Rediscovery and life history of *Bathromelas hyaloscopa* (Meyrick & Lower, 1907) Lepidoptera: Psychidae: Oiketicinae

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ABSTRACT

The rarely seen *Bathromelas* Turner 1947, a monotypic Australian endemic genus with the species *Bathromelas hyaloscopa* (Meyrick & Lower, 1907), is rediscovered, and a new description is provided. The male genitalia, female, pupae of both sexes, late instar larvae, and the unique case design are all figured and described for the first time. The larval host plant is identified as *Allocasuarina luehmannii* (Casuarinaceae), with *B. hyaloscopa* regarded as a Casuarinaceae specialist, unusual as oiketicine psychids are typically polyphagous. Prior to this study the species was known from only three male specimens, with the most recent of those collected in 1938. The data for all known and new specimens is included, and a brief discussion on the systematic affinity of this genus is provided.

The case moths or bagworms, family Psychidae, are a familiar sight across much of Australia, where their prominent and intricately constructed larval cases are frequently found attached to plants, fences, buildings, or almost any available vertical surface. Although some taxa are abundant and ubiquitous, others are very rarely seen, one such being the endemic but obscure *Bathromelas* Turner, 1947, with the single species *B. hyaloscopa* (Meyrick & Lower, 1907), a name based on a single male specimen in SAM from 'north-west Victoria'. In their original description, Meyrick & Lower (1907) placed this species within *Plutorectis* Meyrick & Lower, now considered a synonym of *Lomera* Walker, 1855 (Betrem 1951). Turner (1947) described the genus *Bathromelas* for this species, and refers to an additional specimen from Injune, Qld in QM. A second Injune specimen is in ANIC. This and the QM specimen were both collected in 1938, with no adult specimens having been collected since. No publication has dealt with this genus beyond that of well-known checklists (i.e. Nielsen & Edwards 1996, Sobczyk 2011), and no new information on this taxon has been published since Turner's 1947 paper.

In 2021–2022 the author travelled through rural New South Wales and Queensland and collected a series (n= 15) of live larvae and empty larval cases of a large and distinctive psychid, all from between Yetman, NSW and Injune, Qld. The case design was unusual (Fig. 3) and did not conform to any described species or case structure, but were identical to an empty case present in the SAM collection, and a further case from the QM collection. Neither of these two museum specimens were associated with an emerged adult or a correct identification. Subsequent rearing of the larval material collected in 2021–22 has confirmed the identity of these larvae and larval cases as that of *Bathromelas hyaloscopa* (and with it the confirmation of host plant, habitat, larval and pupal morphology, case design, and adult female morphology) and has provided enough additional male specimens for genitalia dissection, all of which was previously unknown.

MATERIALS AND METHODS

The following museums, institutions and private collections contain specimens of this species: ANIC (Australian National Insect Collection, Canberra), SAMA (South Australian Museum, Adelaide), QM (Queensland Museum). Larval specimens were collected in the field by searching vegetation. Specimens were reared in 2021–22 by sleeving larvae (n = 8) on planted outdoor *Casuarina glauca* for approx. 6 months (Mar-Sept) then transferred to a ventilated, mesh-topped glass enclosure kept indoors at approximately 15-25°C, and were fed both *C. glauca* and *A. luehmannii*. Pupae were transferred to a ventilated pop-up enclosure, and monitored daily for signs of eclosion. Adult male specimens were preserved on the day of eclosion, and empty cases retained with them. Two late instar larvae are preserved in ethanol, one empty male pupa also, females and their respective empty pupae in ethanol, dissected genitalia stored in vials in the same collection as respective specimens. In-text, a '/' in transcribed label data denotes a separate label.

Two partial CO1 sequences were extracted from parasitoid chalcid wasps (BOLD records AUHYM001-22, AUHYM002-22, E.P. Fagan-Jeffries pers. comm.) that emerged from one female pupal *Bathromelas* specimen. Chalcid specimens and associated *Bathromelas* larval case are stored in ANIC.

Adult specimens were dissected by removing the entire abdomen and legs from the left side from the males, soaked in boiling 10% KOH for 8–10 minutes before being cleared in water, with genitalia and remaining abdominal tergites/sternites stored in 95% ethanol solution. Females were dissected in the same way except full-body dissection was performed rather than partial. Terminology for genitalia used herein follows that of Robinson & Nielsen (1993) and Arnscheid & Weidlich (2017).

RESULTS

Family PSYCHIDAE Boisduval, 1829

Subfamily OIKETICINAE Herrich-Schäffer, 1855

Genus *Bathromelas* Turner, 1947

***Bathromelas hyaloscopa* (Meyrick & Lower, 1907)**

Buloke Bagworm Moth

(Figs 1-4)

Holotype ♂: Victoria. N.W. from Casuarina suberosa / 4151 P. hyaloscopa TYPE.: M & L / 13 / SAMA 31-000282 (in SAMA).

Additional material examined: In ANIC: 3♂ with cases, 2♀ with case, 1 larva, and 5 additional empty cases. ♂: Injune, Q., 3.10.1938, W.B. Barnard / ANIC 31-075892. ♂ with case: 8.5 km SW Yetman, NSW, AUST. 28.94305°S, 150.70244°E. E.P. Beaver & M.F. Braby / Collected 4 Feb 2021 as larva on foliage of *Allocasuarina luehmannii*. Pupated Sep 2021, eclosed 16 Nov 2021. ♂ with case: Ellangowan NR, Leyburn, Qld, AUST. 430 m elev. 27.96260°S, 151.65175°E, E.P. Beaver & M.F. Braby / Collected 11-13 Feb 2021 as larva on foliage of Allocasuarina luehmannii. Pupated Sep 2021, eclosed 30 Oct 2021 / ANIC 31-075884. ♀ with case: Ellangowan NR, Leyburn, Qld, AUST. 430 m elev. 27.96260°S, 151.65175°E, E.P. Beaver & M.F. Braby / Collected 11-13 Feb 2021 as larva on foliage of *Allocasuarina luehmannii*. Pupated mid Oct 2021, eclosed 21 November 2021. / Dissection ID EPB-154 / ANIC 31-075885. Larva with case: Ellangowan NR, Leyburn, Qld, AUST. 430 m elev. 27.96260°S, 151.65175°E, E.P. Beaver & M.F. Braby / Collected 11-13 Feb 2021 as larva on foliage of *Allocasuarina luehmannii*. 'Mature larva preserved 26 Dec 2021' ANIC 31-075886. 1 Empty case: Ellangowan NR, Leyburn, Qld, AUST. 430 m elev. 27.96260°S, 151.65175°E, E.P. Beaver & M.F. Braby / Collected 11-13 Feb 2021 as larva on foliage of *Allocasuarina luehmannii*. / Approx 50 Chalcididae parasitoids from female pupa, none exited bag. 14 Sep 2021 / ANIC 31-075887. 1 Empty case: Dthinna Dthinnawan NP, 15 km NNW Yetman, NSW, AUST. 28.77036°S, 150.74561°E, 03 Feb 2021, E.P. Beaver & M.F. Braby / Empty case on trunk of *Allocasuarina luehmannii* / ANIC 31-075888. 3 additional empty cases with data as for the above example, except for ANIC numbers 31-075889, 31-07590, 31-075891. 1♀ with case, 25.52592°S, 148.68404°E, AUSTRALIA, QLD, 37km NNE of Injune, E. P. Beaver & M.F. Braby leg / ex larva on foliage (*Allocasuarina luehmannii*), 24 Mar 2022, eclosed 4 Sep 2022 / NA0018964463.

In QM: 2♂, 1♀ with case, 1 larva with case, 2 additional empty cases. ♂: Injune. 26.9.1938 W.B. Barnard / T250899 / B. hyaloscopa M & L / QM T250899. 1 Empty case: Jan 1986, 5 miles Sth Condamine R., Chinchilla. Grace Lithgow (both in QM). ♂ with case: Ellangowan NR, Leyburn, Qld, AUST. 430 m elev. 27.96260°S, 151.65175°E, E.P. Beaver & M.F. Braby / Collected 11-13 Feb 2021 as larva on foliage of *Allocasuarina luehmannii*. Pupated Sep 2021, eclosed 08 Dec 2021 / Dissection ID EPB-155'. ♀ with case: Ellangowan NR, Leyburn, Qld, AUST. 430 m elev. 27.96260°S, 151.65175°E, E.P. Beaver & M.F. Braby / Collected 11-13 Feb 2021 as larva on foliage of *Allocasuarina luehmannii*. Pupated mid Oct 2021, eclosed 05 December 2021. / Dissection ID EPB-153. Larva with case: Ellangowan NR, Leyburn, Qld, AUST. 430 m elev. 27.96260°S, 151.65175°E, E.P. Beaver & M.F. Braby / Collected 11-13 Feb 2021 as larva on foliage of *Allocasuarina luehmannii* / mature larva preserved 30 Oct 2021. Empty case: Ellangowan NR, Leyburn, Qld, AUST. 430 m elev. 27.96260°S, 151.65175°E, 11-13 Feb 2021, E.P. Beaver & M.F. Braby / Empty case on trunk of *Allocasuarina luehmannii*. Empty case: 8.5 km SW Yetman, NSW, AUST. 28.94305°S, 150.70244°E, 04 Feb 2021, E.P. Beaver & M.F. Braby / Empty case on trunk of *Allocasuarina luehmannii*.

In SAMA: 1 Empty case: Wilson, 6.8.97, A. Cummings / Metura elongatua ? [sic].

Photographed specimen: 1 empty case, 13 Sep 2021, Lawes, 40 km E of Toowoomba, Qld, AUST. 27.55434°S, 152.33959°E iNaturalist observation 94712038.

Description of stages

Late instar larva (Fig. 2A-C, 4C-D)

Length 28-45 mm, width at head capsule 4.5-5 mm. Head hypognathous, mostly matte black with irregular and individually highly variable pale cream markings. Antennae white basally. Ecdysial line light cream. Thorax smooth, lustrous, heavily sclerotised prothoracic shield. Prothorax with rust-coloured spiracle. Pro-, meso- and metathorax with irregular and variable pale cream markings arranged loosely into three dorsal columns. Central column straight, positioned medially, lateral columns slanted at acute angle. Legs three segmented with single tarsal claw, profemora pale cream dorsally. Abdomen less heavily sclerotised, dorsal aspect matte black, leathery, ventrally dark brown. Segments 1-2 with five pale cream ovoid to trapezoidal spots latero-ventrally along medial line. Segment 8 with two light cream-coloured spots laterally, segment 10 with cream spot laterally. Segments 1-8 with rust-coloured spiracle laterally. Uniordinal lateral penellipse of crochets on four pairs of ventral prolegs and a single pair of anal prolegs.

Case (Fig. 3)

Anterior to posterior aperture: 59-100 mm, width 7-13 mm. Female length 75-100 mm, males 59-69 mm. All cases with between one to four stems from hostplant as case adornment, stems 3-5 mm wide by 6-95 mm long, anchored from median of case, to posterior aperture, usually extending freely beyond posterior aperture. Remainder of bag with light grey silk covered in entirety with minute fragments of bark from hostplant, tightly packed together obscuring silk under-layer. Overall light khaki brown to light charcoal colour. Case is solid and structurally sound, similar to that of larger *Lomera* or *Clania* Walker, 1855, and not flaccid or bag-like as in Hyalarcta Meyrick & Lower, 1907 or Metura Walker, 1855.

Pupa

Male (Fig. 2D-F): Length 17 mm. Highly sclerotised, tan to matte black, wing-covers lustrous black. Frons with apical spine bifurcate to two nodes. Labial palps triangular. Maxilla inverse heart-shaped. Eye-piece semi-transparent. First pair of legs corrugated, others smooth. Dorsal abdomen with tergites II and III with both anterior and posterior row of spines, tergites I and IV-VII with only anterior row present.

Female (Fig. 2G-I): Length 40 mm. Elongate, simple, highly sclerotised, dark rust-red, darker dorsally, thoracic plates and head less heavily sclerotised. Tergites with reduced rows of spines, TVII with prominent semi-circular dorsal ridge.

Adult

Male (Fig. 1, 2M-Q, 2T, 4E-F). Wingspan 26-30 mm. FW length 12-13 mm. HW length 7-8 mm.

Head. Rounded, eyes smaller than head capsule, wide-set, eye index ratio 1.6. Labial palps with single palpomere, narrow, triangular. Scales over frons and vertex range from light cream-grey through to black. Scape and pedicel subequal, flattened ovoid. Antennae black, bipectinate, apical flagellomere filiform. Rami 4-5x length of flagellum width in middle, heavily ciliated. Dorsal flagellum covered with pale cream scales.

Thorax dorsally and ventrally clothed with dark grey to charcoal scales, some specimens with cream scales over patagium and anterior tegula. Thoracic scutes deep rust-red to black beneath scales.

Legs (Fig. 2T). Short, clothed with dark brown to charcoal-black scales. Epiphysis elongate, very narrow, 2/3 the length of tibia. Single tibial spur distally on mid and hind legs. Aerolium reduced, ovoid. Two tarsal claws, curved.

Wings. Forewing elongate, narrow, triangular with blunt apex. Costa straight to very subtly concave at middle of discal cell. Margin convex, termen straight. Dense layer of charcoal to black scales, from piliform to short flattened along costa, basal area, basal 2/3rds of termen, wing fringe, elsewhere hyaline. Newly eclosed specimens (Fig. 1J-K, 4E-F) with complete layer of deciduous scales over wing surface, shed after eclosion. Veins light brown. R3+R4 stalked, Three M veins, M2+M3 stalked, two M veins in closed discal cell, free distally. CuP merged with A1 but not forming cell in basal area.

Hindwing. Costa convex, margin slightly sinuate, termen blunt at apex, straight at inner margin. Dense layer of charcoal to black scales along costa, inner basal area and along termen, wing fringe, elsewhere

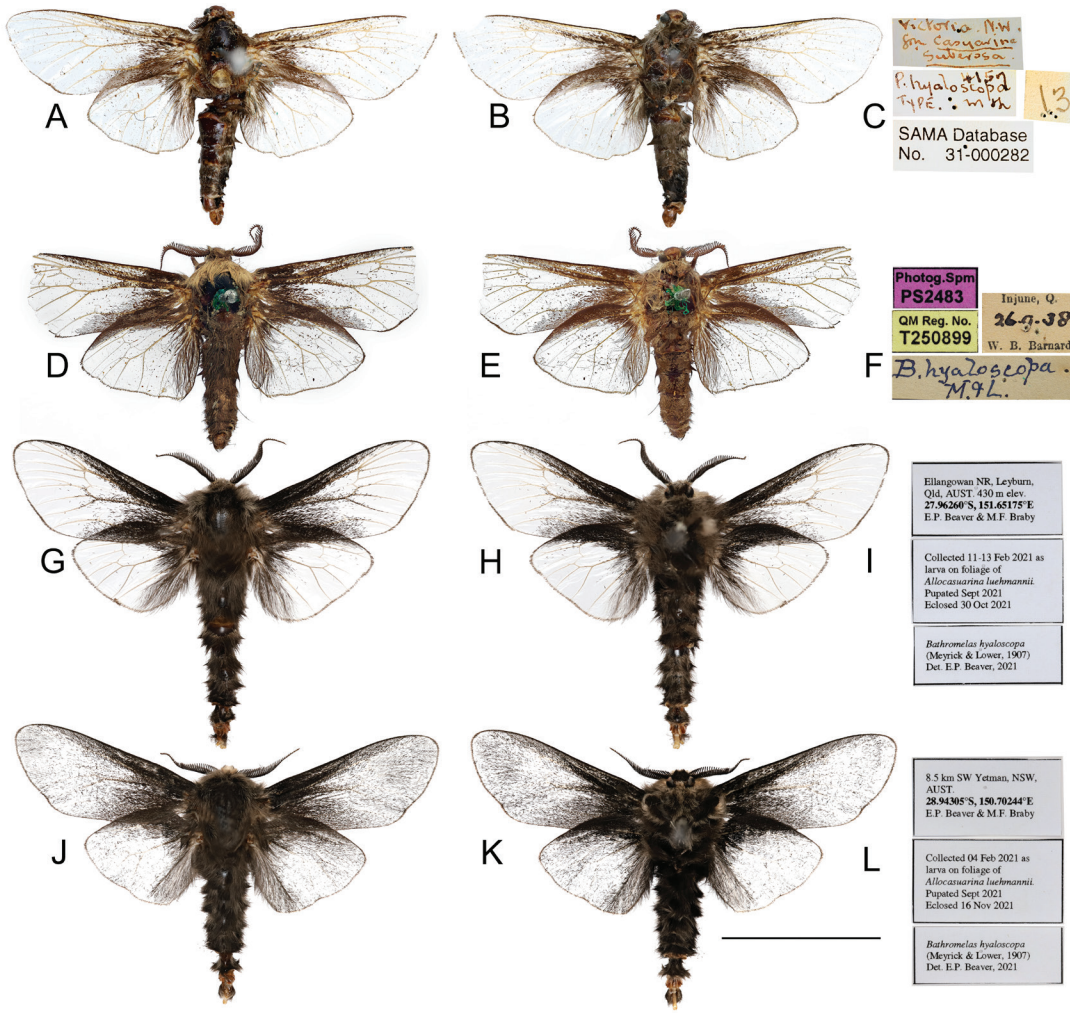

Figure 1. Adult male *Bathromelas hyaloscopa* (Meyrick & Lower, 1907) dorsal view, ventral, and data labels, **A-C**, holotype, **D-F**, specimen in QM from Injune, Qld., photos © Geoff Thompson, **G-H**, reared specimen in ANIC, **J-L**, reared specimen in EPBC. Scale bar 10 mm.

hyaline. Scale type in termen piliform. Deciduous scales over wing surface, shed after eclosion. Veins light brown, Sc and R_1 merged medially, three M veins present, M_2+M_3 sometimes arising from same point on discal cell, discal cell with two M veins merged medially. CuP atrophied, three A veins present [Note: HT with aberrant venation left hindwing Sc and R free, M_1 not reaching margin, with discal cell open, M_2 forked].

Pregenitalia abdomen. Clothed with dark grey to charcoal/black scales, intersegmental membrane transparent. Sternites and tergites (Fig. 2Q) deep rust-red to dark brown. Tergite II rectangular, TIII-TVI trapezoidal with posterior margin becoming concave, TVII and TVIII with anterior margins slightly convex and posterior margin deeply concave, essentially bifurcate. All tergites with anterior lateral corners fine, elongate, becoming gradually longer on TIV-TVIII. Sternites II to SVII all roughly square with convex posterior margin in SIII-SVI and SVIII, anterior lateral corners narrow, elongate, increasing in length proportionally as general sternite size decreases, SVIII with anterior lateral corners modified to paired anterior apophyses, with apexes truncate, lateral sides of sternite slightly concave.

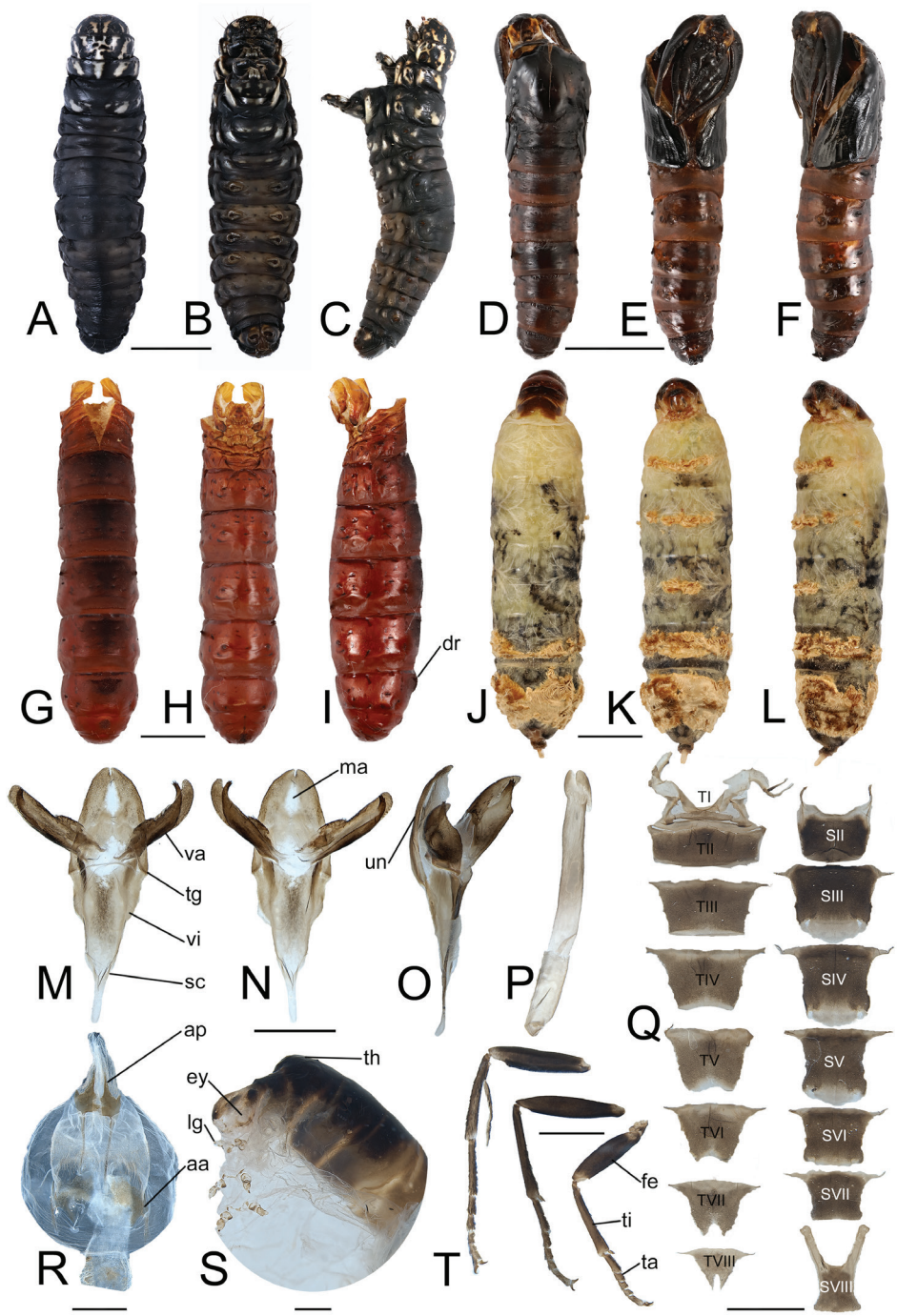

Figure 2. *Bathromelas hyaloscopa* **A-C**, larva, **D-F**, male pupa, **G-I**, female pupa, **J-L**, female, **M-P**, male genitalia EPB-155, **Q**, male abdomen tergites and sternites, **R**, female genitalia EPB-154, **S**, female head and thorax, cleared, **T**, male legs. Scale bars **A-L** 10 mm, **M-P**, **R-T** 1 mm, **Q** 2 mm.. Abbreviations are as follows: aa – apophyses anteriores, ap – apophyses posteriores, dr – dorsal ridge, ey – eye, fe – femur, lg – leg, ma – membranous area of uncus, SII-SVIII – sternite two to sternite eight, ta – tarsus, tg – tegumen, th – thoracic hump, ti – tibia, TI-TVIII – tergite one to tergite eight, un – uncus, va – valva, vi – vinculum.

Male genitalia (Fig. 2M-P). Saccus weakly sclerotised, sub-triangular, posterior finger-like, elongate. Vinculum narrow, more heavily sclerotised medially and towards tegumen, lateral edges medially convex. Tegumen positioned at approximate middle of genitalia, broadest at outer margin, fused with uncus. Uncus broadly triangular, postero-lateral corners acute, posterior apex bifurcate, concave when viewed laterally, setose on dorsal aspect, membranous area present medially below apical bifurcation. 'Transitellar arms' sclerotised, short, linear. Valvae elongate, apexes bifurcate to two lobes, ventral lobe hooked, short spines at apex, with node on lateral edge, inner dorsal margin setose, dorsal lobe triangular with blunt apex, setose. Sacculus narrow, sinuate. Aedeagus elongate, approximately straight, ductus ejaculatorius and vesica smooth, pronounced asymmetrical ovoid at apex.

Female (Fig. 2J-L, 2R-S). Length 35-40 mm, elongate and narrow.

Head. Weakly sclerotised, hypognathous, bulbous, with rounded patch of sclerotisation at frons and above eye, eye present, tentorial pits present, antennae simple, single filiform antennomere, scape and pedicel appressed ovoid. Thorax. Dorsally highly sclerotised, dark brown, laterally and ventrally membranous, transparent. Wingless. Mesoscutum modified with pronounced thoracic hump above head and patagium. Lateral spine-like process present on thorax. Legs present, highly atrophied, weakly sclerotised dorsally and ventrally, two segmented with single apical hook on final segment. Pregenitalia abdomen membranous, transparent, in life with cream-yellow colouration of underlying tissue and eggs. Corethrogyne extensive, dense layer of iridescent golden scales covering TVII and SVII, with ring of scales around SVI and TVI, and the remaining sternites V to SIII all with medial patch of scales.

Female genitalia (Fig. 2R). Apophyses anteriores reduced, simple, weakly sclerotised arising from sclerotised sternite, SVII setose. Apophyses posteriores moderately long, segment VIII sclerotised. Antrum subtriangular, smooth. Corpus bursae rounded [damaged in dissection], diverticulum narrow. Ductus bursae short, narrow. Ovipositor short, simple.

Figure 3. Larval cases of *Bathromelas hyaloscopa*.

Diagnosis

The main diagnostic morphological features compared with other Australian Psychidae are seven characters in the male, (mainly of wing vein morphology, and aspects of male genitalia and tergites) and additionally four characteristics of female adult and pupal morphology. In the male the forewing R5 is stalked from a point at discal cell with R3 + R4, hindwing with two M veins, three A veins, legs with basal tarsomere half-length of total tarsus, abdomen tergites TVII and TVIII have the posterior margin bifurcate with deep medial invagination, uncus apex bifurcate and with distinct central membranous area. Female with bulbous head, thoracic hump present, corethrogyne scales extensive and distributed beyond SVII, pupa with prominent dorsal ridge on TVII. The larval case is also distinctive by way of the tight-packed bark fragments with 1-4 twigs attached parallel from middle to close to posterior aperture.

LIFE HISTORY INFORMATION

Hostplant

The larval hostplant is the foliage of the Buloke *Allocasuarina luehmannii* (Casuarinaceae), a dry woodland tree to 15 m widespread in eastern Australia. All specimens were collected from within the known range of this tree except for the South Australian larval case specimen. However, two other Allocasuarina are widespread in this region of South Australia – *A. verticillata* and *A. muelleriana*, both of which may form small trees. In captivity, larval specimens accepted *Casuarina glauca*, also Casuarinaceae; however, larvae would not accept foliage from any other plant family offered, such as Fabaceae, Myrtaceae, Rosaceae, or Santalaceae. This species is expected to be a Casuarinaceae specialist, and the common name 'buloke bagworm' is suggested to reflect this. Host specificity to this degree is unusual in the Oiketicinae, which are typically broadly polyphagous.

Habitat and ecology

The habitat at the collection sites near Leyburn, Qld, Dthinna Dthinnawan NP, and near Yetman, NSW is largely similar; a dense dry *Allocasuarina luehmannii* and *Callitris* woodland with occasional *Eucalyptus* and *Corymbia* trees scattered throughout (Fig. 4A-B), receiving 350-600 mm of rainfall annually. The most abundant trees in these regions were *A. luehmannii* and *Callitris*, and larvae or empty cases were only located on *A. luehmannii*. A similar environment exists at Injune, Qld; however, the environments in western Victoria and in the Flinders Ranges are structurally different, and specific collection localities or habitats are unrecorded for this species within this south-western aspect of their known range.

Larvae were observed on both saplings and mature trees, generally on outer foliage around 1.3-2 m height. Larvae rest in dense foliage when inactive, and when feeding they travel along a casuarina needle to the distal apex, then feed backwards

Figure 4. Habitat and live habitus of *B. hyaloscopa*. Habitat at **A**, Leyburn, Qld, **B**, Bendidee SF, Qld, **C-D**, live larva, **E**, newly eclosed male expanding wings and **F**, at rest, **G**, empty pupal cases on host tree at Bendidee SF.

from this section. Larval duration is a minimum of two years. Larvae were late instars when collected in February or March, and pupation did not occur until September of the collection year, where only minor increase in overall length was observed over this duration. Pupae were always affixed to the main trunk or lower branches, or wedged in crevasses within the bark (Fig. 4G). Adult flight time and female eclosion is September through to early December. Males emerge in the mid afternoon at 15:45 hr, and attempt to fly immediately in captivity, suggesting that the species is diurnal. This may explain why no specimens are confirmed as to have been taken to light at night. As with other clear winged Oiketicinae where known, the adult males eclose with a complete set of deciduous scales across the entire wing surface area. These scales are shed as the insect vibrates the body and wings to heat itself before flight. One specimen (Figs 1J-L, 4E-F) was preserved before this heating process or flight could take place, in order to illustrate this feature, though some scale loss is apparent between eclosion and preservation. The basal areas of the wings are more heavily scaled with more strongly anchored scales. The eclosion of adult females was determined by the sudden appearance of a tuft of cast golden-coloured corethrogyne scales lodged in the posterior aperture of the larval case. When this was detected, the case was carefully slit open, and the female removed and preserved. Under natural conditions, the adult female will remain partially within her pupal exuvia with only the head and thorax exposed, positioned 'head down' at the posterior aperture of the case.

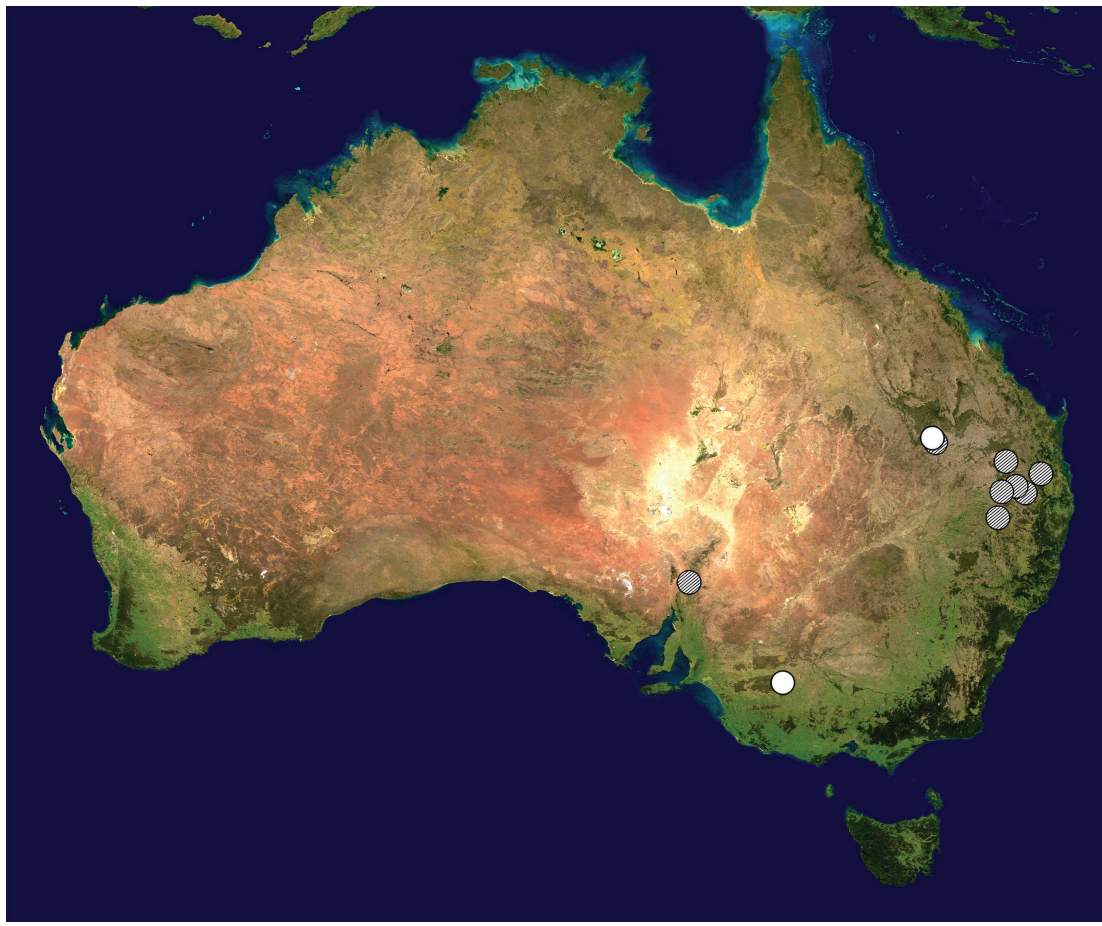

Figure 5. Distribution map of *B. hyaloscopa* with published records as white circles (as approximate from Meyrick & Lower, 1907 and Turner, 1947) and cross-hatched circles for new records referred to in this text.

The posterior aperture is opened by use of her reduced but articulated legs, which also are used to push the corethrogyne scales out of the case. The females are not adapted for survival outside of the case. This behaviour is standard for oiketicine psychids where females are known. Egg laying was not observed but it is suspected to take place within the empty pupal shell of the female, as old empty pupae are often found filled with corethrogyne scales and eggshell fragments freely within this matrix. Empty cases appear to remain within the environment for a substantial period of time, possibly several years before breaking down or falling from the host tree. Some empty cases were found with infauna such as Arachnida: Clubionidae, Sparassidae, Insecta: various Blattodea, Coleoptera, Grylloidea, etc which utilised the cases for shelter and in some examples as food.

Parasitoids

Approximately 50 *Brachymeria* Westwood, 1829, Chalcididae (det. E.P. Fagan-Jeffries) were reared from one case all from a single female pupa. The adult wasps were unable to exit the case for unknown reasons, and the majority were deceased upon opening the bag on the 14th of September 2021. One additional case was located with two small circular holes approximating the diameter of these same *Brachymeria*.

Distribution

Bathromelas is known to occur in scattered localities across the dry wooded areas of eastern Australia (Fig. 5), in south-eastern Queensland from Injune, Leyburn, 8 km south of Chinchilla, 40 km east of Toowoomba, Bendidee SF (Fig. 4G), from northern New South Wales at 8 km SW of Yetman, the nearby Dthinna Dthinnawan NP, as well the single holotype specimen from 'north-west Victoria', and a larval case from Wilson, near Kanyaka, South Australia. All of these localities are situated on or west of the Great Dividing Range. Some 1,100 km separates the Victorian specimen from those in NSW. However, this species is expected to be more widespread in inland eastern Australia in scattered localities where landscape-level areas of undisturbed old-growth stands of the hostplants still persist.

DISCUSSION

In their original description of *Plutorectis hyaloscopa*, Meyrick & Lower (1907) refer to a single male type specimen, which is in SAM (Fig. 1A-C, SAMA Database no. 31-000282), and provide a brief external description; however, they did not describe wing venation or genitalia. They state that the specimen is from 'North-west Victoria. One specimen; beaten from Casuarina sp. in November.' (Meyrick & Lower 1907 pp. 203-4). From this statement, it is unclear if an adult or larval specimen was collected, and although it is usually Lepidoptera larvae that are collected in this manner, the specimen in question was probably an adult at rest as they clearly state that the case and larva is unknown to them, and there is no associated larval case in the SAM collection. The holotype is labelled slightly differently to that listed in Meyrick & Lower, and includes the statement 'from *Casuarina suberosa*' which is now *Allocasuarina littoralis* (Salisb.) L.A.S. Johnson. Curiously, this tree species does not occur in north-west Victoria (Australian Virtual Herbarium, 2022), so it is possible this listing is a misidentification. This, coupled with the vague terminology in Meyrick & Lower (1907), makes the application of this species name as a host record doubtful, and that it was instead collected at rest on a different *Casuarina* or *Allocasuarina* species.

Turner in his generic description refers to two specimens, one from Injune, Queensland, and a further specimen from Wimmera, Victoria. No specimen is known with a label that states 'Wimmera'; however, this is a broad geographic locality in western Victoria, so it is possible that this refers to the holotype specimen. Problematically, he lists a measurement of 32 mm, different from the 30 mm listed in Meyrick & Lower for the holotype in SAM. The Injune specimen (Fig. 1D-F) in the QM collection is a worn specimen, where any measurement of wingspan would be an estimate. A further Injune specimen is in ANIC, it is unset, heavily worm, and damaged by verdigris. In Turner's description (Turner 1947, p. 62) he also states '*antennae pectinate* to *apex*' which is further problematic as the type specimen only has a single antenna, broken to about half, while additionally the antennae of the Injune specimen (and the

others examined) are actually bipectinate without pectination on the final apical antennomere. He also goes on to state *'Forewings with 4 and 5 stalked, 7, 8, 9 stalked, median vein in cell forked*. Hindwings with 4 and 5 approximated throughout, 6 and 7 remote, median vein in cell forked.' In the Comstock and Needham system, this is the same as 'M_2 and M_3 stalked, R_3, R_4 and R_5 stalked' for the forewing, and 'M_1 and M_2 approximated, R and Sc separate'. It is unclear what the use of the term 'approximated' refers to. It is unclear if Turner ever saw the holotype in SAM, or if his description for the genus was based on his Injune specimen. The holotype is an aberrant specimen which has different wing venation in the left hindwing compared with the right; however, this is neglected in both Meyrick & Lower's and Turner's descriptions. The right hindwing is 'typical' in that Sc is merged with R medially, the discal cell is closed, with three M veins both reaching wing margin; however, the left hindwing has Sc and R free, M_1 not reaching margin, with discal cell open, and M_2 is forked. The QM Injune specimen, as well as the three reared males, all have typical venation as described.

Presently, no modern molecular or integrated phylogeny exists for Australian Psychidae, and the relationships both between and within genera (many of which are weakly diagnosed) of Oiketicinae are not well established. It is beyond the scope of this study to place *Bathromelas* within a phylogeny; however, some important characteristics have been identified in the male and are detailed here in comparison with other predominately Australian genera. *Bathromelas* shares several characteristics with *Lomera*; the male genitalia are broadly similar, and both taxa have the first tarsomere elongate, i.e. it comprises ½ total tarsus length, while in other genera such as *Metura*, *Clania*, and *Pseudoclania* Bethune-Baker, 1915 this is less than ½, with the last two genera having the apical tarsomere longest. Although no Lomera are known to have truly hyaline wings, hyalinality is not a generic-level characteristic, with some typically scaled genera (i.e. *Clania*, *Amatissa* Walker, 1862) containing species with partial or fully hyaline wings. Both *Bathromelas* and *Hyalarcta* have clear wings, and may resemble each other at a superficial level, but the wing venation, and wing shape, is not similar, with the hindwing of *Hyalarcta* greatly reduced, round, and with only a single M vein. *Bathromelas* and *Lomera* differ in wing venation, with *Lomera* having two A veins in the hindwing, unlike *Bathromelas* which has three. Additionally, R_5 in the forewing arises from the discal cell in Lomera but it is stalked with R_3 and R_4 in *Bathromelas*. These characteristics are included with caution, as *Lomera* is a problematic and species-rich genus in need of revision, and the characters listed here have only been corroborated for a small number of *Lomera* species. *Lomera* may eventually be shown to be polyphyletic. The wing shape of *Bathromelas* is distinctly triangular. Many genera exhibit this feature (i.e. *Clania*, *Pseudoclania*, see Beaver 2021), with it being a uniform characteristic across all species within. However, and unusually, *Lomera*, a genus with an otherwise predominately rounded forewing apex, has two described species with the triangular forewing shape, *L. melanodes* (Meyrick & Lower, 1907), and L. zophopepla (Meyrick & Lower, 1907). The antennae of *Bathromelas* have the final apical palpomere simple, like Oiketicus and Metura among others, and not bipectinate like Lomera or *Pseudoclania*. Males of *Bathromelas* unusually have the posterior margin of TVII and TVIII essentially bifurcate, a character not reported from other Australian genera, though this feature is poorly sampled across genera.

Identifying unique characteristics within female specimens is a considerable challenge as so few female Oiketicinae are described in detail, with few reliably identified specimens available in collections. Some characteristics not observed in other Australian genera include an extensive corethrogyne, with scaled areas on TV-VII and SIII-VII in *Bathromelas*, other genera where known (i.e. *Metura*, see Beaver 2020) have specialised scales only at the corethrogyne and not elsewhere on the abdomen. Additionally, the presence of a distinct thoracic hump, and dorsal ridge on pupa abdomen, may be characteristics of significance.

The larval cases of *Bathromelas* are structurally unique among Australian psychid species. Some genera such as *Amatissa*, *Dappula* Moore [1883], *Lepidoscia* Meyrick, 1893 and *Pseudoclania* may incorporate small bark fragments or lichens within their case design, layered tightly on the outside of the case in a similar manner to *Bathromelas*,

though none incorporate long twigs at the anterior aperture in the same way as *Bathromelas*. Genera such as *Clania* and *Metura* may sometimes include one or more long twigs in the case design, but in both those genera the case will either be completely or partially covered in stick and/or leaf fragments, and is never layered in entirety with small bark fragments as in *Bathromelas*. Although the larva is patterned similarly to *Lomera*, that genus utilises stick or grass fragments either in a layered vertical parallel series, or attached laterally and alternating in a whorled pattern.

Bathromelas hyaloscopa is expected to be common within suitable environments, as both larvae and empty cases were abundant at the collection localities recorded. Empty cases were observed on trees in roadside vegetation near Leyburn in March 2021 and Feb-March 2022 at a rate of approximately one case every 40 trees. However, they are not evenly distributed within the environment; instead, generally small clusters (3-5 cases) are located every few hundred metres. Empty cases (or active pupae) are conspicuous on the bark of the main trunk or lower branches of the host plant. Active larvae are more difficult to spot as they live attached to growing foliage points. The large gaps of time between collected specimens, and dearth of specimens in general, may be due to the majority of Psychidae in collections being from material collected by light trapping, which appears to be an unsuitable collection method for this genus. By rearing field collected larvae or pupae, more specimens were obtained in a single year than in all of the previous 113 years combined. This highlights the importance of larval rearing as an essential method for obtaining material for any worker dealing with this family of moths. Several other Australian Oiketicinae are known to be day-flying, such as *Hyalarcta* and some *Metura* spp. Some *Elinostola* species are known to eclose around midday, and some *Lomera* are known to eclose in the early morning (both pers. obs); however, it is unclear if these genera contain truly diurnal or crepuscular species, as others have also been taken to light.

A larval case in the SAM collection is obscurely labelled simply with 'Wilson' as the collection locality. Although there is presently no township by this name, this may refer to a now abandoned area by that name in the Southern Flinders Ranges near Kanyaka (Flinders Ranges Council 2022) which was active around 1897 when the specimen was collected. No further material has been collected from South Australia (or from Victoria). However, significant stands of *Allocasuarina verticillata* remain in some areas of the Flinders, such as Dutchmans Stern CP and at Wilpena Pound, and discrete scattered patches across the south-east of the state may also be suitable, particularly near Naracoorte and Boothby Rocks. *Bathromelas* was unrecorded for New South Wales prior to this study, where it has now been collected near Yetman and Dthinna Dthinnawan NP. The widely-spread records across much of inland south-eastern Australia may be indicative of a broader, patchy but unrecorded distribution.

Of nomenclatural significance is the name *Oeceticus* [sic] *felinus* T.P. Lucas 1900, regarded as 'Unplaced to genus' by Nielsen & Edwards (1996), the written description of which (Lucas 1900) is similar in some aspects to this species, the approximate size is similar, and the case was vaguely described as 'from casuarina needles'; however, the whereabouts of Lucas's specimens is currently unknown, and was not stated in his paper. He lists at least two males, one female and her case, from 'May Orchard', Brisbane, Queensland. Curiously, his observation is described as that of male specimens attracted to a female, but the time i.e. day or night, is not specified. Some Lucas material is present in the SA Museum; but unfortunately, no specimens matching the description or labelling are present in this collection or in QM (K. Koch pers. comm) or ANIC. The type is treated as lost, and the name is regarded as a nomen dubium.

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