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## A New Species of *Tamasa* Distant from an Unusual Cave-like Habitat in Australia (Cicadidae: Cicadinae: Tamasini)

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**ABSTRACT.** *Tamasa caverna* n. sp. is described from Black Mountain, northern Queensland, a mountain consisting almost entirely of large rock boulders. The species appears to be unique amongst Cicadidae in that the males sing from under these large boulders far from trees. Notes on its song and behaviour are provided.

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### Introduction

The genus *Tamasa* Distant has recently been redefined and its distinguishing features summarized (Moulds 1990, 2012); it includes four species endemic to eastern Australia. The new species described here is known only from Black Mountain, northern Queensland, and is unique amongst the Cicadidae because the males sing from under giant boulders far from trees. The song of this new species is analyzed and its habit of singing amongst the boulders discussed.

Terminology for morphological features and higher classification follow those of Moulds (2005). The following abbreviations have been used for collections housing specimens: *AM*, Australian Museum, Sydney; *JO*, Collection of John Olive, Malanda; *LWP*, collection of L. W. Popple, Brisbane; *MSM*, collection of M. S. Moulds, Kuranda; *QM*, Queensland Museum, Brisbane.

### Family Cicadidae

#### Tribe Tamasini

#### *Tamasa caverna* n. sp.

Figs 4–10

**Types.** Holotype male, 12.i.2003, Black Mountain near Cooktown, Nth QLD, J. Olive (QM). Paratypes as follows, all from Queensland: 1♂, Black Mountain near Cooktown, 12.i.2003, J. Olive (AM); 1♂, Black Mountain near Cooktown, 12.i.2003, J. Olive; 1♂ 1♀, Black Mountain, 15°39'06"S 145°12'55"E 11, 11.i.2004, J. C. Olive; 3♂♂, Black Mountain near Cooktown, 23.i.2014, J. Olive & S. Orr; 1♂, Black Mountain near Cooktown, 24.i.2014, J. Olive (JO). 1♂ (genitalia prep. T79), Black Mountain, south of Cooktown, 15°39.1'S 145°13.2'E, 11.i.2004, J. Olive; 1♂, 1♀ (female specimen no. 04.QLD.STO.11, voucher for molecular sample), Black Mountain, S of Cooktown, 15°39.1'S 145°13.2'E, 12.i.2004, Cooley, Hill, Marshall, Moulds (MSM). 1♂, Black Mountain via Cooktown, 4.i.2001, R. Morgan (LWP).

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Figure 1. Black Mountain, the habitat of singing males. The males sing below the rocks where it is shaded and cool. Photo by Kathy Hill.



Figure 2. Aerial view of Black Mountain (mountain at left). Photo by Fanie Venter.



Figure 3. Close up of the large boulders of Black Mountain inhabited by *Tamasa caverna* n. sp. Photo by Fanie Venter.

### Description

*Male.* Figs 4, 6–9.

*Head* brown; central area around ocelli black and not reaching posterior margin; area adjacent to epicranial suture brown; a dark brown triangular mark situated about midway between lateral ocellus and lateral cranial depression; a transverse black mark extends from anterior cranial depression almost to eye but reaching eye in some specimens; a further black mark from anterior cranial depression to supra antennal plate; supra antennal plate brown, black centrally; cranial depressions brown; a black line adjacent to eye ventrally; ocelli yellow to reddish amber; postclypeus brown with transverse grooves dark brown to

black, moderately covered with silvery-white cilia; a well-defined broad brown fascia ventrally at midline narrowing toward centre of its length; lorum brown, broad dark brown to black mark adjacent to postclypeus; anteclypeus brown with dark brown midline and black distally; rostrum usually reaching well beyond distal margin of hind coxae but just reaching in some specimens, light brown with a dark brown fascia ventrally at midline, darker brown or black apically; antennae dark brown to black.

*Thorax.* Pronotum light brown with a black mark either side of midline extending from anterior margin to pronotal collar, these broader anteriorly and always joined at pronotal collar and sometimes at anterior margin; a broad brown fascia on midline, broader anteriorly, area between lateral

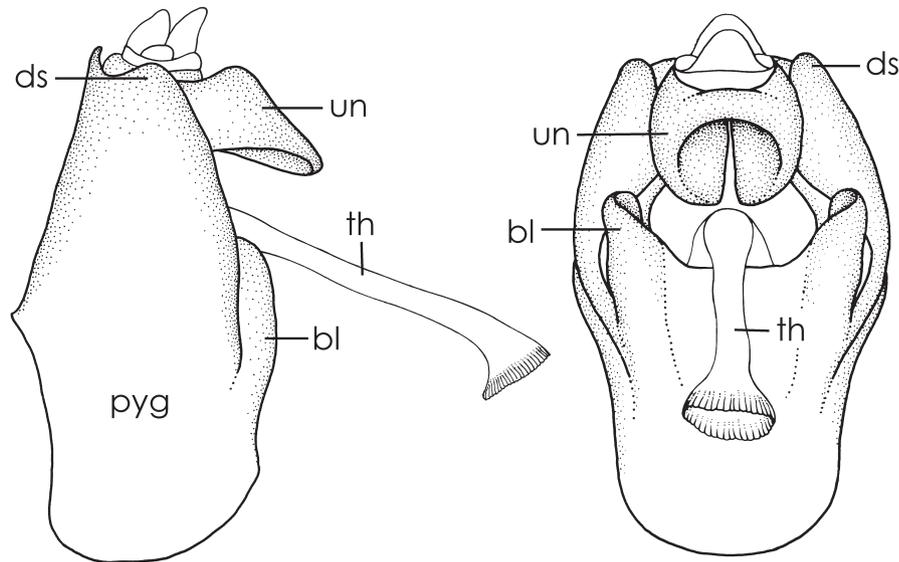


Figures 4–7. *Tamasa caverna* n. sp. (4) male, dorsal view; (5) female dorsal view; (6) male body ventral view showing opercula; (7) male timbal and timbal cover.

fissure and pronotal collar with black mark anteriorly and a dark brown mark posteriorly; area between lateral and paramedian fissures with black mark anteriorly and a dark brown lineal mark somewhat parallel to midline posteriorly; pronotal collar light brown to cream with anterior margin black. Mesonotum brown; submedian sigilla well defined with broad black inner margin and a thin black line along parapsidal suture; scutal depressions dark brown or black; a dark brown or black fascia at midline extending anteriorly from between scutal depressions, often tapering anteriorly and sometimes expanding laterally between the scutal depressions; lateral sigilla not clearly defined with variable amount of dark pigmentation but always with dark brown or black patch adjacent to pronotal collar and at apex; arms of cruciform elevation brown.

*Legs* brown, fore femora with a broad brown or black linear fascia dorsally, extending almost to distal margin where it curves downward on the outer side to terminate more or less hook-like; inner side of fore femora with a dark brown fascia extending full length and extending to each femoral spur; femoral spurs black; fore coxae with a broad black fascia along midline and a black patch distally on the inside; mid and hind coxae with a black patch distally on the outer side.

*Opercula* (Fig. 6) light brown to cream with margins black and distomedial area usually dark brown or black; moderately covered with silvery-white cilia; usually widely separated but meeting or nearly so in some specimens; lateral and distal margins evenly curved forming a semi-circle; medial margin straight.



Figures 8–9. *Tamasa caverna* n. sp., male genitalia. (8) lateral view; (9) ventral view. *bl* basal lobe, *ds* distal shoulder, *pyg* pygofer, *th* theca, *un* uncus.

*Wings* hyaline; costal vein light brown to node; subcostal and radius anterior veins dark brown; veins forming cubital and ulnar cells light brown; median veins and cubitus anterior veins dark brown; ambient vein and veins forming bases of apical cells 1–5 and 7 dark brown; sometimes weakly tinted at distal ends of apical cells 1–4; infuscated at cross veins r and r-m; basal membrane grey; basal cell opaque to lightly translucent brown sometimes becoming hyaline distally. Hind wings hyaline; veins dark brown; jugum infuscated basally but remainder of anal lobe hyaline.

*Abdomen* brown; moderately covered with silvery white cilia; tergite 1 light brown; tergite 2 light brown, the timbal covers weakly developed, broadly triangular with anterior margins black and curled upward; tergite 3 with narrow dark brown or black anterior margin becoming broader laterally; tergites 4 to 7 usually with some dark coloration along anterior margin but absent in some specimens; tergite 8 with a broad dark brown or black patch either side of midline adjacent to anterior margin. Sternites black, light yellow-brown along posterior margins of sternites 1–6, sternite 7 entirely black, sternite 8 light brown with black fascia along midline.

*Timbals* (Fig. 7) with five ribs; ribs 1–3 long and of similar length, ribs 4 and 5 shorter with rib 5 shortest; ribs 1 and 2 always joined dorsally, the lower half of ribs 1 to 4 broader, rib 5 thin for its entire length.

*Female* (Fig. 5). Similar to male. Abdominal segment 8 light brown on its lower half and black on its upper half. Ovipositor brown, black apically; ovipositor sheath not reaching beyond anal styles and dorsal beak.

**Measurements.** The range and mean (in mm) for all available specimens (9♂♂ and 2♀♀).—Body length, male 23–26.5 (23.83), female 24.0–24.4 (24.2); forewing length, male 32–36 (34.05), female 34.6–35 (34.8); head width, male 8–9 (8.49), female 8.5–8.9 (8.7); pronotum width, male 8.5–10 (9.09), female 9.3–9.5 (9.4); abdomen width, male 9–10 (9.61), female 9.4–9.5 (9.45).

**Distinguishing features.** *Tamasa caverna* n. sp. is most similar to *T. doddi* (Goding & Froggatt, 1904) and *T. burgessi* (Distant, 1905) but is easily distinguished from those two species in lacking infuscation at the tips of the fore wings.

The male genitalia of *T. caverna* appear to be unique in having an uncus that is substantially tubular and in lateral view tapers to a bluntly rounded apex and a theca that is straight for most of its length with a trumpet-like apex very finely fluted around its rim.

**Etymology.** Named from the Latin *caverna* meaning a cave, grotto or cavern and referring to the cavern-like habitat of the singing males.

### Distribution and habitat

Known only from Black Mountain south of Cooktown in northern Queensland (Figs 1–3) where males are found amongst large granite boulders. The males rest and sing from within caverns between boulders, usually clinging to the undersides of boulders. The possibility that adults also occur in adjacent rainforest areas away from boulders has not been excluded. The distribution of this species may extend to similar granitic boulder screes in the Melville and Bathurst Ranges north of Cooktown. There are records only for January but based on emergence cycles of other species adults might be encountered throughout much of summer wet season, December to February and possibly beyond.

### Song

The song consists of a broken revving sound often followed by a continuous, mildly rattle-like, call (Fig. 10). The revving component of the song comprises short revving sounds at about one second intervals which may last the entire song. On other occasions there is a continuous or uninterrupted finale. Although singing can occur throughout the day, songs with a continuous part are more often heard in late afternoon and at dusk, this part of the song being similar to all other *Tamasa* species. The frequency of the call is concentrated between 4 and 8 kHz.

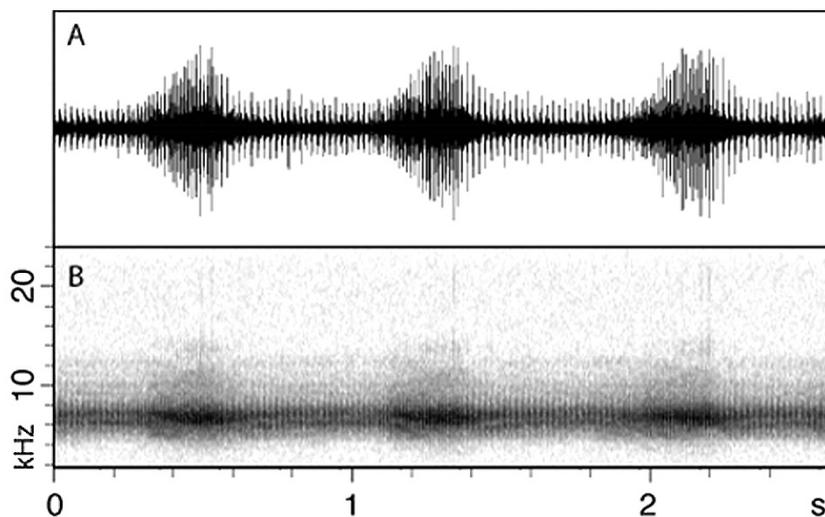


Figure 10. *Tamasa caverna* n. sp., oscillogram (A) and sonogram (B) showing three-second fragment of revving song component, specimen number 04.AU.QL.STO.10. Sound energy (mainly background noise) below 2 kHz was removed before illustration. The recording was made on a Sony TCD-D8 digital recorder sampling at 48 kHz, with a Sennheiser ME62 condenser microphone powered by a Sennheiser K6 power module using battery power and a Sony PBR-330 parabolic reflector. The sonogram and oscillogram were generated in Raven Pro 1.4 build 48, with default settings plus a Hann window set to 256 samples and a 3 dB filter bandwidth of 270 Hz. The recording was made on 11 January 2004 at Black Mountain, south of Cooktown. The ambient air temperature at the road during the recording was 31.5°C; temperatures among the rocks were cooler.

The reason why males call from under boulders remains unknown, no study has directly addressed this question. Dr David Marshall, who has recorded the song, suggests that one explanation may relate to optimization of microclimate, especially in regard to shade and temperature. The species of *Tamasa* are mesic-adapted, with most, especially *T. doddi* and *T. burgessi*, preferring singing stations in forest interiors where microhabitats are shaded and cooler. Similarly, during periods of intense summer solar radiation when exposed and dark-coloured boulders undergo extreme heating, we believe males are driven to cooler interior rock faces—a tropism to shaded and cooler microclimates typical of other *Tamasa* species.

Exposed rock surfaces become superheated to levels that even effect overhanging tree branches making them also unsuitable as singing stations. By locating under rocks and in deep fissures between boulders singing males can prolong their calling periods when otherwise they would cease activity to avoid overheating. The degree to which this behaviour is temperature dependent could be tested on cloudy but warm days—males and females may be more willing to sing and rest on upper rock surfaces, or even in nearby branches. There is also the separate question of colour-pattern matching and the habit of resting on rock surfaces of corresponding colour.

We cannot dismiss the possibility that singing among rocks and boulders has adaptive significance for this species and has become the sound environment in which auditory communication between the sexes must occur. We think this less likely because moving from branches to between and under rocks would reduce intensity, directionality and distance of calls and thereby be subjected to negative selection. Nevertheless, there may be an acoustic modification that occurs within the boulder “galleries” that has become an important part of this species’ calling and mating behaviour.

The Black Mountain Boulder Frog, *Cophixalus saxatilis* Zweifel & Parker also inhabits rock grottoes of Black Mountain (Zweifel & Parker, 1977), but it occurs in other environments away from the boulders. Since the frog calls in both situations it apparently attains no particular acoustic advantage by calling from under and between rocks. Rather it occupies rocky habitats in response to a preference for damp and cool.

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