



Nest guarding by male bees

Zachary M. Portman^{a,1}

In their recent PNAS article on biparental care in *Ceratina nigrolabiata* Friese, Mikát et al. (1) demonstrate biparental care and nest guarding by males and present these strategies as previously unknown in bees. However, nest guarding by males has been documented in multiple other bee species, including another species of *Ceratina*. I am aware of 13 studies that document or suggest nest-guarding behavior in male bees, though I am limited here to the most well-documented examples.

The most in-depth descriptions of nest guarding are on macrocephalic males of *Lasioglossum erythrurum* (Cockerell) by Kukuk and Schwarz (2). Like the present study by Mikát et al. (1), males of *L. erythrurum* primarily defended the nest against conspecific males; they also fought ants that were artificially introduced to the nest and even engaged in a small amount of nest construction and maintenance (2). Similarly, Houston and Maynard (3) observed macrocephalic male *Leioproctus muelleri* Houston and Maynard guarding nests against conspecific males and attacking a nylon thread inserted into the burrow.

Multiple observations have been made of *Lasioglossum zephyrum* (Smith) guarding nest burrows. In a 1903 paper, Melander and Brues (4) provided detailed descriptions of guarding of nest entrances by males who defended against mutillids by blocking the nest entrance with their abdomen [they reported the species as *Lasioglossum pruinosum* (Robertson) but were most likely observing *L. zephyrum* (5)]. Additional observations were made on males of *L. zephyrum* by Rau (6, 7),

as well as by Barrows (8), who observed *L. zephyrum* and *Augochlora pura* (Say) males biting conspecific males who attempted to enter nests.

Finally, males of another *Ceratina* species, *Ceratina smaragdula* (Fabricius), have been reported to guard nests. Males were observed guarding burrows and blocking the entrance with their abdomen (9), and dissected nests revealed older males (rather than young, newly emerged males) inhabiting nests with females (10).

Mikát et al. (1) do an excellent job examining the foraging, reproductive success, and paternity of *C. nigrolabiata* and present a convincing case that males are largely motivated by increased mating opportunities. However, while Mikát et al. (1) do a more thorough job than previous studies on nest guarding in male bees, those previous studies provide valuable biological context and have implications for the interpretation of the results of the present study. In particular, Mikát et al. (1) present biparental care as an evolutionary alternative to eusociality, but this claim is undermined by the fact that male nest guarding occurs in a range of different social structures, including solitary (*Leioproctus*), communal (*L. erythrurum*), and eusocial colonies (*L. zephyrum*). Instead, this suggests that the evolution of male nest guarding is driven by processes separate from the evolution of sociality.

Acknowledgments

I thank Daniel Cariveau (University of Minnesota) for feedback on this letter.

- 1 Mikát M, et al. (2019) Polyandrous bee provides extended offspring care biparentally as an alternative to monandry based eusociality. *Proc Natl Acad Sci USA* 116:6238–6243.
- 2 Kukuk PF, Schwarz M (1988) Macrocephalic male bees as functional reproductives and probable guards. *Pan-Pac Entomol* 64:131–137.
- 3 Houston TF, Maynard GV (2012) An unusual new paracolletine bee, *Leioproctus (Ottocolletes) muelleri* subgen. & sp. nov. (Hymenoptera: Colletidae): With notes on nesting biology and in-burrow nest guarding by macrocephalic males. *Aust J Entomol* 51: 248–257.
- 4 Melander AL, Brues CT (1903) Guests and parasites of the burrowing bee *Halictus*. *Biol Bull* 5:1–27.
- 5 Brothers DJ (1972) Biology and immature stages of *Pseudomethoca f. frigida*, with notes on other species (Hymenoptera: Mutillidae). *Univ Kans Sci Bull* 50:1–38.
- 6 Rau P (1922) Ecological and behavior notes on Missouri insects. *Trans Acad Sci St Louis* 24:1–71.

^aDepartment of Entomology, University of Minnesota, St. Paul, MN 55108

Author contributions: Z.M.P. wrote the paper.

The author declares no conflict of interest.

Published under the PNAS license.

¹Email: zportman@umn.edu.

Published online May 13, 2019.

- 7 Rau P (1926) The ecology of a sheltered clay bank: A study in insect sociology. *Trans Acad Sci St Louis* 25:157–277.
- 8 Barrows EM (1976) Mating behavior in halictine bees (Hymenoptera: Halictidae): I, patrolling and age-specific behavior in males. *J Kans Entomol Soc* 49:105–119.
- 9 Batra SWT (1978) Aggression, territoriality, mating and nest aggregation of some solitary bees (Hymenoptera: Halictidae, Megachilidae, Colletidae, Anthophoridae). *J Kans Entomol Soc* 51:547–559.
- 10 Batra SWT (1976) Nests of *Ceratina*, *Pithitis* and *Braunsapis* from India (Hymenoptera: Anthophoridae). *Orient Insects* 10:1–9.