctures over much of body) and wingless light to dark brown species, with short antennae; male much slenderer and usually smaller.

**Female** (applies to holotype and paratypes, with differences in size and colour; coxae pale in holotype, but not generally). Head: slightly longer than wide; three ocelli present. Large raised crest between eyes (each side rounded), covered in tubercles. Other tubercles present, also on whole of body. Back of head with raised central bump. Antennae shorter than fore femora, with 9 segments; basal segment long and very broad, more than twice width of next, rounded segment, which it tapers to. 3rd segment and beyond even slenderer, but not quite 4 x width of basal segment. 5th segment with raised round basal lump. Thorax: plain or dark and light to blend in with surroundings, pronotum same length as head, but wider; lighter marks may be present (as in holotype). Mesonotum 2.5 x length of pronotum, with various tubercles, some large, notably raised, swollen central area at front of segment. Metanotum and median segment combined only half length of mesonotum. Abdomen: rough and rugged, segments 1-6 broad, then tapering to bilobed tip of elongate anal (10th) segment, which is shorter than 9th. Operculum very narrowed in second half; tip subtruncate and reaching half-length of anal segment. When viewed laterally, rear of segments, particularly 8 & 9 are greatly swollen in centre (rather typical of some other *Pachymorpha* species). Cerci small, not visible beneath abdomen. Legs: short, all wavy, particularly larger bumps or almost foliose expansions on mid femora.

**Male** Generally much smaller and slenderer than the female and mainly dark brown or shades of brown (such as mostly light upperside, dark underside), otherwise the characters are similar. Anal segment short, as in female tip bilobed; poculum reaching end of 9th abdominal segment.





*Pachymorpha springbrookensis* **sp. n.** female (holotype) [PDB]





*Pachymorpha springbrookensis* **sp. n.** male (paratype) [PDB]



**Measurements (in mm)**

Holotype female largest of measurements given, which includes 4 paratypes: Body length 38-50, head 3-3.6, antennae 4.5-7.3, pronotum 3-3.6, mesonotum 6-9.1, metanotum (2.5-2.7) and medium segment (1.5-1.8) combined 4-4.5 mm, femora: fore 9-12.2, mid 8-10.4, hind 10-12.7, tibiae: fore 10-14.2, mid 8-10.9, hind 9-11.6, cerci -;

Male (n=8). Body length 31.5-39.6, head 2.7-2.8, antennae 4.7-9, pronotum 2-2.2, mesonotum 4.2-7, metanotum (3.1-3.4) and medium segment (1.4-1.6) combined 4.5-5 mm, femora: fore 7.3-12, mid 5.1-7, hind 7.3-11, tibiae: fore 10-14.4, mid 5.1-8, hind 6.8-10, cerci -.

Eggs: capsule length 3.4, width 2, height 2.

**Habitat** Montane rainforests, gardens and road verges; at altitudes of 550-1000 m, where they tolerate cooler, wet conditions.

**Foodplants** Ferns.

**Etymology** Named after Springbrook to recognise the importance of this vast area; also present in surrounding areas.

**Distribution** SE Queensland and far northern New South Wales.

**Similar species** Other *Pachymorpha* spp. (revision to follow, pending further DNA material results). Further paratypes from other localities could have been selected from QM, but it is uncertain they are conspecific.

**IUCN** Not applicable.



*Pachymorpha springbrookensis* **sp. n.** female colour forms, helping specimens to blend in with their backgrounds (all paratypes) [PDB]



*Pachymorpha springbrookensis* **sp. n.** female (holotype) head & thorax: dorsal (left) and lateral (right) views [PDB]



*Pachymorpha springbrookensis* **sp. n.** female (holotype) end of abdomen: dorsal (left) and ventral (left) views [PDB]



*Pachymorpha springbrookensis* **sp. n.** female (holotype) end of abdomen: lateral view [PDB]





*Pachymorpha springbrookensis* **sp. n.** male (paratype): (top, left). End of abdomen: dorsal (top, right), lateral (bottom, left) and ventral (bottom, right) views [PDB]



*Pachymorpha springbrookensis* **sp. n.** eggs: lateral (left) and dorsal (right) views [PDB]



*Pachymorpha springbrookensis* sp. n. egg: operculum [PDB]

*Didymuria violescens*  
Spur-legged Stick-insect

Body length male 66–105 mm., female 75–110 mm.

**Female** Body robust, green or occasionally brown with many small tubercles; abdomen very plump when fully laden with eggs. Forewings and hindwings short, the latter with bold reddish, pink or whitish veins, reaching about end of 3rd abdominal segment. Cerci longer than anal segment.

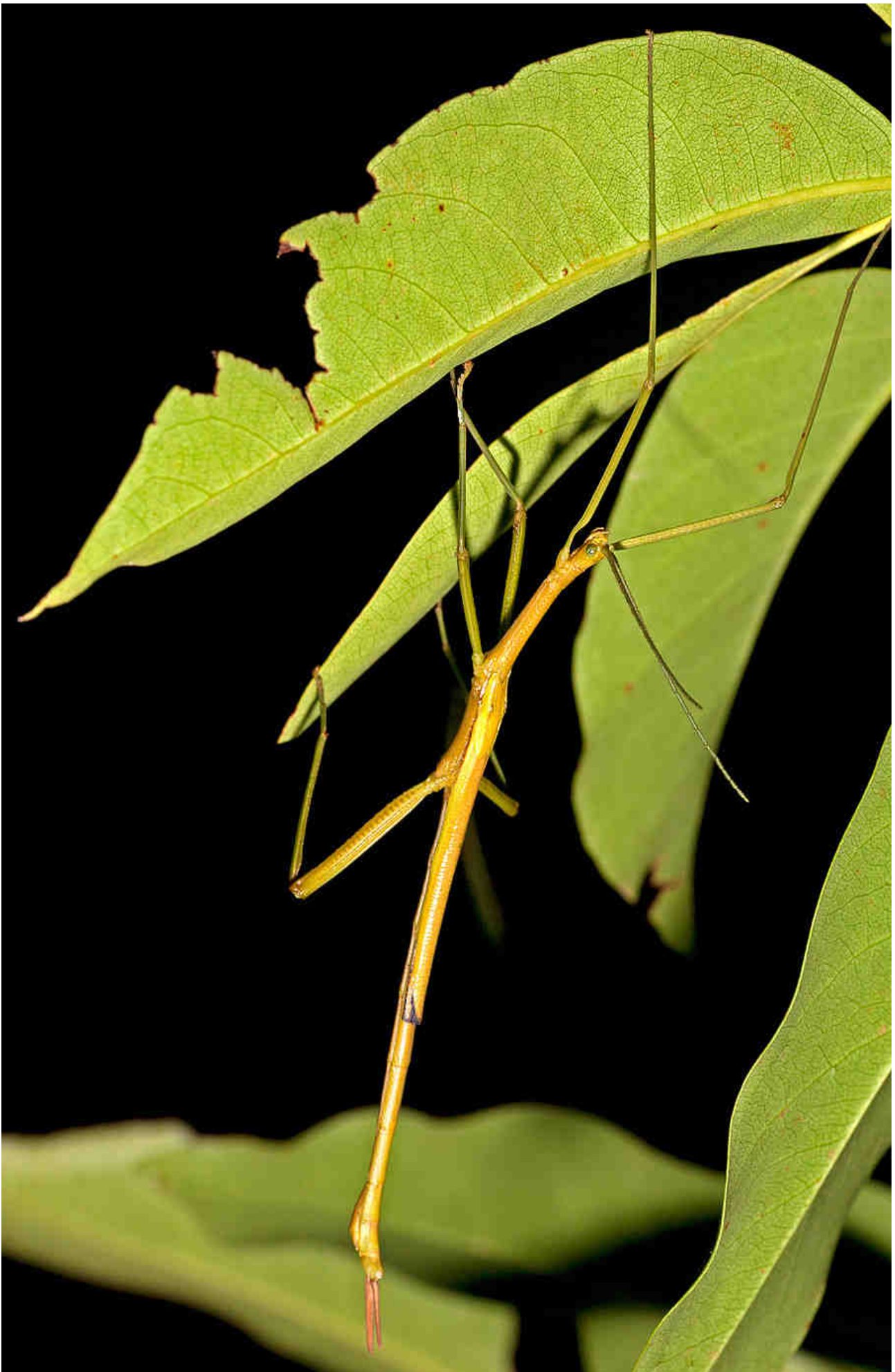
**Male** Body similar but slender. Hind femora robust; with three long spines. Hindwings longer than female, reaching to end of 4th abdominal segment; varying shades of mauve or dark brown, used in a startle display. Poculum reaching end of 9th abdominal segment. Cerci longer than anal segment.

**Widespread and common, sometimes in pest numbers**



*Example locality:* Binna Burra [uncommon or absent in Springbrook and surrounds, but usually associated with drier habitats]

*Main Season:* November to February



*Didymuria violescens* male [RMC]



**Habitat** Woodlands and rainforests and gardens. Foodplants *Eucalyptus* (Myrtaceae), considered a forest pest in some drier localities, particularly at high altitude.

**Distribution** New South Wales and SE Queensland, Tasmania and South Australia.

**Similar species** *Didymuria virginea* (wings longer and male hind femora lacking three larger spines of *violescens*) parts of northern Queensland). A similar, as yet undescribed *Didymuria* species occurs in Western Australia.

IUCN [www.iucnredlist.org/species/80200678/80200874](http://www.iucnredlist.org/species/80200678/80200874)



*Didymuria violescens* female, startle display with wings exposed in an effort to startle potential predators and avoid being eaten [PDB]



*Didymuria violescens* female [PDB]



*Didymuria violescens* male [PDB]



***Micropodacanthus tweedae* Brock & Coupland, sp. n.*****Tweed's Stick-insect*****Rare****Types**

Holotype female, AUSTRALIA, Queensland, Ankida Nature Refuge, 28.182°S, 153.258°E, 06.ii.2017, P.D. Brock & N. Tweed, c.646 m, DNA project PB0152 (QM, T246616)

**Body length** male c.48 mm., female 79 mm.

**Description** Body leaf green, head, central longitudinal band of pronotum and mesonotum brown, also coxae. Hindwings pink and with flush of same colour on much of abdomen dorsally. Description of female holotype. Head: as long as wide, brownish (including darker areas), except green laterally; three ocelli present. Antennae longer than forelegs, with 26 segments; basal segment flattened, slightly broader and twice length of next segment. Thorax: pronotum about same length and width as head with broader green area; central dark brown link extending from head to almost half length of segment. Mesonotum longer than pronotum, with an upper row of 4 dark brown spine-like large tubercles, followed by two rows of 2 tubercles; in addition, 5 small green tubercles feature on lateral border of pronotum, with others beneath. Metanotum shorter than mesonotum. Underside of thorax brown and rugged, with some tubercles. Abdomen: green with pinkish flush dorsally, leaving a green border. Abdomen very bloated when egg-laying; tapered to emarginate tip, with supra-anal plate conspicuous. Cerci leaf-like, longer than anal (10th) segment. Operculum reaching end of abdomen, tapered to oval tip; distinctive swollen area at base of 8th abdominal segment, with distinctive bold longitudinal line, less conspicuous at tip of anal (10th) segment. Wings: forewings long, green, in part well over 2 x width of mesonotum; tip subtruncate. Hind wings tessellated deep pink and white; the outer, narrow margin is mostly whitish. Pre-anal part of hindwings with broad yellow basal third bright yellow, otherwise green. Legs: green, medium length (except smaller midlegs), slightly hairy; mid and hind femora with several evenly spaced small serrations on ventrolateral carinae; tibiae smooth; tarsi of modest length.

Although no males have been collected, photographs of both sexes were taken by RMC between 2016 and 2019 and the body length estimated. As usual in the genus, the male is much smaller and slenderer than the female, but the colour and characters are the same. Margin of forewings broad, whitish brown, continuing on first part of hindwings. Operculum reaching half-length of 9th abdominal segment.

**Measurements (in mm)**

Body length 79, head 4.5, antennae 32, pronotum 4.5, mesonotum 6.5, metanotum (4.5) and medium segment (2.5) combined 7 mm, forewing 31, hindwing 59, femora: fore 15, mid 11, hind 18, tibiae: fore 14, mid 9, hind 15, cerci 4.5.

Eggs: capsule length 3.8, width 1.5, height 1.6.

**Habitat** Montane rainforests.

**Foodplants** *Flindersia schottiana* (Rutaceae).

**Etymology** Named after Noelene Tweed (Queensland) for her invaluable assistance to PDB in searching for Australian phasmids since 2010, many which are being used in DNA barcoding work. Noelene found the holotype on the outside of a dustbin, the rarest specimen on a February 2017 expedition with PDB! It had presumably been blown down in the wind overnight or been attracted to lights.



*Example localities:* Ankida, Binna Burra

*Main Season:* November to February

**Distribution** SE Queensland.

**Similar species** Other little-known, smaller *Micropodacanthus* spp. from north Queensland, although at least one species occurs in SE Queensland. *M. tweedae* is the largest species of *Micropodacanthus* known so far and whilst very similar in appearance to adult *M. sztrakai* (female 66 mm) from Kuranda, they have very distinct eggs. Those of *M. tweedae* have the capsule unevenly shaped, with the base lobed. The capsule is distinctly pitted and includes long, narrow pits. The operculum has a narrowing stalk to a knob-like capitulum. Eggs of *M. sztrakai* are again roughly rectangular, but the capsule has smaller, less distinct pits on a rough surface and lacks the basal lobes; additionally, the operculum lacks the capitulum knob.

**IUCN** Not applicable.



*Micropodacanthus tweedae* **sp. n.** eggs, dorsal and lateral view [PDB]



*Micropodacanthus sztrakai* eggs (for comparison)



*Micropodacanthus tweedae* **sp. n.** female head & thorax, close-up (holotype) [PDB]



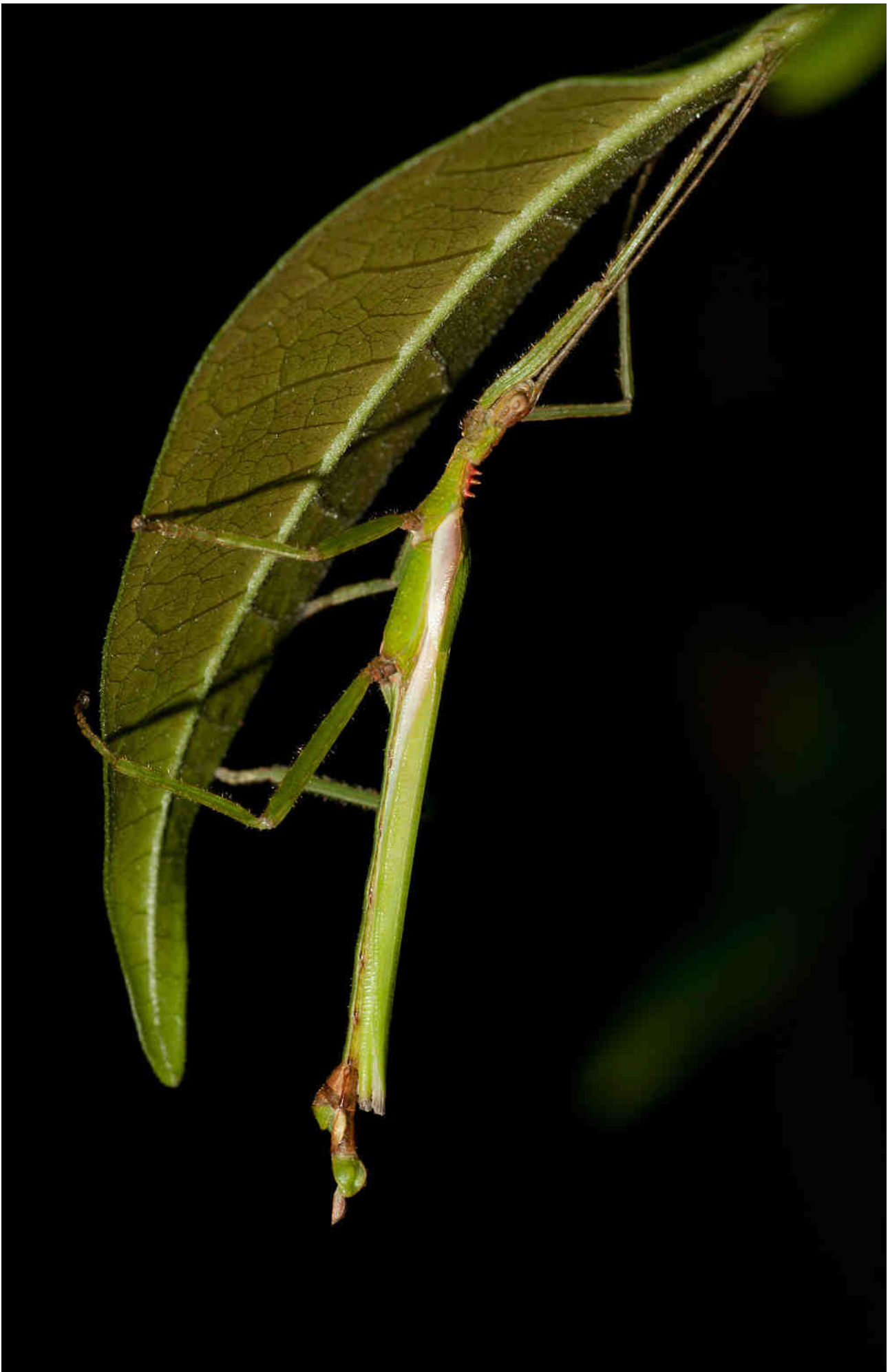


*Micropodacanthus tweedae* **sp. n.** mating pair [RMC]



*Micropodacanthus tweedae* **sp. n.** female (holotype) [PDB]





*Micropodacanthus tweedae* **sp. n.** male [RMC]



*Micropodacanthus tweedae* **sp. n.** female end of abdomen (holotype): dorsal view (top, left), lateral view (top, right), ventral view (bottom, left). Wings (bottom, right) [PDB]

### *Parapodacanthus ailaketoae* Aila Keto's Stick-insect

**Body length** male 71–78 mm., female 89–90 mm.

**Female** Body robust, leaf green, with yellowish lines. Mesonotum slightly longer than pronotum, with four rows of darker-tipped brown spine-like tubercles of equal size, the front pair curved forwards; a darker longitudinal line runs through the centre between spines. Lateral margin of meso- and metathorax with brown tubercles. Ventral surface of metathorax whitish, with tubercles. Abdomen green, with middle part reddish-brown; operculum boat-shaped, reaching end of abdomen. Forewings and hindwings long, the latter reddish, almost reaching end of abdomen. Cerci long and slender; longer than anal segment.

**Male** Body similar but slender. Differences include fore and hindwings with broad cream marginal band, followed by thick mauve band with a narrow greenish yellow vein between. Poculum tip rounded, reaching end of abdomen. Anal segment split into two large lobes.

**Habitat** Wet sclerophyll forest with dense understorey of rainforest plants and rainforests.

**Foodplants** *Schizomeria ovata* (Cunoniaceae) and *Vitex lignum-vitae* (Lamiaceae).

**Distribution** New South Wales and SE Queensland.

**Similar species** *Parapodacanthus hasenpuschorum* (much larger spines on mesonotum) found in parts of northern Queensland.

Rare



*Example localities:* Ankida, Apple Tree Park, Cunningham's Gap, Goomburra, Purling Brook area, Binna Burra

*Main Season:* November to March



**Notes** Has been found feeding alongside *Micropodacanthus tweedae* sp.n.

**IUCN** Not assessed



*Parapodacanthus ailaketoae* mating pair [PDB]

### ***Tropidoderus childrenii*** **Children's Stick-insect**

**Body length** male 110–124 mm., female 105–142 mm.

**Female** Body robust with mid and hindlegs broadened, pale to mid green or occasionally pale brown. Forewings and hindwings long (rarely both with speckled mauve markings), the latter whitish with brownish or green veins, reaching end of 8th abdominal segment. Pre-anal part of forewings with mainly bold mauve or blue base, partly red. Operculum reaching or more often exceeding end of abdomen; cerci shorter than anal segment.

**Male** Body brown, slender, including legs. Forewings with whitish margin. Hindwings shorter than female, reaching to about end of 6th abdominal segment, or just beyond. Operculum reaching half-length of 9th abdominal segment. Cerci long, about equal in length to 9th and 10th abdominal segments.

**Habitat** Woodlands, scrublands, parks and gardens.

**Foodplants** *Eucalyptus* (Myrtaceae).

**Widespread**



*Example localities:* Dry, Eucalypt communities within region

*Main Season:* November to March

**Distribution** New South Wales, SE & C Queensland, South Australia, Australian Capital Territory and Victoria.

**Similar species** Other *Tropidoderus* species.

**IUCN** [www.iucnredlist.org/species/80227932/80228015](http://www.iucnredlist.org/species/80227932/80228015)



*Tropidoderus childrenii* female [RMC]





*Tropidoderus childrenii* pair, female on left [PDB]

***Extatosoma tiaratum***  
**Macleay's Spectre**

**Body length** male 75–115 mm., female 100–160 mm.

**Female** Body broad, spiny, with spiny leaf-like legs; brown, green or yellowish with rudimentary wings, shorter than leaf-like forewings (sometimes mottled green and whitish; lichen form). Head large, hind part conical and spiny. Underside of body and lateral surfaces rather spinnier than upperside. Abdominal segments 5-7 with foliose expansions laterally; equipped with several spines. Operculum exceeding end of abdomen; cerci very short.

**Male** Body brown, slenderer than female and less spiny. Head with three conspicuous ocelli. Mesonotum with whitish lateral margin. Hindwings (black or greyish and white chequered) a little short or reaching/just exceeding end of abdomen. Poculum boat-shaped, reaching end of abdomen.

**Habitat** Rainforests, riparian habitats, parks and gardens.

**Foodplants** *Eucalyptus* (Myrtaceae) *Callicoma* (Cunoniaceae), *Caesalpinia sepiaria* (Fabaceae) and *Rosa* sp. (Rosaceae), *Backhousia myrtifolia* (Myrtaceae), *Psidium guajava* (Myrtaceae), *Diploglottis australis* (Sapindaceae).

**Widespread**



*Example localities:* Binna Burra, Ankida, Springbrook, Goomburra, Rosins Lookout Conservation Park (Beechmont)

*Main Season:* October to April



*Extatosoma tiaratum* mating pair [RMC]



**Distribution** New South Wales, Queensland. There is a 2015 record from South Australia, the latter possibly an escapee or release from culture stock. An old record from Lord Howe Island is possibly an erroneous locality, possibly also an old record from Victoria.

**Similar species** None.

**Notes** Produces a sweet, nutty smell if disturbed.

**IUCN** [www.iucnredlist.org/species/80201037/104413678](http://www.iucnredlist.org/species/80201037/104413678)



*Extatosoma tiaratum* 1st instar nymph [PDB], which chases about rather ant-like, before feeding; said to resemble a *Leptomyrmex* ant. These differ in colour. Lacking the black head of 1st instar nymphs from northern Queensland, which are said to mimic other *Leptomyrmex* species



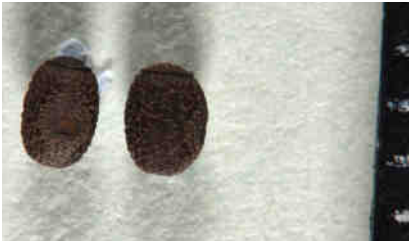
An ant from Springbrook: *Leptomyrmex* sp.



*Extatosoma tiaratum* green female [RMC]

**Eggs of phasmids not illustrated above**

(where available, scale bar shown = 1 mm), showing different shape of egg capsules within genera



*Candovia annulata*



*Candovia granulosa*



*Candovia robinsoni*



*Candovia strumosa*



*Gibbernecrosia kooymani*  
[Photo by Stephen Petrović]



*Acrophylla enceladus*



*Acrophylla titan*



*Anchiale austrotessulata*



*Ctenomorpha marginipennis*



*Eurycnema goliath*



*Onchestus gorgus*



*Didymuria violescens*



*Parapodacanthus ailaketoae*



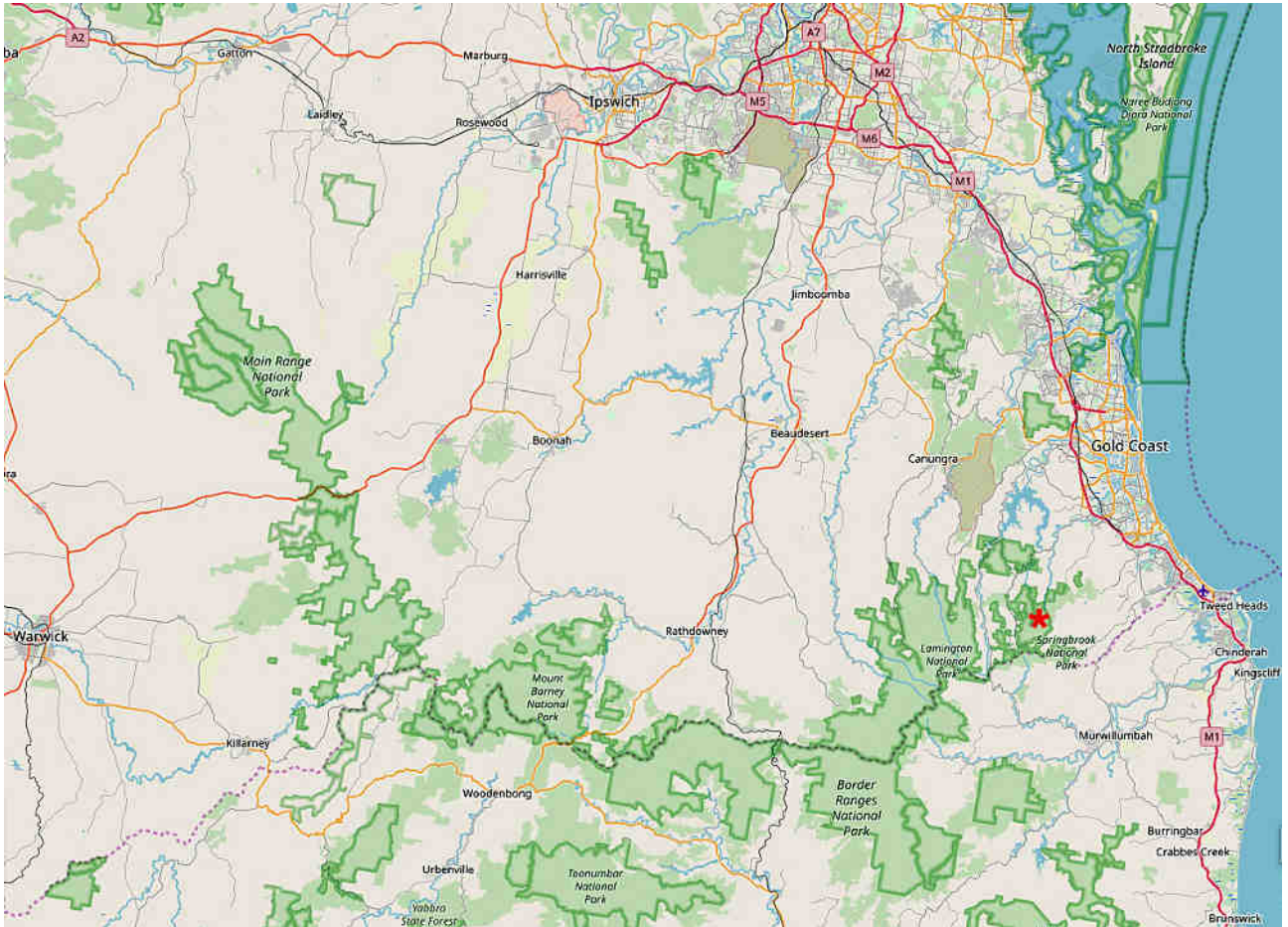
*Tropidoderus childrenii*



*Extatosoma tiaratum*



## East Coast Australia map, showing National Parks

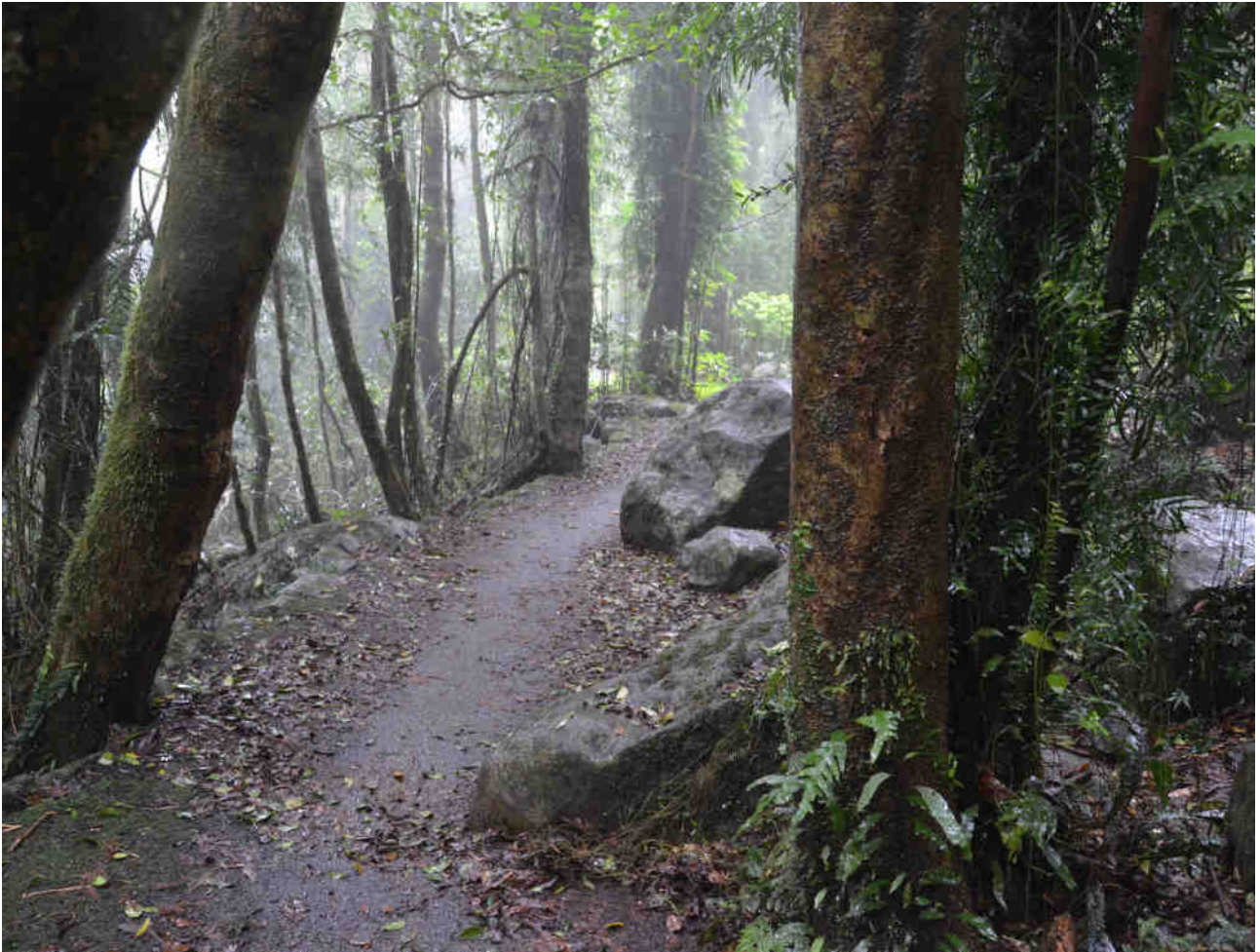


## Habitat photos



Binna Burra [PDB]





Springbrook, Best of the Best Lookout



Springbrook [RMC]



## Checklist of phasmids from Springbrook, Binna Burra or nearby

These include reference to the number of described Australian species and how many are present in Springbrook, Binna Burra and surrounds. Further work on Australian species from other areas is on-going, so it is expected the number of species in some of these genera, will soon increase. Full taxonomic details are included in Brock et al (2019).

### Family Lonchodidae

#### Subfamily Necrosiinae

***Candovia* Stål, 1875<sub>1</sub>** [9 Australian spp. | 4 spp. in Springbrook/Binna Burra]

*C. annulata* (Brunner, 1907) Banded-legged Stick-insect

*C. granulosa* (Brunner, 1907) Granulated Stick-insect

*C. robinsoni* Brock & Hasenpusch, 2007 Robinson's Stick-insect

*C. strumosa* (Redtenbacher, 1908) Richmond River Stick-insect

*C. sp n.*<sub>1</sub> description awaited

<sub>1</sub> This genus is being revised following DNA-barcoding. New species are being described and some species will be transferred to other genera in due course.

***Gibbernecrosia* Brock, Hasenpusch & Petrović, 2019** [1 Australian sp. | 1 sp. in Springbrook/Binna Burra]

*G. kooymani* Brock, Hasenpusch & Petrović, 2019 Kooyman's Stick-insect

### Family Phasmatidae

#### Subfamily Phasmatinae

***Acrophylla* Gray, 1835** [7 Australian spp. | 3 spp. in Springbrook/Binna Burra]

*A. cookorum* Brock & Coupland, sp. n. Cook's Stick-insect

*A. enceladus* (Gray, 1835) Giant Acrophylla Stick-insect

*A. titan* (Macleay, 1826) Titan Stick-insect

***Anchiale* Stål, 1875<sub>2</sub>** [2 Australian spp. | 1 spp. in Springbrook/Binna Burra]

<sub>2</sub> This genus (very close to *Acrophylla*) is in need of revision; it is likely that several cryptic species occur across a vast geographical range.

*A. austrotessulata* Brock & Hasenpusch, 2007 Tessellated Stick-insect

***Ctenomorpha* Gray, 1833** [2 Australian spp. | 1 sp. in Springbrook/Binna Burra]

*C. marginipennis* Gray, 1833 Margined-winged Stick-insect

***Eurycnema* Gray, 1833** [2 Australian spp. | 1 sp. in Springbrook/Binna Burra]

*E. goliath* (Gray, 1834) Goliath Stick-insect

***Onchestus* Stål, 1877** [2 Australian spp. | 1 sp. in Springbrook/Binna Burra]

*O. gorgus* (Westwood, 1859) Gorgon Stick-insect

#### Subfamily Pachymorphinae

***Pachymorpha* Gray, 1835** [4 Australian spp. | 1 sp. in Springbrook/Binna Burra]

*P. springbrookensis* Brock & Coupland, sp. n. Springbrook Pachymorpha Stick-insect

#### Subfamily Tropidoderinae

***Didymuria* Kirby, 1904** [2 Australian spp. | 1 sp. in Springbrook/Binna Burra]

*D. violescens* (Leach, 1814) Spur-legged Stick-insect

***Micropodacanthus* Brock & Hasenpusch, 2007** [3 Australian spp. | 1 sp. in Springbrook/Binna Burra]  
*M. tweedae* Brock & Coupland, sp. n. Tweed's Stick-insect

***Parapodacanthus* Brock, 2003** [2 Australian spp. | 1 sp. in Springbrook/Binna Burra]  
*P. ailaketoae* Brock & Monteith, 2018 Alia Keto's Stick-insect

***Tropidoderus* Gray, 1835** [5 Australian spp. | 1 sp. in Springbrook/Binna Burra]  
*T. childrenii* (Gray, 1833) Children's Stick-insect

### Subfamily Extatosomatinae

***Extatosoma* Gray, 1833** [1 Australian sp. | 1 sp. in Springbrook/Binna Burra]  
*E. tiaratum* (Macleay, 1826) Macleay's Spectre

### Species potentially found in Springbrook, Binna Burra or surrounds

The following species are potentially considered possible in Springbrook, Binna Burra or surrounds: Lonchodidae, Subfamily Necrosiinae - *Candovia* Stål, 1875: *C. aberrata* (Brunner, 1907), *Mesaner* Redtenbacher, 1908: *M. sarpedon* (Westwood, 1859) Dark-winged Stick-insect; Phasmatidae, Subfamily Phasmatinae - *Paronchestus* Redtenbacher, 1908: *P. pasimachus* (Westwood, 1859) Slender-dark Stick-insect; Subfamily Tropidoderinae: *Podacanthus* Gray, 1833: *P. typhon* Gray, 1833 Large Pink-winged Stick-insect, *P. viridiroseus* Gray, 1835 Red-winged Stick-insect, *P. wilkinsoni* Macleay, 1881 Ringbarker Stick-insect; Subfamily Xeroderinae - *Xeroderus* Gray, 1835: *X. kirbyi* Gray, 1835 Kirby's Stick-insect.



*Candovia aberrata* female [PDB]



*Candovia aberrata* male [PDB]



*Paronchestus pasimachus* female [PDB]





*Mesaner sarpedon* female [RMC]



*Xeroderus kirbyi* female [RMC]



Example *Podacanthus* sp. *P. viridiroseus* female [RMC]

## Discussion

Tropical North Queensland is particularly rich in phasmids (Brock & Hasenpusch, 2009), but the number of new, spectacular phasmid species found in Springbrook National Park (SE Queensland) alone (4 mentioned in this paper, and 2 others described in 2018/19) let alone the surrounds, is astonishing in an area well known by entomologists. Searching for these impressive insects can be an exciting and fulfilling undertaking. It can be especially engaging for children who often find them fascinating. It is important to encourage an enduring respect for these valuable ecosystems in the younger generations if they are to survive the encroachment of man in years to come. The results of this article will hopefully encourage others to undertake more detailed surveys in Australia and elsewhere, to add to our knowledge on phasmids and the environment; there is a wealth of valuable museum material for specialists to examine in major Australian museums.

On-going molecular work should assist in identifying cryptic species and clarify the taxonomy of some genera; some results are awaited and/or further material of other species is being obtained for comparison purposes.

## Acknowledgements

We wish to thank the following contacts for their assistance, including fieldwork: Aila Keto and Keith Scott, including arranging PDB's and RMC's stays in Springbrook [Aila and Keith have been the drivers in efforts to safeguard tracts of land on the mountain (and rainforests elsewhere in Australia, see <https://rainforest.org.au/people.html>) and continue to explore and document the fauna that occurs there], Ceris and Mark Ash (Springbrook Wildlife Appreciation Group), Helen Brock (2016 visit with PDB), Colleen Foelz (assisted RMC on numerous trips), Geoff Monteith (2016 visit with PDB, including organising collecting permits), Noelene Tweed (2017 visit with PDB), Brian Cox, Oskar Conle, Jack Hasenpusch, Braxton Jones, Karin Koch, Barbara Mantovani, David Rentz and Beth Ripper. Volunteers of the Springbrook Rescue project, within the Australian Rainforest Conservation Society took photographs of phasmids encountered and routed these through Aila Keto. The maps were prepared using the mapping facility on the Atlas of Living Australia.

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# A new species of *Onchestus* Stål (Phasmida: Phasmatidae) from Eungella, Queensland

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## Abstract

Studies on the seldom reported, Australian genus *Onchestus* have revealed a new species from Eungella National Park in Queensland: *Onchestus ripperae*, which is described and figured, including the egg. Keys are provided to compare it with the two other known *Onchestus* species.

## Key words

*Onchestus*, *O. ripperae* new species, Australia

## Introduction

The genus *Onchestus* Stål, 1877, has occasionally been mentioned in the literature since being revised by Brock & Hasenpusch (2006). Although phasmids are generally understudied, enthusiasts of the Australian phasmid fauna can refer to Brock and Hasenpusch (2009), which has encouraged some further studies. This includes extensive searches in several Queensland rainforests by Beth Ripper in November and December 2015 (Ripper, 2016a & b, 2017), who kindly provided data and photographs to the authors. PDB first found what turned out to be a male nymph of a new *Onchestus* species in Eungella National Park (about 80 km west of Mackay) on 19 November 2009; this was reared by JWH and is the holotype. Beth Ripper found a further nymph and adult female in the same area (eggs deposited), which were photographed, but not collected.

The type species of *Onchestus*, *O. gorgus* (Westwood, 1859) from southeast Queensland and New South Wales is only referenced in checklists and similar (Brock et al, 2020) and *O. rentzi* from northern Queensland surprisingly remained undetected until 2006. *O. ripperae* **sp. nov.** from Eungella c.750 km further south (c.400 km if Atlas of Living Australia records from Townsville area are accurate), was first observed in 2009 as mentioned above, even though the area is much visited by naturalists looking to observe Platypus, endemic frogs and other wildlife. The authors have other, likely endemic phasmids to describe from Eungella, which is the longest continual area of subtropical rainforest in Australia.

## Abbreviations for depositories

NHUK – Natural History Museum, London

QM - Queensland Museum, Brisbane, Australia

## *Onchestus* Stål

*Onchestus* Stål, 1877: 63.

Type species.— *Lopaphus gorgus* Westwood, 1859, by original designation.

*Onchestus*; Kirby, 1904: 394, Redtenbacher, 1908: 462, Otte and Brock 2005: 232, Brock and Hasenpusch, 2006: 21, also 2009: 169. For other references, see Brock et al, 2020.

Characteristics of the genus. — **Description.** Medium sized phasmids, body wrinkled and broad, particularly in female. Head, pronotum and mesonotum tuberculate, possibly with some spines. Head with or without pair of long spine-like protuberances slanting backwards (male) and sometimes with



**Key to adults of *Onchestus* (Figs 1-6)**

| Species                              | Head                                                                                             | Hindwings                                                                                                                                                                                         | Operculum (female)      |
|--------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <i>O. gorgus</i> (Figs. 1-2)         | Lacking pair of large tuft-like protuberances in both sexes.                                     | Short, not reaching end of 3rd abdominal segment in male, shorter than combined length of head to mesonotum in female (reaching about end of 4th abdominal segment).                              | Slight basal lobe.      |
| <i>O. rentzi</i> (Figs. 3-4)         | Usually with pair of large tuft-like protuberances, pointing sharply backwards in male.          | Moderately long, reaching beyond end of 5th abdominal segment in male (perhaps reaching end of segment 6), exceeding combined length of head to mesonotum in female.                              | Conspicuous basal lobe. |
| <i>O. ripperae</i> sp. n. (Figs 5-6) | As far as known with pair of large tuft-like protuberances, slightly pointing backwards in male. | Very short in male, same length as forewings i.e. only reaching end of median segment, shorter than combined length of head to mesonotum in female (just exceeding end of 3rd abdominal segment). | Conspicuous basal lobe. |

a pair of large tuft-like protuberances (female), which is variable within species and may be absent. Triangular central slightly raised area between eyes, which are large; three ocelli present. Antennae with 22–26 segments, reaching or exceeding length of fore femora; basal segment very broadened. Legs long, all femora with pair of apical spines. Central carina of fore femora sometimes very dentate; mid- and hind femora less dentate, but with variable number and lobes and/or crests, largest on mid femora (absent in male of one species). Forewings elongate, leaf-like. Hind wings very short or almost full-sized (male), shorter than normal in females; pre-anal part of hind wings with conspicuous black base, hind wings black and white tessellated to a varying degree. Operculum elongate, just exceeding end of abdomen (male poculum (subgenital plate)) about half the length of 9th abdominal segment). Cerci short, almost concealed in female, longer in male. Egg: Unusually shaped large capsule, with four sides when viewed from operculum. Capitulum small, on a short stalk. Micropylar plate with central, oval area, inset into the capsule. Capsule with numerous ridges and pits.

**Distribution** Australia.

**Notes** Two other species described by Thunberg, 1815, with locality unknown are unlikely to belong to *Onchestus*, but were transferred to it by Kirby (1904). An undescribed species from Yamdena Island, Indonesia also belongs to *Onchestus*, or has a close affinity; this is so far known from a single male in NHMUK (the female escaped, Tony Whitten, pers. com. 13 November, 2007).



Figure 1. *Onchestus gorgus* mating pair [PDB]





Figure 2. *Onchestus gorgus* female startle display [PDB]

### ***Onchestus gorgus* (Westwood, 1859)**

#### **Gorgon Stick-insect**

(Figs. 1-2, 7)

*Lopaphus gorgus* Westwood, 1859: 102, pl. 11: 4. Syntypes 2 females, Australia (New South Wales): Richmond River (NHMUK).

*Onchestus gorgus*: Kirby, 1904: 394; Otte and Brock 2005: 232; Brock and Hasenpusch, 2006: 23 & 2009: 113.

**Distribution** Southeast Queensland: Mt. Glorious, McPherson Range, Boombana in D'Aguilar Range, 15.xi.2011, P.D. Brock, G. Monteith et al, Springbrook, Purling Brook, 04.ii.2017 P.D. Brock, R. Coupland & N. Tweed et al (also see Brock & Coupland, in press) [Atlas of Living Australia [ALA] 6 records from 2014 to 2020, including: Booroobin, Nr. Kenilworth, Scenic Rim] and New South Wales: Richmond River (type locality), Mt Warning, 15.ii.2017, B. Jones [ALA: Gloucester River Campsite, 24.iii.2014]; seldom recorded.

### ***Onchestus rentzi* Brock & Hasenpusch, 2006**

#### **[Rentz's Stick-insect]**

(Figs. 3-4, 8)

*Onchestus rentzi* Brock and Hasenpusch, 2006: 23. Holotype male, Australia (Queensland): Polly Creek, Garradunga, Innisfail, 15.xi.2001, J. Hasenpusch (QM). Paratypes of both sexes are deposited in QM, NHMUK and P.D. BROCK Coll.





Figure 3. *Onchestus rentzi* male [PDB]





Figure 4. *Onchestus rentzi* female [Beth Ripper]



Figure 5. *Onchestus ripperae* male [PDB]



Figure 6. *Onchestus ripperae* female [Beth Ripper]

**Distribution** Northern Queensland: Bones Knob, Cairns, Capre Tribulation, Garradunga, Kuranda, Mossman, Mt Halifax, Mt. Lewis, Nr Tully. Also found in Babinda Boulders – Devil’s Hole Track, Davies Creek National Park, Goldsborough Walking Trail, Home Rule Campsite, Jumrum Creek, Mt Sorrow, Speewah Campsite, in xi/xii.2015 (Beth Ripper, pers. comm., 2016) and further records in ALA, indicating it is fairly widespread.

***Onchestus ripperae* sp. n.**

**[Ripper’s Stick-insect]**

(Figs. 5-6, 9-24)

Holotype male, QUEENSLAND, Eungella NP, Broken River, 21.1681°S 148.5044°E, ex. nymph 20.xi.2009, P.D Brock, DNA project JH-0098 (reared by J.W. Hasenpusch, reached adult ii.2010) [T246825] (QM).

**Description** Brown, medium sized insect of stout appearance in female, with black hindwings. Male (Figs. 5, 10-17): Head. Slightly longer than wide, slightly behind eyes with pair of robust broad-based central spines (2.5 mm high) slightly pointing backwards; eyes large and three ocelli present. Semi-circular depression formed of tubercles between eyes to front of head; several other sparse tubercles also present. Antennae slightly hairy and long, with 26 segments (even so not reaching end of tibiae); basal segment broader than others and more than twice length of segment 2, which is slightly broader, but about same length as segment 3. The 4th segment is small, less than half length of 3rd, the remainder mainly longer than segment 3.

*Thorax.* Pronotum shorter than head, with central impression and a few lateral tubercles. Mesonotum 6x length of pronotum, with small, sparse tubercles of similar size; mainly laterally and either side of central line. Metanotum and median segment combined just over half length of mesonotum, with a few sparse tubercles.

*Abdomen.* Elongate, partly ridged, with sparse tubercles of varying size. 8th abdominal segment about same length as 9th, but 10th (anal) segment noticeably smaller; tip rather hairy and triangular incised. Poculum broad, tapered to a slightly rounded tip, reaching ½ length of 9th segment. Cerci leaf-like, broader in centre, tapered to a rounded tip.

*Wings.* Forewings short, about same length as hindwings. Pre-anal part of wings with black inner margin. Hindwings black.

*Legs.* Elongate and hairy. All femora with pair of apical spines.

*Female* (Figs. 18-22, based on high resolution photographs). Stout, similar in general appearance, body wrinkled. Whole body much more tuberculate, some more spine-like. Head with pair of large 5 mm. tuft-like protuberances. Hindwings just exceeding end of 3rd abdominal segment. Abdomen with central tufts at back of segments 6 & 7. End of anal segment subtruncate. Operculum boat-like, reaching end of abdomen; with basal lobe. Legs spinier than male, notably fore femora, with lobes on mid femora and tibiae.

*Egg* (Figs. 9, 23-24). Brown, unusually shaped large capsule, with four sides when viewed from operculum. Capitulum small, on a short stalk. Micropylar plate with central, oval area, inset into the capsule. Capsule with numerous ridges and pits, in part sculptured with paler brown net-like pattern, operculum plain and heavily pitted.

*Measurements.* (in mm) for holotype male and 1 female (from photograph). Length of body: female c.110, male 90. Head: female 7, male 4. Antennae: female 30, male 46. Pronotum: female 6, male 3.



Mesonotum: female 21, male 18. Metanotum & Median segment: female 11, male 10. Forewing: female 18, male 6. Hindwing: female 24, male 6. Femora, fore, mid, hind: female 32, 20, 32, male 29, 25, 34. Tibiae, fore, mid, hind: female 44, 28, 42, male 33, 29, 40. Cerci: female 1, male 1.5. Eggs: Capsule length 11, width 5.5, height 7.

**Etymology** Named after Beth Ripper, for her outstanding work in the field on phasmids of Queensland.

**Distribution** The type is from central Queensland where it is known from the tourist locality of Eungella National Park and may be endemic. Beth Ripper found them in the same locality.

### Key to eggs of *Onchestus* (Figs 7-9)

| Species                           | Shape of capsule when viewed laterally with micropylar plate on right (see Figs 1-3) | Capsule sculpturing                      |
|-----------------------------------|--------------------------------------------------------------------------------------|------------------------------------------|
| <i>O. gorgus</i> (Fig 7)          | Keels very swollen; upper left keel pronounced.                                      | Dark uneven lines; some pits.            |
| <i>O. rentzi</i> (Fig 8)          | Slight upper left keel but can be sharply defined, as shown.                         | Moderately pitted.                       |
| <i>O. ripperae</i> sp. n. (Fig 9) | Slight upper left keel.                                                              | Paler brown net-like pattern; some pits. |



Figure 7. *O. gorgus* [PDB]

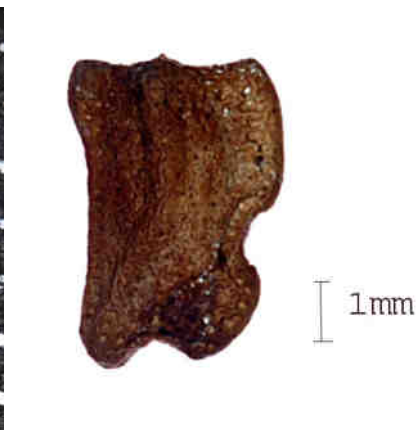


Figure 8. *O. rentzi* female [PDB]



Figure 9. *O. ripperae* sp. n. [Beth Ripper]

Habitat. Subtropical rainforest, feeding on an unknown plant, accepted *Eucalyptus* spp. in captivity.

**Note** as usual in phasmids, there can be variation in colour and spines/tubercles within a species. However, *Onchestus* is usually brown in colour, more rarely mottled or greenish; the new species is easily recognisable by its short hindwings (particularly noticeable in male), in addition to other characters.

### Discussion

The relatively few records in the literature and disjunct distribution of *Onchestus* in Queensland are similar to the distribution of two *Parapodacanthus* species, also uncommon in Australia and known from few records (Brock & Monteith, 2018). The apparent scarcity of species often relates to limited interest in phasmids, and/or the fact they are nocturnal and rarely searched for at night, so the true distribution may be much more extensive than recorded. Initial results on DNA-barcoding of the Australian phasmid fauna is given in Velonà et al. (2015), again further work is in progress, including

DNA-barcoding results for *Onchestus*.

Efforts to obtain further material of a likely *Onchestus* species from Yamdena Island have been unsuccessful, but no other known phasmids in Australia have an association with Yamdena Island, the vast majority being endemic to Australia. Even where they do have apparent links to other countries, detailed research indicates Australian phasmid species may represent valid species, for example *Nanophyllium australianum* Cumming, Le Tirant & Teemsma (2018), previously considered to be *Nanophyllium pygmaeum* Redtenbacher, 1906 from Papua New Guinea (only males are known). As an example of another oddity, *Megacrania batesii* Kirby, 1896 (type locality - Solomon Isles) is thought to also occur in New Guinea. It is probable that molecular work may help determine what is at present known in Australia as *M. batesii* as yet another Australian endemic.

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Figure 10. *Onchestus ripperae* holotype male as collected (nymph) [PDB]





Figure 11. *Onchestus ripperae* holotype male lateral view [PDB]



Figure 12. *Onchestus ripperae* holotype male head and thorax dorsal view [PDB]



Figure 13. *Onchestus ripperae* holotype male head and thorax lateral view [PDB]



Figure 14. *Onchestus ripperae* holotype male mid-body including wings [PDB]



Figure 15. *Onchestus ripperae* holotype male end of abdomen dorsal view [PDB]



Figure 16. *Onchestus ripperae* holotype male end of abdomen lateral view [PDB]



Figure 17. *Onchestus ripperae* holotype male end of abdomen ventral view [PDB]



Figure 18. *Onchestus ripperae* female dorsal view [Beth Ripper]



Figure 19. *Onchestus ripperae* female lateral view [Beth Ripper]





Figure 20. *Onchestus ripperae* female head lateral view [Beth Ripper]



Figure 21. *Onchestus ripperae* female end of abdomen dorsal view [Beth Ripper]



Figure 22. *Onchestus ripperae* female end of abdomen lateral view [Beth Ripper]



Figure 23. *Onchestus ripperae* egg [Beth Ripper]



Figure 23. *Onchestus ripperae* egg from above, showing operculum [Beth Ripper]



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### Distribution map showing *Onchestus* species



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# Checklist of stick insects (Insecta: Phasmatodea) of North America, with three new records for Nuevo León, México

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## Abstract

An updated checklist of stick insects (Insecta: Phasmatodea) of Canada, the USA and México is presented, including 105 species grouped in 21 genera and seven families. Geographical records at state (México and the USA) and province (Canada) levels from the literature are provided for most species. New records for *Diapheromera (Rhabdoceratites) covilleae* Rehn & Hebard, 1909, *Megaphasma denticrus* (Stål, 1875) and *Parabacillus coloradus* (Scudder, 1893) are also made for the state of Nuevo León, México.

## Key words

Canada, *Diapheromera (Rhabdoceratites) covilleae*, Diapheromeridae, Heteronemiidae, *Megaphasma denticrus*, *Parabacillus coloradus*, USA

# Listado de insectos palo (Insecta: Phasmatodea) de Norteamérica, con tres nuevos registros para Nuevo León, México

## Resumen

Se presenta un listado de insectos palo (Insecta: Phasmatodea) de Canadá, EE. UU. y México, siendo registradas 105 especies agrupadas en 21 géneros y siete familias. Se proveen registros geográficos a nivel de estado (México y EE.UU.) y provincia (Canadá) provenientes de la literatura para la mayoría de las especies. También se hacen nuevos registros de *Diapheromera (Rhabdoceratites) covilleae* Rehn & Hebard, 1909, *Megaphasma denticrus* (Stål, 1875) y *Parabacillus coloradus* (Scudder, 1893) para el estado de Nuevo León, México.

## Introduction

Phasmatodea are terrestrial and mostly nocturnal herbivores, which have a predominantly tropical distribution; they rely heavily on imitating various parts of plants in order to avoid detection from predators (Bradler Buckley, 2018), although some species which have strong chemical defences can show aposematic colorations (Hoskisson, 2000).

America, a continent conformed by two contrasting biogeographical regions, has a very diverse phasmid fauna. However, the diversity of stick insects in these two regions is not equal, being higher in the Neotropical realm (roughly, Central America, South America, the West Indies, and the southern portion of México) than in the Nearctic realm (roughly, Canada, the USA and central and northern México, including the Baja California peninsula) (Bradler Buckley, 2018). The North American region, integrated by Canada, the USA and México, shows a mixture of both Neotropical and Nearctic taxa.

A list of the species found in Canada and the USA can be found in Arment (2006), and a list of the species found in México can be found in López-Mora & Llorente-Bousquets (2018). The latter does not include state records and in order to improve this, an updated checklist for the species of stick insects of North America is provided, including state (for México and the USA) and province (for Canada) records from the literature. New records are also made for three species of stick insects from the Mexican state of Nuevo León.

## Methodology

The following works were consulted for the making of the checklist: Arakelian (2008), Arment (2006), Brock (1998, 1999), Brock et al. (2016), Caudell (1902, 1903, 1913), Conle et al. (2007), Escoto-Rocha et al. 2013, Gorochoy & Berezin (2008), Headrick & Wilen, 2011, Hebard (1922, 1932, 1934a, 1934b, 1937, 1942), Hennemann & Conle (2012a, 2012b), Hennemann et al. (2016), Law & Crespi (2002), López-Mora & Llorente-Bousquets (2018), López-Mora & Martínez-Cervantes (2021), Mariño & Márquez (1983), Miskelly & Paiero (2019), Otte (1978), Redtenbacher (1906, 1907, 1908), Rehn (1904a, 1904b, 1909), Rehn & Hebard (1909a, 1909b, 1909c), Rueda-Salazar & Cano-Santana (2009), Sandoval & Vickery (1996, 1999), Scudder (1901), Shelford (1908), Stidham & Stidham (2018), Vickery (1993, 1997), Vickery & Sandoval (1997, 1999, 2001) and Zompro (2000, 2001a, 2001b, 2005).

The three new records of stick insects here presented are from collections carried out in different localities in the state of Nuevo León; all the specimens were caught manually and are deposited in the entomological lab of the Facultad de Ciencias Forestales (FCF) of the Universidad Autónoma de Nuevo León (UANL) located in Linares, Nuevo León, México. The genus (and subgenus) of the specimens was determined using the keys present in López-Mora & Llorente-Bousquets (2018); and the species were later determined by comparing the specimens to the descriptions of the species of their respective genus or subgenus: *Megaphasma* (Cadell, 1903: 878; Zompro, 2001a: 212), *Parabacillus* (Caudell, 1902; Hebard, 1934b) and *Rhabdoceratites* (Hebard, 1932: 219, 1942: 293; Rehn & Hebard, 1909b: 126).

## Results

### I. Checklist of North American stick insects (Insecta: Phasmatodea)

In the listing, “?” is used when a state or a more precise locality has not been mentioned for the species e.g. “Mexiko” as in the case of *Bacteria foliolata* Redtenbacher, 1908; it is also used when the locality given is deemed too generic to be associated with any one state e.g. “Montes mexicani” as in the case of *Pseudosermyle tolteca* (Saussure, 1859). “\*” is used when the literature (Arment, 2006) mentions that the state record is dubious. And “\*\*” is used for the new state records.

#### Family Diapheromeridae Kirby, 1904

##### Genus *Bacteria* Berthold, 1827

1. *Bacteria aetolus* Westwood, 1859 México (Sinaloa)
2. *Bacteria foliolata* Redtenbacher, 1908 México (?)
3. *Bacteria frustrans* Redtenbacher, 1908 México (Colima)
4. *Bacteria horni* Redtenbacher, 1908 México (?)
5. *Bacteria nova* Redtenbacher, 1908 México (?)
6. *Bacteria quadrispinosa* Redtenbacher, 1908 México (Sinaloa)
7. *Bacteria reclusa* (Brunner von Wattenwyl, 1907) México (?)

##### Genus *Bostra* Stål, 1875

8. *Bostra jaliscensis* Rehn, 1904 México (Jalisco)
9. *Bostra margaritata* Redtenbacher, 1908 México (?)
10. *Bostra procoppi* Redtenbacher, 1908 México (?)
11. *Bostra saussurei* Redtenbacher, 1908 México (?)
12. *Bostra similis* Redtenbacher, 1908 México (Jalisco)
13. *Bostra tridenticulata* Redtenbacher, 1908 México (Guerrero)



**Genus *Diapheromera* Gray, 1835**

14. *Diapheromera* (*Diapheromera*) *arena* Stidham & Stidham, 2018 USA (New Mexico, Texas)
15. *Diapheromera* (*Diapheromera*) *arizonensis* Caudell, 1903 USA (Arizona, Texas)
16. *Diapheromera* (*Diapheromera*) *calcarata* (Burmeister, 1838) México (Chihuahua, Jalisco, Sonora)
17. *Diapheromera* (*Diapheromera*) *carolina* Scudder, 1901 USA (Georgia, North Carolina, South Carolina)
18. *Diapheromera* (*Diapheromera*) *erythropleura* Hebard, 1923 México (Sinaloa)
19. *Diapheromera* (*Diapheromera*) *femorata* (Say, 1824) Canada (Manitoba, Ontario, Quebec), and USA (Alabama, Arizona, Arkansas, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, West Virginia, Wisconsin, Washington)
20. *Diapheromera* (*Diapheromera*) *kevani* Vickery, 1997 México (Baja California, Baja California Sur)
21. *Diapheromera* (*Diapheromera*) *nitens* Brunner von Wattenwyl, 1907 México (?)
22. *Diapheromera* (*Diapheromera*) *persimilis* Caudell, 1904 USA (Arkansas, Kansas, Louisiana, Nebraska, Oklahoma, Texas)
23. *Diapheromera* (*Diapheromera*) *petita* Vickery, 1997 México (Baja California, Baja California Sur)
24. *Diapheromera* (*Diapheromera*) *tamaulipensis* Rehn, 1909 USA (New Mexico, Texas) and México (Coahuila, Tamaulipas)
25. *Diapheromera* (*Diapheromera*) *torquata* Hebard, 1934 USA (Texas)
26. *Diapheromera* (*Diapheromera*) *velii* Walsh, 1864 USA (Colorado, Indiana, Iowa, Kansas, Louisiana, Minnesota, Missouri, Nebraska, New Mexico, Oklahoma, South Dakota, Texas) and México (Coahuila, Nuevo León, San Luis Potosí)
  - *Diapheromera* (*Diapheromera*) *velii eucnemis* Hebard, 1937 USA (New Mexico, Texas) and México (Nuevo León)
  - *Diapheromera* (*Diapheromera*) *velii velii* Walsh, 1864 USA (Colorado, Indiana, Iowa, Kansas, Louisiana, Minnesota, Missouri, Nebraska, New Mexico, Oklahoma, South Dakota, Texas), México (Coahuila, San Luis Potosí)
27. *Diapheromera* (*Rhabdoceratites*) *beckeri* Kaup, 1871 México (?)
28. *Diapheromera* (*Rhabdoceratites*) *covilleae* Rehn & Hebard, 1909 USA (Arizona, New Mexico, Texas) and México (Baja California Sur, Coahuila, Nuevo León\*\*)

**Genus *Dubiophasma* Zompro, 2001**

29. *Dubiophasma longicarinatum* Zompro, 2001 México (Oaxaca)

**Genus *Manomera* Rehn & Hebard, 1907**

30. *Manomera blatchleyi* (Caudell, 1905) USA (Connecticut, Delaware, Illinois, Indiana, Iowa, Kansas, Maryland, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Virginia, Wisconsin)
  - *Manomera blatchleyi atlantica* Davis, 1923 USA (New York)
  - *Manomera blatchleyi blatchleyi* (Caudell, 1905) USA (Connecticut, Delaware, Illinois, Indiana, Iowa, Kansas, Maryland, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Virginia, Wisconsin)
31. *Manomera brachypyga* Rehn & Hebard, 1914 USA (Florida)
32. *Manomera tenuescens* (Scudder, 1900) USA (Alabama, Florida, North Carolina, South Carolina)

**Genus *Megaphasma* Caudell, 1903**

33. *Megaphasma denticrus* (Stål, 1875) USA (Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, Texas, Wisconsin) and México (Nuevo León\*\*, Veracruz)
34. *Megaphasma furcatum* (Brunner von Wattenwyl, 1907) México (Guerrero)

**Genus *Ocnophila* Brunner von Wattenwyl, 1907**

- 35. *Ocnophila ciliata* Brunner von Wattenwyl, 1907 México (Guerrero)
- 36. *Ocnophila submutica* Brunner von Wattenwyl, 1907 México (Baja California)

**Genus *Phanocles* Stål, 1875**

- 37. *Phanocles burkartii* (De Saussure, 1868) México (Veracruz)
- 38. *Phanocles zehntneri* (Redtenbacher, 1908) México (Veracruz)

**Genus *Pseudosermyle* Caudell, 1903**

- 39. *Pseudosermyle arbuscula* (Rehn, 1902) USA (California)
- 40. *Pseudosermyle carinulata* (Brunner von Wattenwyl, 1907) México (Ciudad de México, Estado de México, Durango, Guerrero, Puebla)
- 41. *Pseudosermyle catalinae* Rentz & Weissman, 1981 USA (California)
- 42. *Pseudosermyle chorreadero* Conle et al. 2007 México (Chiapas)
- 43. *Pseudosermyle claviger* Conle et al. 2007 México (Veracruz)
- 44. *Pseudosermyle elongata* (Brunner von Wattenwyl, 1907) México (Guerrero, Jalisco, Nayarit)
- 45. *Pseudosermyle godmani* (Brunner von Wattenwyl, 1907) México (Guerrero, Jalisco)
- 46. *Pseudosermyle incongruens* (Brunner von Wattenwyl, 1907) México (Veracruz)
- 47. *Pseudosermyle inconspicua* (Brunner von Wattenwyl, 1907) México (?)
- 48. *Pseudosermyle neptuna* (Brunner von Wattenwyl, 1907) México (Baja California Sur)
- 49. *Pseudosermyle olmeca* (De Saussure, 1870) México (?)
- 50. *Pseudosermyle phalangiphora* (Rehn, 1907) México (Campeche, Quintana Roo, Tabasco, Veracruz, Yucatán)
- 51. *Pseudosermyle procera* Conle et al. 2007 México (Veracruz)
- 52. *Pseudosermyle straminea* (Scudder, 1900) USA (Arizona, Arkansas\*, California, Colorado, Illinois\*, Nevada, New Mexico, Oklahoma, Texas, Utah)
- 53. *Pseudosermyle striatus* (Burmeister, 1838) USA (Texas\*) and México (Veracruz)
- 54. *Pseudosermyle strigata* (Scudder, 1900) USA (Alabama, Arizona, Arkansas, Louisiana, Mississippi, Texas) and México (Aguascalientes, Jalisco, Tamaulipas)
- 55. *Pseudosermyle strigiceps* (Kaup, 1871) México (?)
- 56. *Pseudosermyle tenuis* Rehn & Hebard, 1909 USA (Texas)
- 57. *Pseudosermyle tolteca* (De Saussure, 1859) México (?)
- 58. *Pseudosermyle tridens* (Burmeister, 1838) México (Aguascalientes, Ciudad de México, Guerrero, Jalisco, Morelos, Nayarit)
- 59. *Pseudosermyle truncata* Caudell, 1903 USA (Arizona, California)

**Genus *Sermyle* Stål, 1875**

- 60. *Sermyle bidens* (Kaup, 1871) México (Puebla)
- 61. *Sermyle elegantor* (Brunner von Wattenwyl, 1907) México (Guerrero)
- 62. *Sermyle mexicana* (De Saussure, 1859) USA (Texas) and México (Veracruz)
- 63. *Sermyle saussurei* Stål, 1875 México (?)
- 64. *Sermyle tuberculata* (Caudell, 1904) USA (Texas)

**Family Heteronemiidae Rehn, 1904****Genus *Heteronemia* Gray, 1835**

- 65. *Heteronemia contracta* (Brunner von Wattenwyl, 1907) México (Jalisco)
- 66. *Heteronemia foliata* (Brunner von Wattenwyl, 1907) México (Guerrero)
- 67. *Heteronemia forcipata* (Brunner von Wattenwyl, 1907) México (?)
- 68. *Heteronemia oaxacae* Hebard, 1932 México (Oaxaca)
- 69. *Heteronemia unidentatus* (Brunner von Wattenwyl, 1907) México (Jalisco, Veracruz)



**Genus *Parabacillus* Caudell, 1903**

70. *Parabacillus coloradus* (Scudder, 1893) USA (Arizona, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, Utah, Wyoming) and México (Aguascalientes, Michoacán, Nuevo León\*\*)
71. *Parabacillus hesperus* Hebard, 1934 USA (Arizona, California, Nevada, New Mexico\*, Oregon, Texas\*, Utah)
72. *Parabacillus palmeri* (Caudell, 1902) México (Durango, Jalisco)

**Family Lonchodidae Brunner von Wattenwyl, 1893**

**Genus *Carausius* Stål, 1875**

73. *Carausius morosus* Brunner von Wattenwyl, 1907 introduced to USA (California)

**Family Phasmatidae Leach, 1815**

**Genus *Haplopus* Burmeister, 1838**

74. *Haplopus scabricollis* (Gray, 1835) USA (Florida)

**Genus *Hypocyrtus* Redtenbacher, 1908**

75. *Hypocyrtus postpositus* Redtenbacher, 1908 México (Oaxaca, Veracruz)
76. *Hypocyrtus scythrus* (Westwood, 1859) México (Oaxaca, Veracruz)

**Genus *Medauroidea* Zompro, 2000**

77. *Medauroidea extradentata* (Brunner von Wattenwyl, 1907) introduced to USA (California)

**Family Prisopodidae Brunner von Wattenwyl, 1893**

**Genus *Prisopus* Peltier de Saint Fargeau & Seville, 1827**

78. *Prisopus berosus* Westwood, 1859 México (Oaxaca, Yucatán)

**Family Pseudophasmatidae Rehn, 1904**

**Genus *Agrostia* Redtenbacher, 1906**

79. *Agrostia rugicollis* (Gray, 1835) México (Colima)

**Genus *Anisomorpha* Gray, 1835**

80. *Anisomorpha buprestoides* (Stol, 1813) USA (Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Texas)
81. *Anisomorpha ferruginea* (Palisot de Beauvois, 1805) USA (Delaware, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Mississippi, North Carolina, Nebraska\*, Oklahoma, Pennsylvania, South Carolina, Texas and Virginia)
82. *Anisomorpha paromalus* Westwood, 1859 México (Yucatán)

**Genus *Autolyca* Stål, 1875**

83. *Autolyca elena* Gorochoy & Berezin, 2008 México (Chiapas)
84. *Autolyca pallidicornis* Stal, 1875 México (Chiapas)

**Family Timematidae Caudell, 1903**

**Genus *Timema* Scudder, 1895**

85. *Timema bartmani* Vickery & Sandoval, 1997 USA (California)
86. *Timema boharti* Tinkham, 1942 USA (California)
87. *Timema californicum* Scudder, 1895 USA (California)

88. *Timema chumash* Hebard, 1920 USA (California)
89. *Timema coffmani* Sandoval & Vickery, 1999 USA (Arizona)
90. *Timema cristinae* Vickery, 1993 USA (California)
91. *Timema dorotheae* Strohecker, 1966 USA (Arizona)
92. *Timema douglasi* Sandoval & Vickery, 1996 USA (California, Oregon)
93. *Timema genevieveae* Rentz, 1978 USA (California)
94. *Timema knulli* Stroheckeri, 1951 USA (California)
95. *Timema landelsense* Vickery & Sandoval, 2001 USA (California)
96. *Timema monikense* Vickery & Sandoval, 1998 USA (California)
97. *Timema morongense* Vickery, 2001 USA (California)
98. *Timema nakipa* Vickery, 1993 México (Baja California)
99. *Timema nevadense* Strohecker, 1966 USA (California, Nevada)
100. *Timema petita* Vickery & Sandoval, 2001 USA (California)
101. *Timema podura* Strohecker, 1936 USA (California) and México (Baja California)
102. *Timema poppense* Vickery & Sandoval, 1999 USA (California)
103. *Timema ritense* Hebard, 1937 USA (Arizona)
104. *Timema shepardi* Vickery & Sandoval, 1999 USA (California)
105. *Timema tahoe* Vickery, 1993 USA (Nevada)

## II. New records for Nuevo León, México

### *Megaphasma denticrus* (Stål, 1875)

Diapheromeridae

Figures 1-2

FCF-PHASM001: 5 males, 5 females from Cerro de la Silla (25°37'51.6"N, 100°12'27.7"W), municipality of Guadalupe. Collected during mating in 12 VII 2018 by Manuel de Luna and Roberto García Barrios at around 14:00 hr, on yellow zapote *Casimiroa greggii* (Rutaceae).

See discussion.

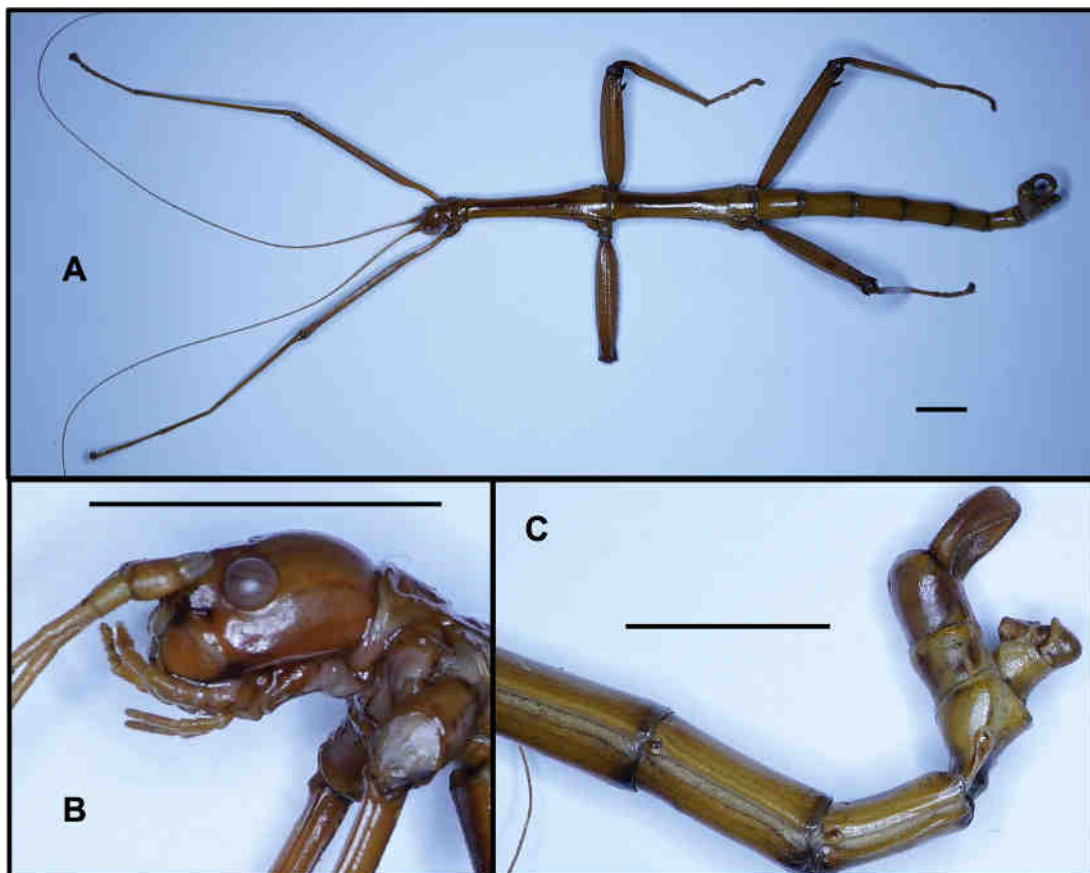


Figure 1. *Megaphasma denticrus* male (FCF-PHASM001): A, dorsal habitus. B, lateral view of head. C, lateral view of abdominal apex. Scale bar = 10mm.



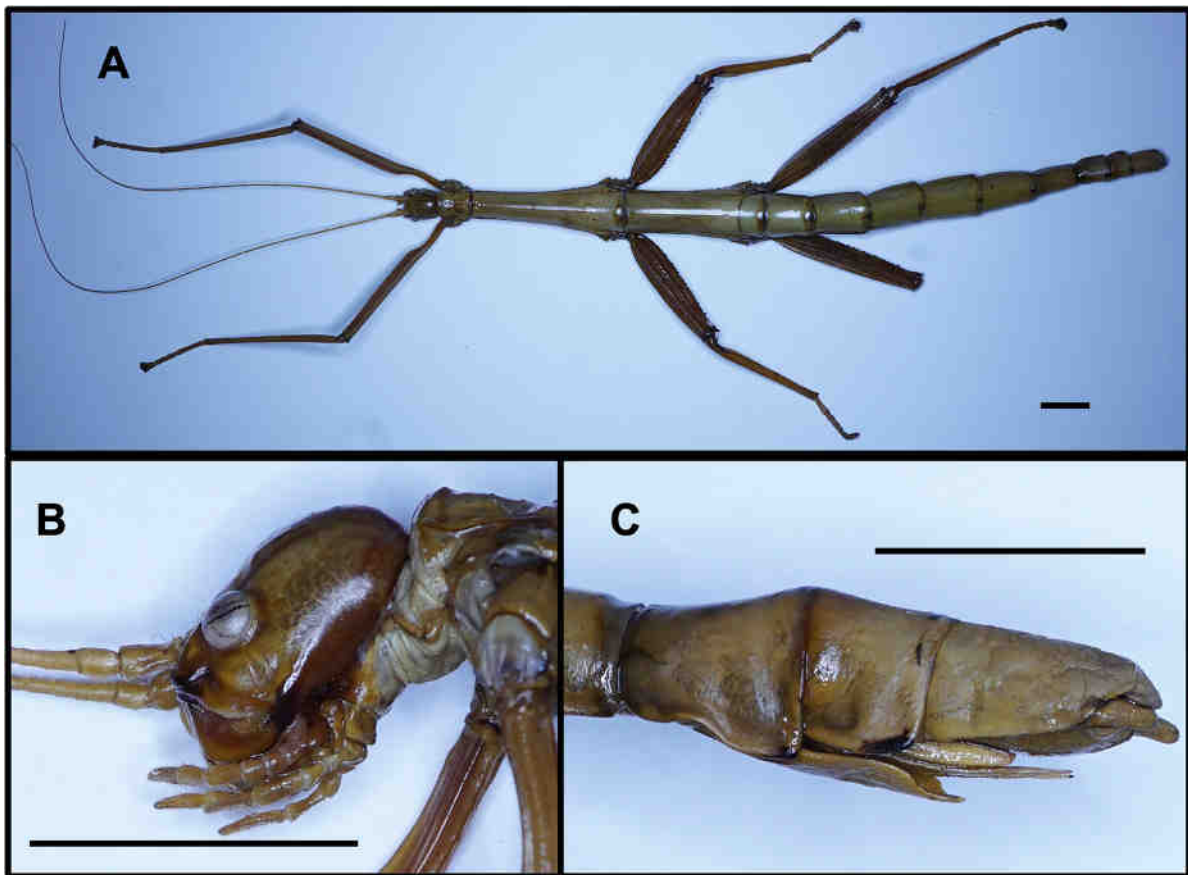


Figure 2. *Megaphasma denticrus* female (FCF-PHASMA-001): A, dorsal habitus. B, lateral view of head. C, lateral view of abdominal apex. Scale bar = 10mm.

***Diapheromera (Rhabdoceratites) covilleae* Rehn & Hebard, 1909**

Diapheromeridae

Figures 3-4

FCF-PHASM002: 15 males, 10 females from La Carroza (26°6'27.14"N, 100°41'56.18"W), municipality of Mina. Collected during mating/feeding on 12 X 2020 by Manuel de Luna and Roberto García Barrios at around 19:00 hr, on creosote bush *Larrea tridentata* (Zygophyllaceae).

This represents the first recorded instance of the species in the state.

***Parabacillus coloradus* (Scudder, 1893)**

Heteronemiidae

Figure 5

FCF-PHASM003: 1 female from Sierra de Nacataz (25°45'56.9"N, 100°38'33.7"W), municipality of García. Collected in 7 XI 2020 by Manuel de Luna at around 14:00, on the ground, alone.

This represents the first recorded instance of the species in the state; see discussion.

## Discussion

The publication with records of *M. denticrus* and *P. tridens* for the Mexican state of Tamaulipas (Barrientos-Lozano et al., 2008b: 10 as *Diapheromera denticrus*, *Megaphasma dentricus* and *Pseudosermigle tridens tridens*, respectively) was not peer-reviewed and lacked physical or photographic vouchers (Luna & Hernández-Baltazar, 2020: 161), for that reason, it was not taken into account in the present listing. *Megaphasma denticrus* also appeared in a listing of insects from the Mexican state of Nuevo León (Quiroz-Martínez et al., 1999: 87 as *Megaphasma denticus*), however, that listing was also not peer-reviewed and lacked vouchers; nonetheless, several specimens of *M. denticrus* from Nuevo León were collected and are presented in this article (see results), confirming its presence in the state.

The female specimen of *Parabacillus* was determined as *P. coloradus* given its geographical distribu-

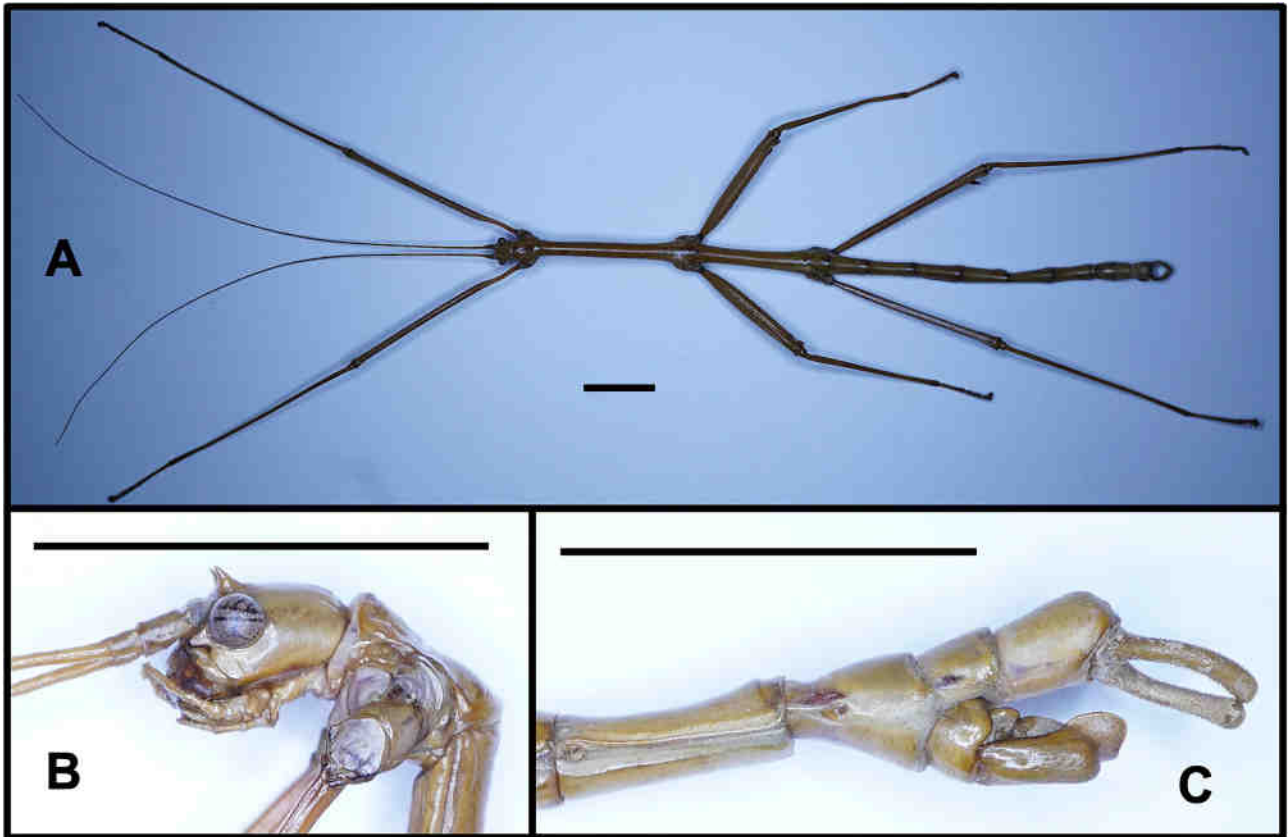


Figure 3. *Diapheromera (Rhabdoceratites) covilleae* male (FCF-PHASMA-002): A, dorsal habitus. B, lateral view of head. C, lateral view of abdominal apex. Scale bar = 10mm.

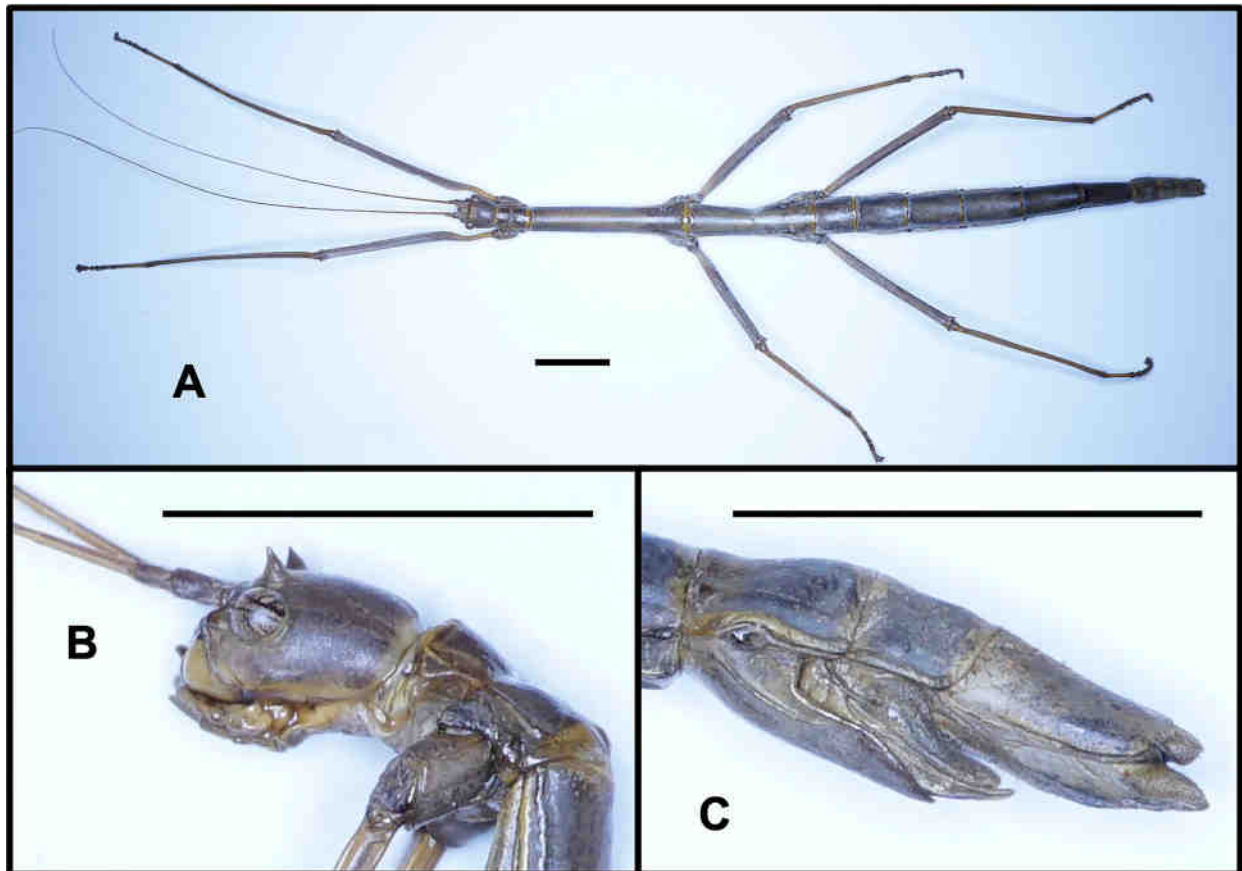


Figure 4. *Diapheromera (Rhabdoceratites) covilleae* female (FCF-PHASMA-002): A, dorsal habitus. B, lateral view of head. C, lateral view of abdominal apex. Scale bar = 10mm.

tion (Hebard, 1934b). Several searches were carried out to find more specimens, specially the male, however, they were not successful. A future publication dealing with the adult male of this particular locality is desirable.



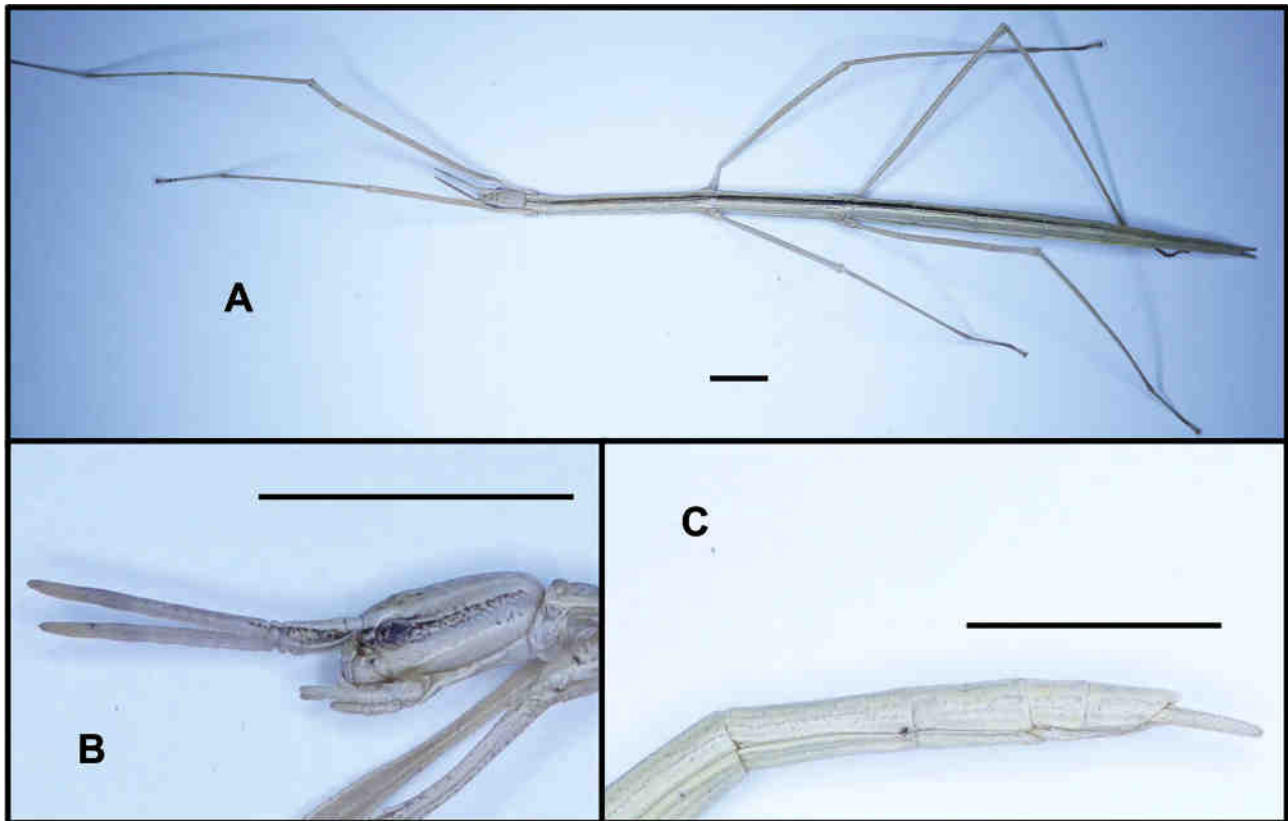


Figure 5. *Parabacillus coloradus* female (FCF-PHASMA-003): A, dorsal habitus. B, lateral view of head. C, lateral view of abdominal apex. Scale bar = 5mm.

*Diapheromera* (*D.*) *femorata*, a very common and widespread Nearctic species, was included in the list of López-Mora & Llorente-Bousquets (2018: 48, 75), citing Barrientos-Lozano et al. (2008a) as a source; however, that was a preliminary work and in a later publication (Barrientos-Lozano et al., 2008b), *D. (D.) femorata* was not mentioned. Scudder (1901) had mentioned *D. (D.) femorata* for México, but gave no specific locality. Given that there are no other formal records of the species for México, *D. (D.) femorata* is here excluded from the Mexican phasmid fauna, although it could be present in the northernmost states; further research could confirm its presence in the country. On the other hand, *P. strigata* was not included in the aforementioned listing, despite having mentions for the Mexican states of Aguascalientes and Jalisco (Escoto-Rocha et al. 2013) as well as Tamaulipas (Hebard, 1932), so it is included in the present listing for México.

There are records of *D. (R.) covilleae* from the Mapimi Biosphere Reserve (Rivera, 2006: 145 as *Diapheromera covillae*), however, this reserve is located in the Mexican states of Chihuahua, Durango and Coahuila, and the precise collection sites of *D. (R.) covilleae* within the reserve were not disclosed. Efforts to contact the author and the curator of the collection where the specimens had been deposited were fruitless, therefore, this record was not added to the list.

*Carausius morosus* is a predominantly parthenogenetic Asian species which is used as a laboratory animal and is also commonly kept as a pet, this species has established breeding populations in California, USA (Arakelian, 2008; Brock, 1999; Headrick & Wilen, 2011), becoming one of two exotic species of stick insects that can be found in North America, the other being *M. extradentata*, which can also be found in California, USA (Krauss et al. 2009).

Type specimens of *Ocnophiloidea regularis* (Brunner von Wattenwyl, 1907) have been labelled from México (Brock, 1998), however, these specimens are lost and are not traceable; following López-Mora & Llorentes-Bousquets (2018: 74) and unless new information is published regarding the presence of this species in México, it should not be included as part of the Mexican phasmid fauna. *Paracalynda picta* (Brunner von Wattenwyl, 1907) has also been mentioned for México, however, Henne-

mann & Conle (2012a) mention that the Mexican specimen was incorrectly identified (López-Mora & Llorentes-Bousquets, 2018: 74), therefore, the species was also not added to the listing of the present article.

Following López-Mora & Llorentes-Bousquets (2018: 75), *Heteronemia mexicana* Gray, 1835 is not listed for México in the present article, as there is evidence that it was described from mislabelled specimens from South America (Zompro, 2001b). Zompro (2001b) revised the type species of *Heteronemia* and restricted the genus to Chile, however, the generic affinities of the rest of the species was not clarified; a revision of the type material of *H. contracta*, *H. foliata*, *H. forcipata*, *H. oaxacae*, and *H. unidentatus* is needed to corroborate if they actually belong to *Heteronemia*, this would also confirm if the genus is indeed present in North America.

Other species whose records for México are dubious are: *Agrostia cinerea* (Oliver, 1792) (Shelford, 1908: 374 as *Perliodes grisescens*); *Ceroys perfoliatus* (Gray, 1835) (Shelford, 1908: 366); *Hesperophasma planulum* (Westwood, 1859) (Shelford, 1908: 357 as *Phantasis planula*); *Libethra brevipes* Brunner von Wattenwyl, 1907 (Shelford, 1908: 345); *Paraphanocles keratoskeleton* (Olivier, 1792) (Shelford, 1908: 364 as *Bacteria bicornis*); *Pseudophasma blanchardi* (Westwood, 1859) (Shelford, 1908: 372 as *Phasma annulipes*); *Pseudophasma perezi* (Bolívar [Y Urrutia], 1881) (Shelford, 1908: 372); and *Pygrrhynchus subfoliatus* Audiner-Serville, 1838 (Shelford, 1908: 366). None of the aforementioned species were included in the latest revised list of Mexican species (López-Mora & Llorente-Bousquets, 2018), nor are they included in the one presented in this article.

The three American states with the highest diversity of stick insects are California with 25 species (including the two introduced ones), Texas with 19 species, and Kansas and Arizona each with 11 species (Fig. 6); Alaska, Idaho and Montana do not count with any record of a species of stick insect (Fig. 6). The three Mexican states with the highest diversity of Phasmatodea are Veracruz with 12 species, Jalisco with ten species and Guerrero with nine species (Fig. 7); in contrast, the state of Guanajuato only has a record of an undescribed species of *Pseudosermyle* (López-Mora & Martínez-Cervantes, 2021), while Hidalgo, Querétaro, Tlaxcala and Zacatecas do not have any formal records of a species of stick insect (Fig. 7), this undoubtedly is due to the lack of sampling, rather than the absence of phasmids in those states. Canada has only one species, which is found in the provinces of Manitoba, Ontario and Quebec, being apparently absent from the rest (Miskelly & Paiero, 2019).

While the stick insects of the USA and Canada seem to be well known, the phasmid fauna of México is very poorly studied, mainly due to the difficulty of collecting them (López-Mora & Martínez-Cervantes, 2021), meaning they are often undersampled, unless specifically looking for them; the hardships that comes in rearing them in the laboratory, a task necessary to study them in greater detail, also play a role in them being understudied; finally, there seems to be a general disinterest from researchers towards groups that are not of medical or economic importance, which further enhances the problem.

## Conclusion

The region of North America has a phasmid fauna composed of 105 species (and four subspecies) grouped in 21 genera and seven families. Canada has only one species of stick insect, *D. (D.) femorata* (Diapheromeridae). The USA has 49 species (and four subspecies) grouped in eleven genera and six families, including two exotic species. Finally, México has the greatest diversity among these countries, with 65 species (and two subspecies) grouped in 17 genera and six families.

## Acknowledgements

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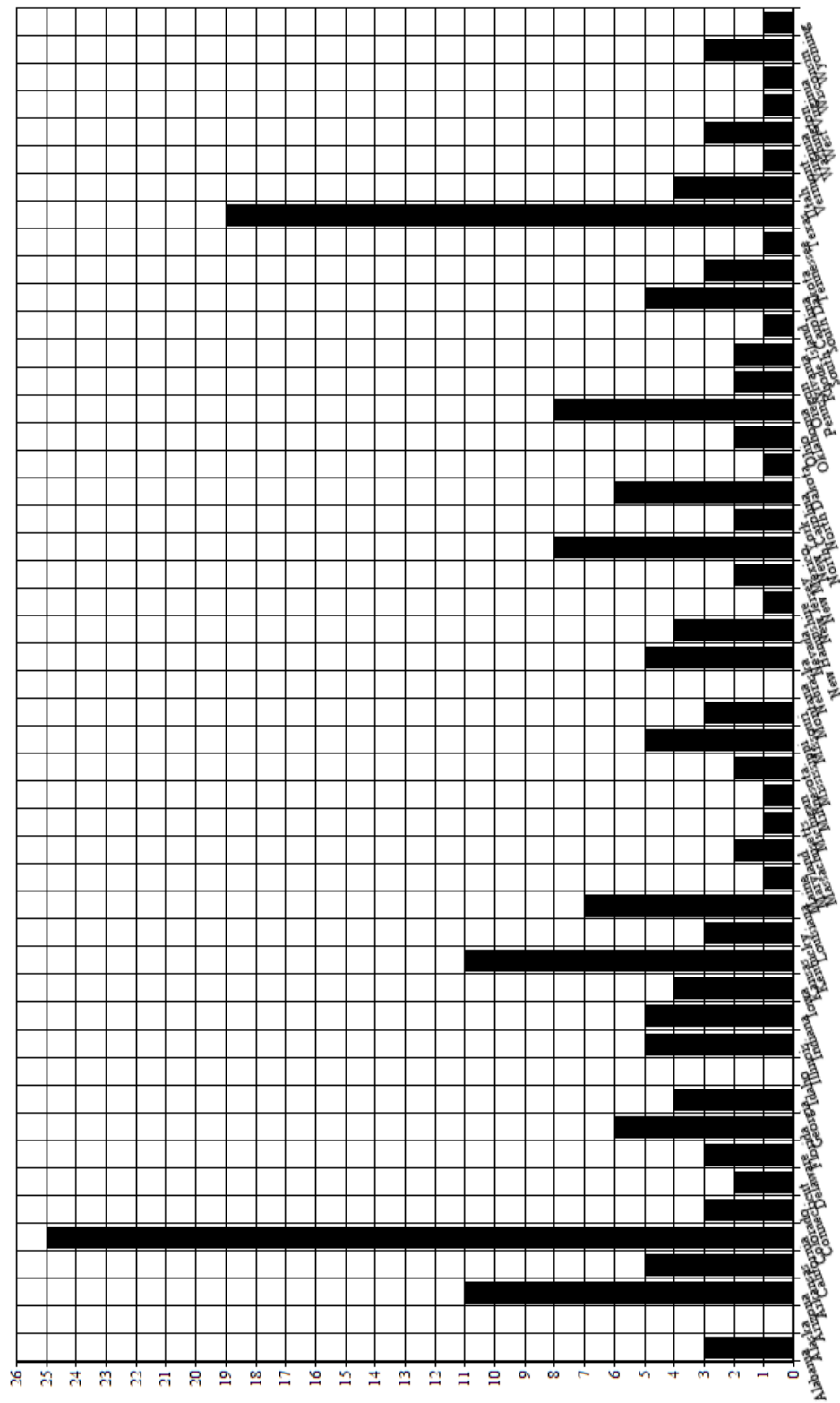


Figure 6. Number of species of stick insects registered for each state of the USA (not including Hawaii).

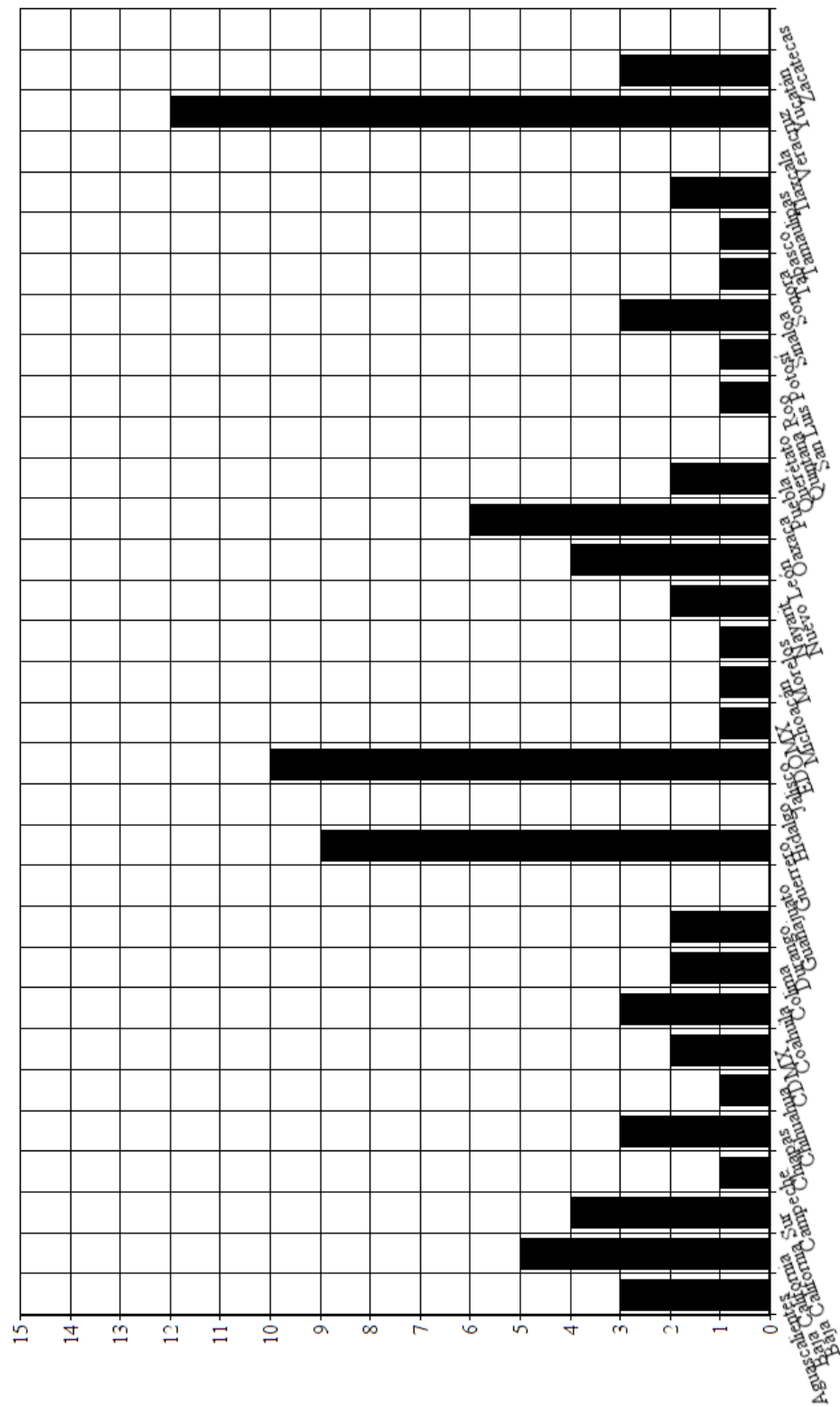


Figure 7. Number of species of stick insects registered for each state of México.



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# A new species of *Pachymorpha* Gray, 1835 (Phasmida: Phasmatidae) from Queensland

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## Abstract

Further studies on the Australian genus *Pachymorpha* include a new species from near Airlie Beach, Queensland: *Pachymorpha pearsoni*, which is described from both sexes and figured, also typical habitat. A revision of the genus is pending.

## Key words

*P. pearsoni* new species, Australia

## Introduction

*Pachymorpha* Gray, 1835 s. str. is endemic to Australia, but is in need of thorough revision as it erroneously includes taxa from China, Congo, Madagascar, Myanmar, New Guinea, Sarawak and Tanzania (Brock et al, 2022), which all represent other genera. The Australian fauna comprises four described and several yet undescribed species. A full revision in progress, including molecular analysis. *P. springbrookensis* Brock & Coupland 2022 was the most recently described species. The author became aware of the new species described in this paper from a pair in Queensland Museum noticed in the collection in 2007 and images on Flickr. The species is described now as it is not included in a study based on molecular sequences to be published much later, as no further material has been obtained. Keys are included in Brock & Hasenpusch (2009), except for *P. springbrookensis* and *P. pearsoni* sp. n.

## Materials & Methods

The type material was photographed using a Nikon D5000 combined with Nikon 105 mm macro lens and dedicated Nikon macro flash and a light box, which was used to take measurements by ruler and confirmed under a microscope. A live female was photographed in nature by Steve & Alison Pearson, along with the habitat.

Descriptions are based on detailed examination of the type material, supplemented by observation on female colouration from a photograph.

Abbreviations for depositories

QM - Queensland Museum, Brisbane, Australia

## *Pachymorpha* Gray

*Pachymorpha* Gray, 1835: 21.

Type species. — *Bacillus squalidus* Gray, 1833: 28, pl. 3:2 [= *Pachymorpha squalida*], by original monotypy, Gray, 1835: 21.

*Pachymorpha*; Audinet-Serville, 1838: 258, Stål, 1875: 11, Kirby, 1904: 342, Brunner, 1907: 212, Otte and Brock 2005: 243, Brock and Hasenpusch, 2007: 48, 761, also 2009: 33, 157. For other references, see Brock et al, 2022.

**Characteristics.** — Description. Small-sized, wingless stick-insects, strong central longitudinal line, generally rather rugged appearance, whether stout or more elongate, with pair of spines or tubercles between eyes, sometimes on a raised ridge. Usually has tubercles, possibly spines, from back of head to at least first abdominal segment. Head longer than wide, eggs small. Antennae short, not reaching end

of fore femora; shorter in male; basal segment considerably broadened. Pronotum shorter than head. Mesonotum variable,  $3-4 \times$  length of pronotum. Metanotum shorter than mesonotum. Abdomen with conspicuous ridges; final segments may be unusually shaped when viewed laterally, with hind part of segments raised. Operculum rounded at tip, reaching up to half the length of anal segment, which is beak-shaped or rounded at tip. Latter abdominal segments in some males rounded, of rather swollen appearance, anal segment then very narrow pronged structure; poculum broad, rounded at tip, reaching about end of 9th abdominal segment. Cerci short. Legs robust, smooth or bumpy. Egg: Large, broad, oval capsule. Operculum convex with a rough surface. Micropylar plate broadened towards hind part, with a slight central line.

**Distribution** Australia.

**Notes** In need of revision – see Introduction above.

***Pachymorpha pearsoni* sp. n.**

[Pearson's Pachymorpha]

(Figs. 1-3)

Holotype female, QUEENSLAND, Mt. Hayward, 350 m., 20.xi.1992-mid.04.1993, D. Cook & G. Monteith, RF. Intercept & Pitfalls [T258500] (QM).

Paratype male, same data [T258501] (QM).

Other material: female, photographs taken near Josteens Rise, Mandalay Heights, Airlie Beach, 04.vii.2009, Steve and Alison Pearson, male, same data except 18.01.2022.

**Description.** Small brown-bodied, with some lighter and darker patterned areas and on specimens seen, whitish dusting or broad patch on lower half of mesonotum (other *Pachymorpha* species can vary so a series needs to be examined to confirm).

**Female holotype** (Figs. 1A-G) and in nature (Figs. 3A-C).

**Head.** Small, about as longer as wide, with stout pair of horn-like tubercles between fairly small eyes. Various tubercles present, particularly raised at back of head and from live specimen examined from photographs, can expand to form a blackish or dark brown region, either side of mid-line, which extends to pronotum. Antennae much shorter than fore femora, with 7 segments; basal segment considerably broader than others and more than  $5 \times$  length of very small segment 2, which is only half length of segment 3.

**Thorax.** Pronotum shorter than head, with largest tubercles extending from head and at back of segment. When viewed laterally, hind part of segment steeply elevated. Side margins swollen and raised. Rest of thorax with raised lateral lines and tubercles, also with raised and swollen central longitudinal line (also present ventrally, along with tubercles), elevated at front of mesonotum, with swollen tubercles nearby. Mesonotum almost  $3 \times$  length of pronotum, very rough and swollen with a combination of large round to wavy tubercles. Metanotum and median segment combined shorter than mesonotum, with various tubercles, segments raised at front and hind part. The most notable character of the thorax is the broadening of these segments, with the mesonotum particularly expanded so the hind part is extraordinarily for a stick-insect, wider than long.

**Abdomen.** Rough and swollen, narrower than thorax and segments narrowed gradually towards tip. Large, light triangular marks are present centrally, clearer on segments 1-6. Various tubercles present and a particularly robust longitudinal central line, a continuation from thorax. As is typical in *Pachymorpha*, hind part of segments swollen and elevated when viewed laterally, but anal segment (which is longer than segment 8 or 9) strongly tapered towards a duck-like tip, slightly triangular incised in centre. Operculum tapered to a narrow, rounded tip, reaching  $\frac{1}{2}$  length of anal segment. Cerci very short and not visible.



A



B



C



D



E



F



G

Figure 1. *Pachymorpha pearsoni* sp. n. female (holotype). A dorsal view, B lateral view, C ventral view, D head & thorax, lateral view. End of abdomen: E dorsal view, F lateral view, G ventral view [all PDB] .





A



B



C



D



E



F



G

Figure 2. *Pachymorpha pearsoni* sp. n. male (paratype). A dorsal view, B lateral view, C ventral view, D head & thorax, lateral view. End of abdomen: E dorsal view, F lateral view, G ventral view [all PDB],

*Legs.* Short, stout and slightly uneven due to bumps. All femora with pair of apical spines; fore femora slightly incurved (these more mottled than mid and hind femora).

**Male paratype** (Figs. 2A-G). Stout, similar in general appearance, with body strongly swollen. Smaller than female and less broadened. Whole body tuberculate but lacking some very large tubercles in female and hind part of segments less elevated, except for abdominal segments 7-9. Anal segment less wide than segment 8 or 9, tip slightly rounded but lobed either side. Poculum broad and rounded at tip, reaching end of 9th abdominal segment.

**Egg** Unknown.

**Measurements.** (in mm) for holotype female (first), then male paratype. Length of body: 39, 32. Head: 4, 3. Antennae: 5, 4. Pronotum: 2.8, 2. Mesonotum: 7.5, 5.5. Metanotum: 3, 2.5. Median segment: 2, 1.3. Femora, fore, mid, hind: 9.5, 7, 9.5; 8, 6, 8. Tibiae, fore, mid, hind: 9.5, 7, 9; 8, 5.5, 7.5.

**Cerci** -.

**Etymology** Named after Steve Pearson, a retired Queensland Parks and Wildlife Service ranger who has worked his whole life on conservation management. Along with his wife Alison, they have taken numerous photographs of plants and invertebrates of that area, including this new species on the edge of rainforest next to their property in Mandalay rainforest, near Airlie Beach.

**Distribution** The Whitsunday region of Queensland in and around Conway National Park, near the coast at Airlie Beach. This species is likely to be found in other parts of the National Park as well.

**Habitat** Tropical lowland rainforest, in an ever-changing area due to cyclones. Dominant canopy species are replaced after bad cyclone damage, speeding the natural progression of rainforest species and structure changes (Steve Pearson, pers. comm., 2022).

**Conservation Status** Needs surveying in Queensland and more information on its ecology, but likely to warrant Red List status.

**Note** Easily distinguished from other Australian species by the distinctly broadened mesothorax and metathorax, therefore no keys are provided in this paper.

## Discussion

The genus *Pachymorpha* is uncommon in Australia with some species known from few specimens. Or are they? There are over 150 records on the Atlas of Living Australia from widespread sites, indicating that naturalists at least occasionally manage to find them. The apparent scarcity of species may relate to limited interest in phasmids, and/or the fact they are nocturnal and rarely searched for at night, so the true distribution may be much more extensive than recorded. However, whilst it appears that this strange-looking species is genuinely rare, further surveys are needed to evaluate this. Efforts to obtain further material of *Pachymorpha pearsoni* sp. n. for molecular work, have been unsuccessful so far. Initial results on DNA-barcoding of the Australian phasmid fauna are given in Velonà et al. (2015), with further work in progress, including DNA-barcoding results for *Pachymorpha*. This is much needed, as cryptic species can be very similar in appearance, as shown in leaf-insects by Cumming et al. (2021a,b) and Heteropterygidae by Bank et al. 2021.

It is hoped that naturalists may be able to help discover more about the ecology of *P. pearsoni*. Like some *Pachymorpha* species, they may live in leaf litter, only moving around at night to feed on low-growing vegetation or saplings. The type specimens were found in a pitfall trap, and one was photographed beneath *Flindersia shotiana* (Rutaceae) which has since been wiped out by a cyclone; another was found in leaf litter in the same area, just before publication of this paper. A neighbour of the Pear-

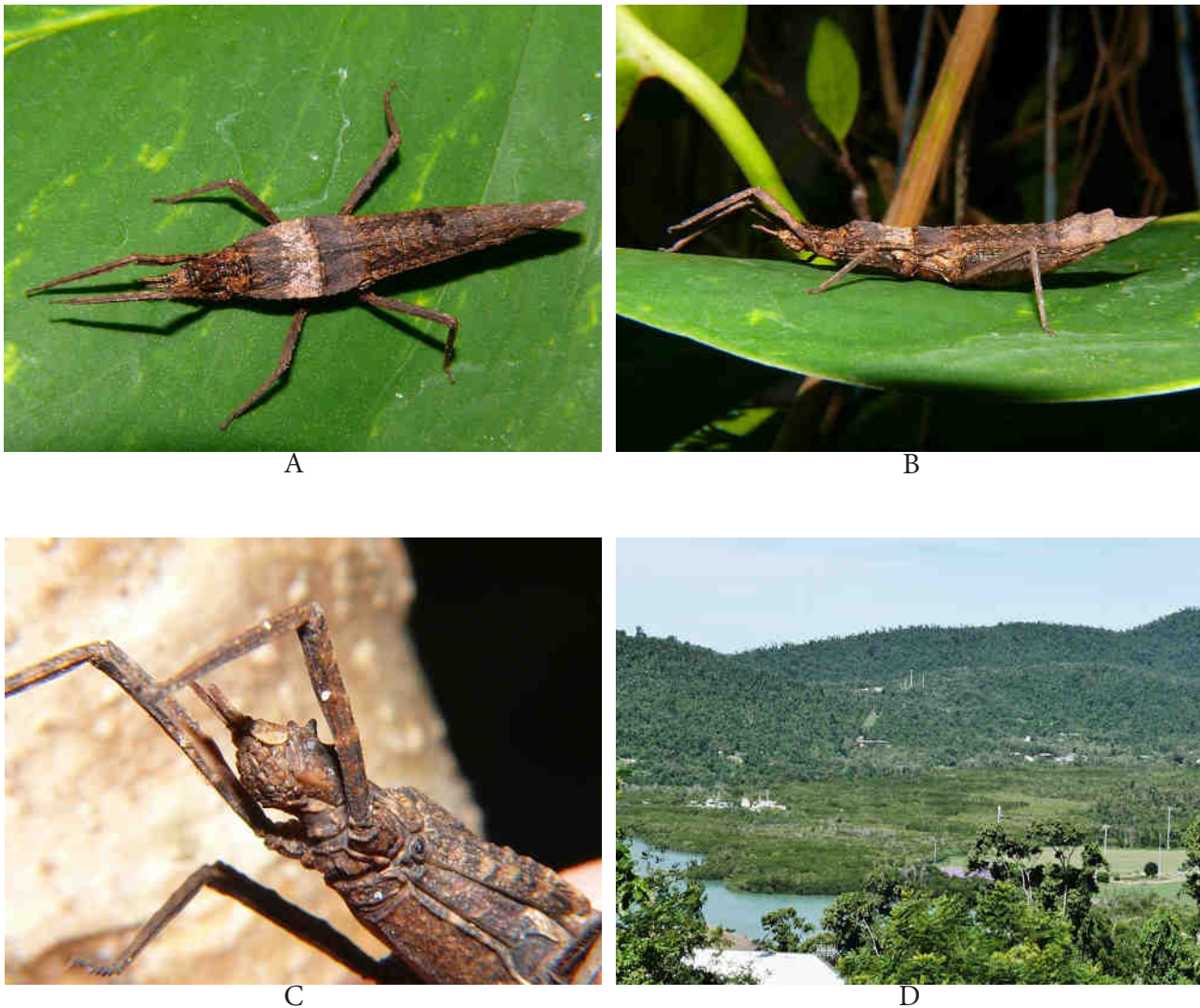


Figure 3. Female, Mandalay rainforest: A dorsal view, B lateral view, C head & thorax D. habitat (in background) [all Steve & Alison Pearson].

sons reports they were found years ago ‘on the floor of the rainforest and on the base of tree stumps’. The actual foodplant(s) are not yet known, but may include *Eucalyptus tereticornis* (Myrtaceae) which used to occur nearby and is known as a foodplant for some *Pachymorpha* spp.

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