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SCIENTIFIC NOTE

Burying beetles (Coleoptera: Silphidae) in the forest canopy: The unusual case of *Nicrophorus pustulatus* Herschel

The burying beetle *Nicrophorus pustulatus* Herschel can reproduce in both large (Trumbo 1992) and small (Robertson 1992) carcasses in the laboratory, but has never been observed using these in the wild (Robertson 1992) and comes more readily to lights than to traps baited with carrion (Anderson 1982; Lingafelter 1995). Under natural conditions, this species has only been observed breeding in nests of black rat snakes (Blouin-Demers and Weatherhead 2000; Keller and Heske 2001) and may never use carrion for breeding purposes. In 2005 we caught two specimens of *N. pustulatus* Herschel in flight intercept traps suspended 15 meters or more above the ground in a bottomland hardwood forest in Georgia. We returned in 2006 to suspend carrion traps at three different heights to compare the vertical distribution of *N. pustulatus* with other burying beetles.

The study site was a mature bottomland hardwood forest bordering the Oconee River in Oglethorpe County, Georgia. The upper canopy consisted of willow oak (*Quercus phellos* L.), water oak (*Q. nigra* L.), sweetgum (*Liquidambar styraciflua* L.), sycamore (*Platanus occidentalis* L.), loblolly pine (*Pinus taeda* L.), river birch (*Betula nigra* L.), and several less common species. Hophornbeam (*Ostrya virginiana* (Mill.) K. Koch) was common in the mid-story. The understory was variable, but was completely dominated in places by Chinese privet (*Ligustrum sinense* Lour.), an introduced shrub from Asia. We suspended four window traps at three different heights (0.5 m, 5 m, and 15 m) for a total of 12 traps. The traps were between 30 and 347 meters apart based on GPS coordinates. A slingshot-fishing reel combination was used to get fishing line over the limbs, which was then used to pull a heavier rope into place. The rope was used to suspend the higher traps (5 and 15 m) and allowed us to access them from the ground. The lower traps (0.5 m) were suspended from metal poles. The traps were made by cutting grooves halfway down the middle of two clear plexiglass panels (20 × 30 cm) which were then pushed together to create a + shaped barrier. The top of the barrier had a wire attached for hanging the trap and the bottom was wired to a white plastic bucket (diameter 16 cm, depth 15 cm). The bucket was partially filled with a 1 % formaldehyde solution (New and Hanula 1998) to preserve the sample. We attached one frozen rat (≈ 35 g) to each trap, and these were replaced after one week of sampling. We sampled four times from May 1 to May 29, 2006, and combined these for statistical analysis. We used the General Linear Models procedure of SAS (SAS Institute 1990) to conduct one-way analysis of variance and Tukey's Studentized Range Test to separate means. Voucher specimens of each species have been deposited in the Georgia Museum of Natural History.

We caught three species of burying beetles over the four-week period (Table 1), but only two species were abundant enough for statistical analysis. *Nicrophorus orbicollis* Say was over seven times more abundant than *N. pustulatus* (Table 1), but was concentrated near the ground (Fig. 1). In contrast, *N. pustulatus* was more numerous than *N. orbicollis* in the highest traps (Table 1) and was captured more frequently there than near the ground (Fig. 1).

Nicrophorus pustulatus may be more abundant in the canopy than near the ground to avoid interactions with *N. orbicollis* Say and other competitors. This seems likely given the

Table 1. Total number of burying beetles (Silphidae) captured in carrion traps at three different heights in a bottomland hardwood forest, Oglethorpe Co., Georgia.

	Trap Height			
Species	0.5 m	5 m	15 m	Total
Nicrophorus orbicollis Say	183	53	16	252
N. pustulatus Herschel	1	12	21	34
N. tomentosus Weber	2	1	2	5
Total	186	66	39	291

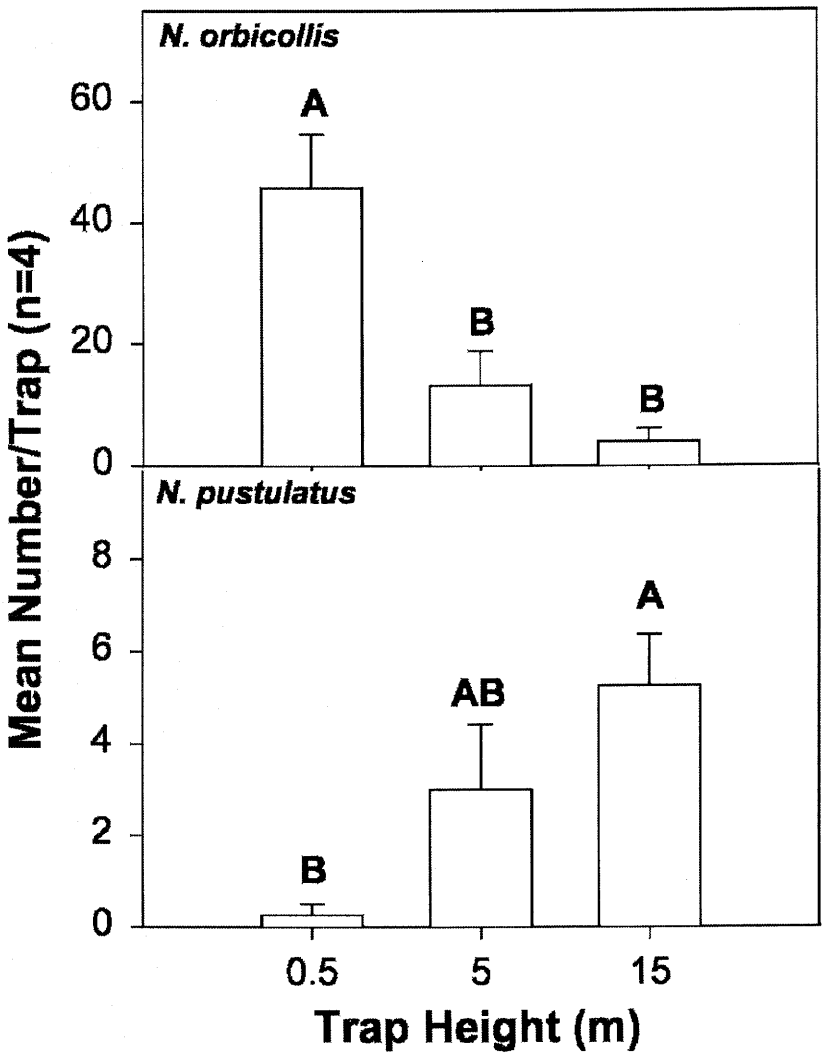

Fig. 1. The mean (± SE) number of burying beetles (*Nicrophorus orbicollis* and *N. pustulatus*) captured in carrion traps at three different heights in a bottomland hardwood forest, Oglethorpe Co., Georgia.

weak parental care exhibited by *N. pustulatus* (Scott 2006) and the numerical dominance (Ulyshen and Hanula 2004; Shubeck and Schleppnik 1984; Trumbo 1990) and competitive strength (Wilson *et al.* 1984; Trumbo and Bloch 2002) of *N. orbicollis* at ground level. Under natural settings, *N. pustulatus* has only been found breeding in the eggs of black rat snakes near the ground (Blouin-Demers and Weatherhead 2000; Keller and Heske 2001) so the importance of carrion to this species remains unknown. Our results suggest that if *N. pustulatus* does use carrion, it may preferentially search for it in the forest canopy (*e.g.*, tree cavities) where competition is less severe.

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