

Neurotoxic pesticide changes odds in aggressive interactions between native and invasive ants



Rafael F. Barbieri* & Philip J. Lester
Victoria University of Wellington, New Zealand

*e-mail: rafael.barbieri@vuw.ac.nz

1. Rationale

Neonicotinoid pesticides negatively affect behaviour of non-target organisms. Foraging and interspecific aggression are two important behaviours that ensure success of many animals. Behavioural changes are probably most relevant when they involve interactions between native and invasive species.

2. Aims

We examined the effects of sublethal neonicotinoid (NIC) exposure on the foraging activities of New Zealand's native ant *Monomorium antarcticum* (Fig. 1). Also, we assessed effects on the aggression of this native ant in interactions with the invasive Argentine ant *Linepithema humile* (Fig. 2).

3. Methods

We offered ants a 1:4 honey/water solution containing $1.25\mu\text{g mL}^{-1}$ of the neonicotinoid Imidacloprid. Firstly, we assessed the likelihood of *M. antarcticum* colonies exploring new foraging territories (Fig. 3a,b). Then, we subjected groups of the native and invasive ants to interspecific interactions. Groups of ants were either exposed (NIC+) or not exposed (NIC-) to the neonicotinoid.

4. Results

Sublethal exposure to the neonicotinoid pesticide reduced the likelihood of *M. antarcticum* colonies exploring new territories. After 36 days of exposure we observed a three-fold decreased probability of *M. antarcticum* colonies reaching the top level of the new territory (Fig. 3c) ($z=-2.68$, $p=0.007$; Coxph). The aggressive behaviour of *M. antarcticum* workers exposed to the neonicotinoid (NIC+) was significantly lower than the non-exposed ones (NIC-) (Fig 4a; $z=-4.49$, $p<0.001$; GLMM). Interestingly, the survival probability of Argentine ant workers increased when interacting with exposed *M. antarcticum* workers (Fig. 4b) ($z=2.83$, $p=0.005$; Coxph).

5. Conclusion

Sublethal exposure to neonicotinoids can alter foraging behaviour and modify the outcome of interspecific interactions between a native and an invasive ant. Non-target pesticide exposure could potentially change the dynamics of communities and influence invasion success.

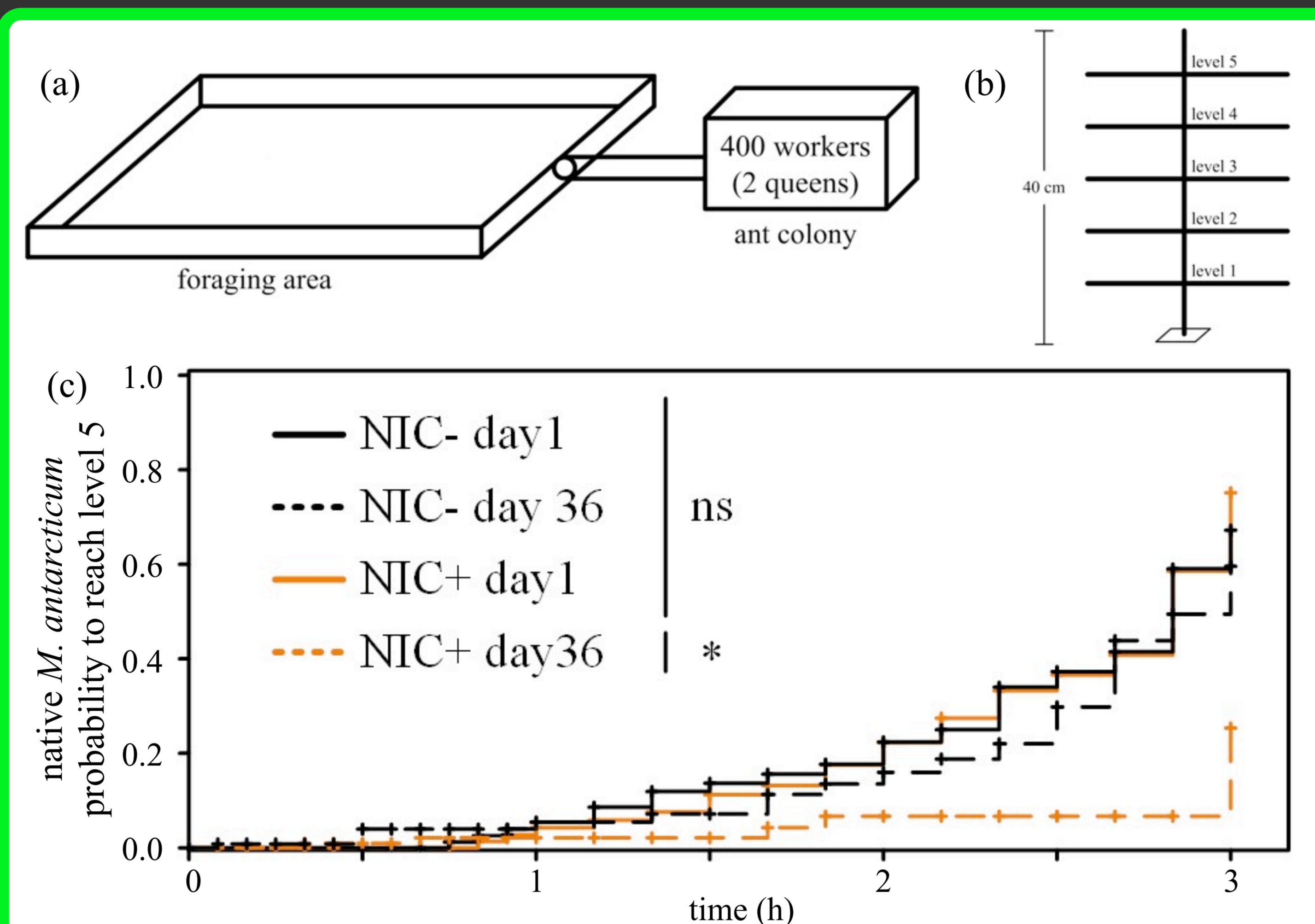


Fig 3. Foraging behaviour of *M. antarcticum*. (a) the foraging area where ants had access to food sources; (b) the new territory allocated into the foraging area before initiate the trials; (c) the probability of ants to reach the highest level of the new territory over a three-hour period.

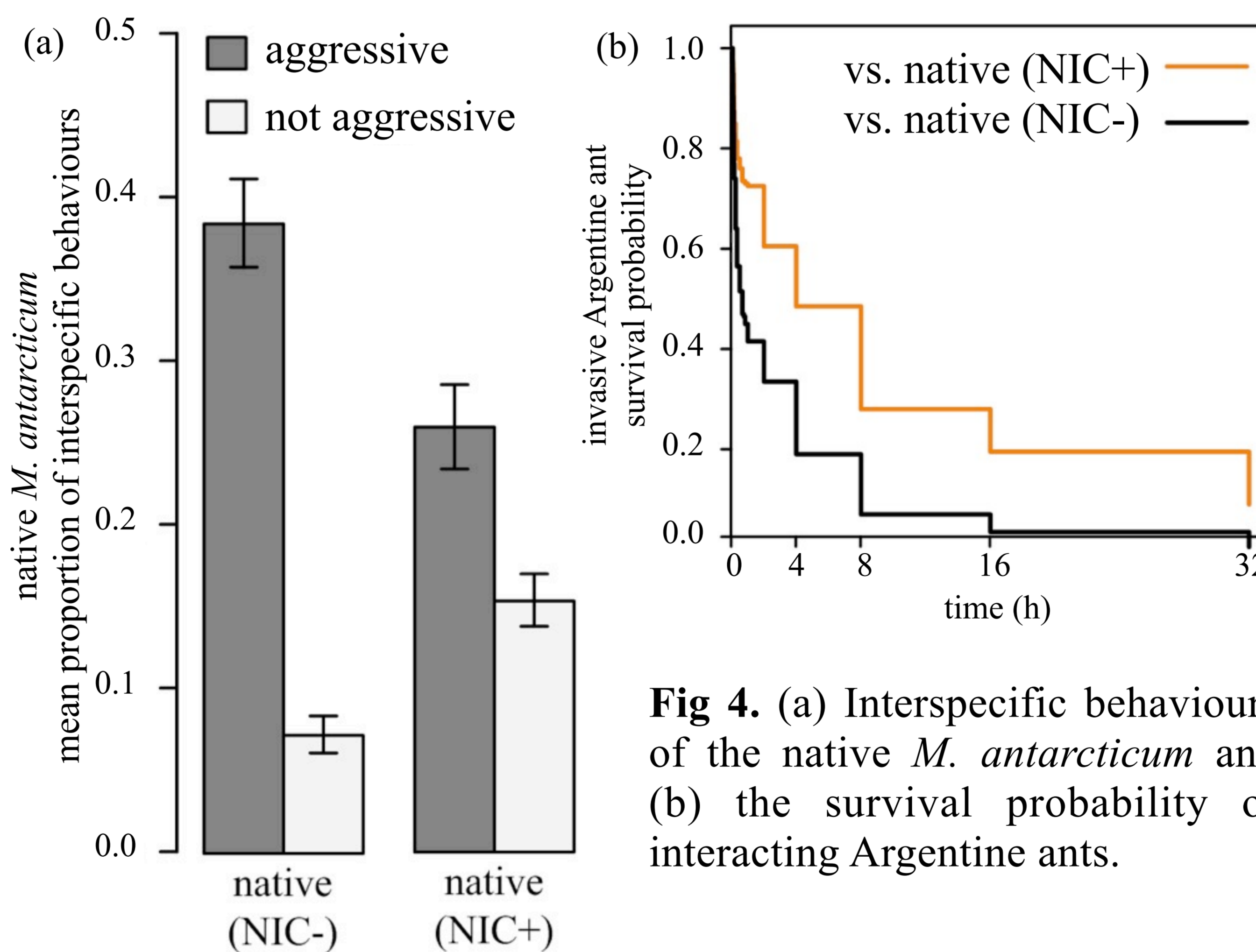


Fig 4. (a) Interspecific behaviours of the native *M. antarcticum* and (b) the survival probability of interacting Argentine ants.

Fig. 1. The native Southern ant *M. antarcticum*

Photo: George Novak

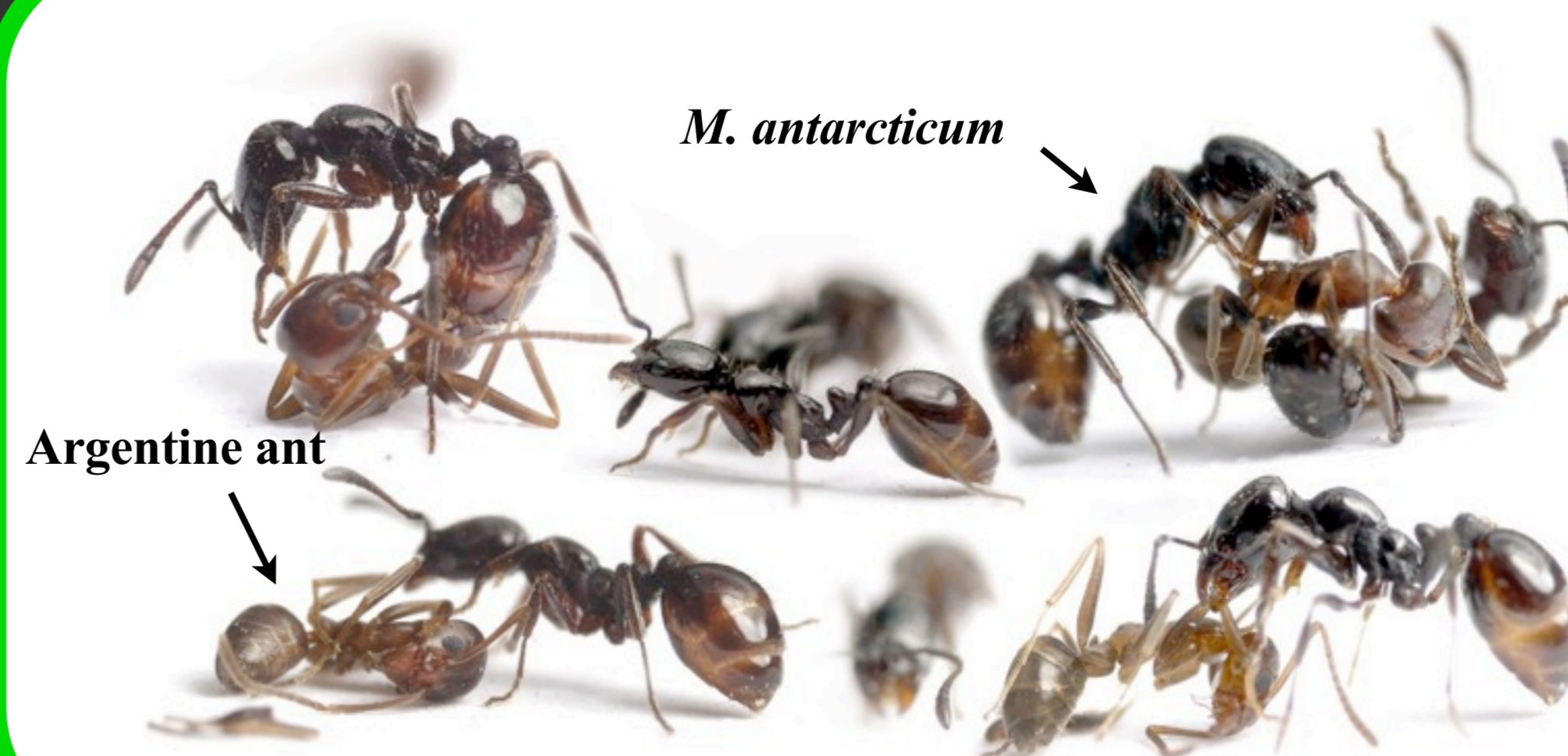


Fig 2. The native *M. antarcticum* interacting with the invasive Argentine ant.

Photo: George Novak

Acknowledgments:

- VUW and Centre for Ecology and Biodiscovery (financial support)
- VUW and IUSI (Australasian Section) (travel grant)
- Global Change Biology team – VUW (2012 - 2013)
- Ant club VUW for insightful comments
- George Novak (photos)