Length of Multiple-Funnel Traps Affects Catches of Some Bark and Wood Boring Beetles in a Slash Pine Stand in Northern Florida

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LENGTH OF MULTIPLE-FUNNEL TRAPS AFFECTS CATCHES OF SOME BARK AND WOOD BORING BEETLES IN A SLASH PINE STAND IN NORTHERN FLORIDA

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The multiple-funnel trap has gained broad acceptance for catching bark and ambrosia beetles since the trap was developed more than 25 years ago (Coleoptera: Scolytidae) (Lindgren 1983). The trap consists of black plastic funnels aligned vertically over each other, allowing for intercepted beetles to fall through the funnels into a wet or dry collection cup located on the bottom funnel. Currently, there are 2 national programs in the USA that use baited multiple-funnel traps for detecting exotic species: the Cooperative Agricultural Pest Survey (CAPS) and the Early Detection and Rapid Response program (EDRR) (USDA APHIS 2007; Rabaglia et al. 2008). Multiple-funnel traps are available in several sizes or lengths, expressed by the number of funnels (4-, 8-, 12- or 16-unit) (Contech Inc., Delta, BC; Synergy Semiochemicals Corp., Burnaby, BC). The general expectation is that longer multiple-funnel traps catch more beetles. In support of that position, Hoover et al. (2000) found that catches of the striped ambrosia beetle, *Trypodendron lineatum* (Olivier) (Coleoptera: Scolytidae), in traps baited with the pheromone lineatin, increased as the length of traps were increased from 4 to 16 units. Haack & Lawrence (1997) found that catches of *Tomicus piniperda* (L.) were higher in 12- and 16-unit traps than in 8-unit ones.

The objective of our study was to verify that long multiple-funnel traps (16-unit) catch more bark and wood boring beetles than short traps (8-unit) in a slash pine (*Pinus elliottii* Engelm.) stand in northern Florida. We focused our study on common southern species attracted to the binary combination of ethanol and (–)-α-pinene used in the national programs (Miller 2006; Miller & Rabaglia 2009). We conducted 1 trapping experiment in a mature slash pine stand on the Osceola National Forest near Olustee, FL for 9 weeks in 2001 (29 Aug-8 Nov). PheroTech Inc. (now Contech) supplied separate lures for releasing ethanol and (–)-α-pinene at rates of approximately 0.6 and 2 g/d, respectively, as well as 8-unit and 16-unit multiple-funnel traps. Traps were set in 6 blocks of 2 traps per block with all traps set 10-15 m apart. There were 2 treatments: (1) 8-unit; and (2) 16-unit multiple-funnel traps. One trap of each treatment type was randomly assigned to a position within each block. All traps were baited with ethanol and (–)-α-pinene. Each trap was suspended between trees by rope such that the bottom of each was 0.2-0.5 m above ground level. No trap was within 2 m of any tree. Collection cups contained approximately 150 mL of pink propylene glycol solution (Peak RV and Marine Antifreeze, Old World Industries Inc., Northbrook, IL). Using SYSTAT ver. 11.00.01 (SYSTAT Inc., Point Richmond, CA), we conducted two-sided t tests on data transformed by $\ln(y + 1)$ to remove heteroscedasticity (Pepper et al. 1997).

Catches of *Arhopalus rusticus nubilus* (LeConte) (Cerambycidae) in 16-unit traps were 143% greater than those in 8-unit traps (Table 1).

TABLE 1. CATCHES OF SOME BARK AND WOOD BORING BEETLES IN 8-UNIT AND 16-UNIT MULTIPLE-FUNNEL TRAPS, BAITED WITH ETHANOL AND (-)-A-PINENE, IN THE OSCEOLA NATIONAL FOREST, FL (N = 6).

	Mean (±SE) beetle catches		
	8-Unit Trap	16-Unit Trap	P value (t test)
Cerambycidae			
Arhopalus r. nubilus	27.0 ± 3.3	65.7 ± 12.4	0.008
Xylotrechus s. sagittatus	23.3 ± 6.4	34.2 ± 12.7	0.790
Scolytidae			
Dendroctonus terebrans	3.5 ± 1.3	5.5 ± 1.6	0.245
Ips grandicollis	3.7 ± 1.7	4.7 ± 1.0	0.329
Xyleborinus saxesenii	63.7 ± 10.0	65.7 ± 15.2	0.919
Xyleborus spp.	17.5 ± 2.8	34.0 ± 2.7	0.002
Curculionidae			
Hylobius pales	59.2 ± 11.8	27.2 ± 5.6	0.015
Pachylobius picivorus	3.2 ± 0.9	3.7 ± 1.0	0.667

There was no effect of trap length on catches of *Xylotrechus sagitattus sagittatus* (Germar). Catches of *Xyleborus* Eichhoff spp (Scolytidae) in 16-unit traps were 94% greater than those in 8-unit traps, whereas catches of *Xyleborinus saxesenii* (Ratzeburg) were unaffected by trap length. Catches of 2 common bark beetles, *Dendroctonus terebrans* (Olivier) and *Ips grandicollis* (Eichhoff), were unaffected by trap length. The lack of significant differences for *X. s. sagittatus*, *D. terebrans* and *I. grandicollis* may be a consequence of low power due to low overall trap catches. Trap catch differences of *A. r. nubilus* and *Xyleborus* spp between 8-unit and 16-unit traps could be related to differences in trap surface area for interception of beetles or to preferences for taller vertical silhouettes (Hoover et al. 2000). In contrast, catches of the reproduction weevil *Hylobius pales* Herbst (Curculionidae) in 16-unit traps were 54% less than those in 8-unit traps (Table 1), possibly representing a preference for stumps over standing trees. *Pachylobius picivorus* LeConte was unaffected by trap length although trap catches were low.

Trap selection is a compromise between cost, ease of deployment, and trap performance. Currently, 8- and 16-unit traps with wet cups cost US$ 39.24 and US$ 57.02, respectively (Contech, Delta BC). The longer 16-unit traps can be unwieldy, particularly in areas with substantial undergrowth. Our results suggest that managers should consider the likelihood of increased trap performance based on trap length for target species in choosing trap type. For some species such as *X. saxesenii* and *Hylobius pales*, longer traps do not necessarily result in greater numbers of captures. Moreover, it is unclear if higher trap catches relate directly to a higher probability of capture for rare individuals such as newly-introduced exotic species.

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Summary

In 2001, we compared catches of some common species of bark and wood beetles in 8- and 16-unit multiple-funnel traps baited with ethanol and (–)-α-pinene in a slash pine stand on the Osceola National Forest in northern Florida with bottoms of both trap types at the same height above ground level. More *Arhopalus rusticus nubilus* (Cerambycidae) and *Xyleborus* spp (Scolytidae) were caught in 16-unit traps than in 8-unit ones whereas catches of *Hylobius pales* (Curculionidae) were lower in 16-unit traps than in 8-unit ones. Trap length had no effect on catches of *Xylotrechus sagittatus sagittatus* (Cerambycidae), *Dendroctonus terebrans*, *Ips grandicollis*, *Xyleborinus saxesenii* (Scolytidae) and *Pachylobius picivorus* (Curculionidae).

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