

SHORT COMMUNICATION

Notes on the habitat and biology of the rare ant genus *Tyrannomyrmex* (Fernández, 2003)

MARK K. L. WONG^{1,2*} AND GORDON W. J. YONG³

¹National Parks Board, Singapore Botanic Gardens,
1 Cluny Road, Singapore 259569

²Entomological Network of Singapore, Block 539, Ang Mo Kio,
Avenue 10, #13-2577, Singapore 560539

³Department of Biological Sciences, National University of Singapore,
14 Science Drive 4, Singapore 117543

*Corresponding author: markwong.research@outlook.com

Keywords: Myrmicinae, Solenopsidini, Formicidae, Secondary forest, Singapore

INTRODUCTION

The myrmicine ant genus *Tyrannomyrmex* Fernández, 2003 comprises three species of tropical ants restricted to the Oriental region. The biology of these ants is thus far unknown, as records of all species are based on solitary workers extracted from leaf litter samples. Both *Tyrannomyrmex dux* Borowiec, 2007 and *Tyrannomyrmex legatus* Alpert, 2013 are known from single specimens collected in India and Sri Lanka respectively; while the type species *Tyrannomyrmex rex* Fernández, 2003 described from a solitary worker collected in Peninsular Malaysia, was recently recorded from a single worker in Singapore (Jacquemin et al. 2015). The genus was also recorded from Sabah, Borneo (Fisher et al. 2015).

The first known live colony of *T. rex* (and of the genus as a whole) was collected in Singapore in March 2016. Here we provide measurements for *T. rex* workers, describe their habitat, and discuss preliminary observations on their biology from rearing the ants in captivity for 10 days. Three video recordings (Electronic Supplementary Material) accompany our descriptions of the ants' behaviour.

MEASUREMENTS FOR *TYRANNOMYRMEX REX*

Workers of *T. rex* display some variation in body size, however, no discernable differences in morphological shape or structure were observed between individuals. Figure 1 shows the largest worker (TL 4.52 mm) in the present collection from Singapore, which is a fifth larger than the holotype (TL 3.75 mm, Fernández 2003) from Peninsular Malaysia, which remains the smallest *T. rex* worker so far collected. The following measurements of *T. rex* workers (after Fernández 2003) include the holotype measurement, followed by the range of measurements for 10 workers from the current collection: HL 0.80, 0.81–0.97 mm; HW 0.60, 0.64–0.73 mm; EL 0.06, 0.07–0.11 mm; SL 0.64, 0.67–0.81 mm; PrW 0.49, 0.52–0.62 mm; WL 1.06, 1.23–1.48 mm; PL 0.43, 0.45–0.56 mm; PPL 0.29, 0.30–0.34 mm; PW 0.31, 0.30–0.36 mm; PPW 0.31, 0.31–0.37 mm; GL 0.92, 0.95–1.17 mm; TL 3.75, 3.75–4.52 mm; CI 75, 75–78; SI 106, 103–110.



Fig. 1. In profile view, the largest *T. rex* worker (TL 4.52 mm) in the current collection.

SPECIFIC HABITAT AND COLONY DESCRIPTION

The colony of *T. rex* was collected by hand in the Mandai area (1.401°N, 103.777°E) of Singapore, which comprises secondary forests, previously managed as orchards (e.g. durian, rambutan, banana) and rubber plantations during the early 1900s. The collection site showed signs of disturbance from regular military training activities – the forest floor was open due to trampling of understory plants and littered with bottles and food wrappings. Discovering *T. rex* in such habitat indicates that *Tyrannomyrmex* species are not necessarily “restricted to pristine or relatively

undisturbed forests” as previously suggested by Jacquemin et al. (2015).

We found the ants beneath the leaf-litter (removed for Winkler extraction) at the base of a tree (diameter at breast height = 1.2 m). Several workers were clustered on the freshly exposed soil surface, around a small (<15 cm) piece of moist, fibrous rotting wood partially buried in damp soil. No additional conspecifics were found in the surrounding soil upon manual searching, or present in Winkler extractions of leaf-litter samples from the area. When dismantled, the piece of rotting wood revealed two hollow cavities which appeared to be nest chambers harbouring more *T. rex* workers and brood. At the time of collection,

the *T. rex* colony contained a total of 13 workers (including 1 callow), 2 worker pupae, 1 male pupa, 9 larvae and 5 eggs (some eggs may have been lost).

No nests of other ant species were found in the vicinity of the *T. rex* colony, nor were there other ants around or inside the *T. rex* nest. This suggests that *Tyrannomyrmex* species are not social parasites – a previous speculation by Jacquemin et al. (2015) based on the ants' supposedly pathogen-rich habitats (i.e. soil and litter), in spite of their puzzling lack of functional metapleural glands for sanitation and chemical defences (i.e., based on the absence of a metapleural gland orifice in *T. rex* and *T. dux* specimens examined by Fernández 2003, Borowiec 2007 and Jacquemin et al. 2015; also observed in the *T. rex* workers from the current collection).

OBSERVATIONS IN CAPTIVITY

The *T. rex* colony was transferred into a standard 'nest tube' setup comprising a 20 ml glass test tube half-filled with water that was stoppered by a wool plug, and connected to a wider foraging area for the ants of 20 x 15 x 4 cm. A plastic straw (diameter = 4 mm) held in place by wool at the mouth of the nest tube provided a nest entrance.

Activity patterns

Tyrannomyrmex rex is likely nocturnal, based on daily observations throughout the 10 days for which the ants were in captivity, indoors away from sunlight. During daylight hours, all individuals remained clustered within the nest tube with little movement observed, regardless of whether the setup was in the dark or placed under direct artificial lighting. However, at night-time between two to four workers were observed exploring the foraging area in the dark; this activity persisted even when direct artificial lighting was introduced at night. The environmental cues by which *T. rex* may maintain circadian rhythms are unknown.

Defence

Tyrannomyrmex rex demonstrated a 'timid' behaviour: when intimidated – either by nudging with forceps or when encountering invertebrates

(e.g. a millipede in Video S1), the ants typically curled their head and gaster inwards and under their legs and mesothorax, remaining motionless until the "aggressor" moved on, after which the ants quickly moved away (Video S1). Stinging was only observed once in *T. rex* following significant threat: a millipede crawled into the cluster of *T. rex* workers and brood within the nest tube, over multiple 'curled-up' workers, before being grabbed and stung by one individual (Video S2).

Cafeteria experiment

The prey of *T. rex* remains unknown despite numerous attempts to offer a selection of items in the foraging area. *Tyrannomyrmex rex* workers always antennated items while keeping their distance, and subsequently moved away. This behaviour was consistent for both live and dead prey items offered, including millipedes, centipedes (Geophilomorpha), mites (Oribatida), springtails (Collembola), spiders (Oonopidae), termite workers, workers and brood of other ant species collected from leaf litter at the same site (*Carebara*, *Eurhopalothrix*, *Hypoponera*, *Monomorium*, *Ponera*), and commercial honey. Considering their extremely timid nature, as well as their small, blunt mandibles with little dentition along the basal mandibular and clypeal margins (Fernández 2003), it is conceivable that *T. rex* are specialised predators of invertebrates which are much smaller than themselves, eggs of other invertebrates, or are scavengers.

Tyrannomyrmex rex male

A single male *T. rex* emerged two days after the colony was collected. Unfortunately, the specimen was completely consumed by its nestmates soon after. Video S3 shows the live male *T. rex*.

CONCLUSION

The paucity of records for *Tyrannomyrmex* species is likely attributable to their small colony size (i.e. 30 individuals including workers and brood in our *T. rex* colony), as well as their nesting habits in moist rotting wood under leaf-litter – an environment likely to be missed by conventional ant collection methods such as leaf-litter sampling, pitfall traps, and even direct hand sampling. The

suspected nocturnal activity patterns of *Tyrannomyrmex* species may further reduce their chances of being discovered, and their potentially specialised yet unknown trophic preferences might explain their absence from bait collections thus far. In general, remarkably similar combinations of ecological and behavioural idiosyncrasies have been suggested for other rarely collected ant genera (e.g. *Tatuidris* in Donoso 2012).

ACKNOWLEDGEMENTS

The authors would like to thank Christian Peeters and Benoit Guénard for their encouragement to write up the present findings and suggestions to improve an earlier version of the manuscript. We are also grateful to John Ascher for his support with laboratory and imaging facilities, and staff from the National Biodiversity Centre for their assistance with research permits. Finally, we wish to extend our gratitude to two anonymous referees who provided comments on an earlier version of the manuscript.

REFERENCES

- Alpert GD, 2013. A new species of *Tyrannomyrmex* (Hymenoptera: Formicidae) from Sri Lanka. *Zootaxa* 3721: 286 – 290.
- Borowiec ML, 2007. A new species of *Tyrannomyrmex* (Hymenoptera: Formicidae: Myrmicinae) from India. *Zootaxa* 1642: 65 – 68.
- Donoso DA, 2012. Additions to the taxonomy of the armadillo ants (Hymenoptera, Formicidae, *Tatuidris*). *Zootaxa* 3503: 61 – 81.
- Fernández F, 2003. A new myrmicine ant genus from Malaysia with uncertain affinities (Hymenoptera: Formicidae). *Zootaxa* 341: 1 – 6.
- Fisher BL, Guénard B and Robson S, 2015. Borneo, fAN-Tastique! *Asian Myrmecology* 7: 171 – 174.
- Jacquemin J, Sonet G, Bourguignon T, Evans TA and Delsinne T, 2015. Second record and DNA barcode of the ant *Tyrannomyrmex rex* Fernández (Hymenoptera: Formicidae: Myrmicinae). *Sociobiology* 62: 276 – 280.

APPENDIX

Captions for videos deposited as electronic supplementary material are follows:

Video S1. Responses of *T. rex* worker to a millipede. The worker curls up when the millipede crawls towards and over it; the worker then moves away quickly.

Video S2. *Tyrannomyrmex rex* worker stings millipede intruder. A millipede crawls into the cluster of *T. rex* workers and brood within the nest tube, over multiple ‘curled-up’ workers, before being grabbed and stung by one individual.

Video S3. Male *Tyrannomyrmex rex* in captive nest tube.

ASIAN MYRMECOLOGY

A Journal of the International Network for the Study of Asian Ants

Communicating Editor: Adam L Cronin