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A NOVEL AERIAL-INTERCEPTION TRAP FOR ARTHROPOD SAMPLING

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Although there are many field techniques to estimate the abundance and diversity of arthropods in terrestrial ecosystems, all have significant limitations (Chapman and Kinghorn 1955, Southwood 1978, Masner and Goulet 1981, Canaday 1987, Atkinson et al. 1988, Chénier and Philogène 1989, McEwen 1997, Dobony and Edwards 2001). In particular, methods for sampling arthropods moving through the air usually have major drawbacks, such as high cost per unit or difficulty of installation and sample retrieval. When I wished to assess the affect of fire on the arthropod community in Florida scrub at the Archbold Biological Station in Highlands Co., I also was faced with the problems of replicate sampling at several different locations and dealing with severe thunderstorms accompanied by high wind and torrential rainfall. Here I describe a novel trap that solves some of the aforementioned problems.

The trap consisted of an array of four transparent, recycled 2-liter polycarbonate beverage bottles, each having a 17 cm wide × 13 cm high strip in its side removed to allow the entry of arthropods. When viewed from the side, the area of the opening in each bottle was 10.5 × 13 cm. Hence, the effective surface area of the trap with four bottles was 550 cm^2. The intact bottom of each bottle served as a reservoir for ~200 ml of collecting fluid, such as soapy water. The bottles were suspended by their caps that were bolted in a 2 × 2 array centered on the underside of a 20 × 30 cm piece of 1.3 cm (0.5 in) thick exterior grade plywood (Fig. 1). This conformation stabilized the bottles in windy conditions. The wooden platform provided, along with the top portion of the bottles, shelter from precipitation. Each trap was mounted on two 1.3 cm (0.5 in) diameter × 2.5 m steel reinforcing rods (commonly called "rebar") placed vertically to a depth of 30-40 cm in the soil. After the tops of the rods were slipped through the two 1.6 cm (5/8 in) holes near the ends of a platform (Fig. 1), the trap was lowered to the desired position 0.5, 1.0, or 1.5 m above ground and held in place by medium binder clips attached to the rods beneath the platform. For additional stability in high winds, a second binder clip could be attached to a rod just above the plywood platform. The cost of each trap, including the two rods, was $1-2. Furthermore, I found that I could assemble and install a dozen traps at 10 m intervals along a transect in the scrub in 2-3 h.

Arthropods were removed from the four reservoirs in each trap by aspirating the fluid with a conventional meat baster and rapidly filtering it through a tea strainer, allowing the filtrate to return to a reservoir. The filtered arthropods were emptied into a plastic cup, then the cup was capped and taken to the lab where its contents were placed in 70% isopropyl alcohol for preservation until the arthropods were identified. When evaluating the traps under field conditions, I found that I spent less than 1 h processing the catch of a dozen traps, which meant that I could effectively operate a dozen traps simultaneously by myself in burned and unburned scrub even when they needed to be serviced daily.

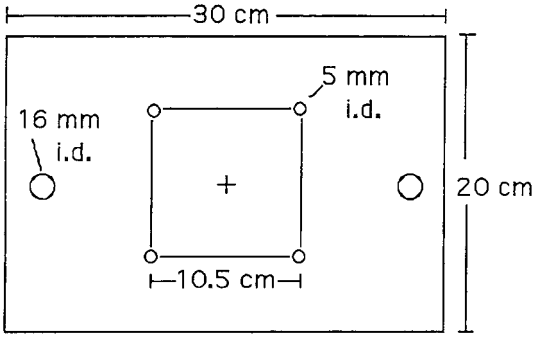


Fig. 1. Schematic diagram of the plywood platform used to suspend four transparent 2-liter polycarbonate beverage bottles for trapping aerial arthropods. Bolts threaded through the four small holes held the bottle caps in place. The assembled trap was supported in the field on two rebar rods threaded through the large holes in the platform.

To evaluate the overall efficiency of this trap design, I determined the diversity of arthropods caught when a dozen traps were operated for six days in a row at four month intervals (June and October 2001 and February 2002) in scrub after it was burned on February 12, 2001 by an intense wildfire. As a control, another dozen traps were operated simultaneously in nearby scrub that had recovered from a burn in July 1998. The specimens (N = 1609) were identified to order (Table 1). (A more detailed analysis will be forthcoming.) Four orders (Diptera, Hymenoptera, Coleoptera, and Homoptera) accounted for 86.5% of all arthropods collected. This result is identical to the results reported by Dobony and Edwards (2001) when evaluating their new flight -intercept trap that was operated on the ground in forests in West Virginia during May-July 1998. But the cost of their trap, constructed entirely of acrylic Plexi-

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TABLE 1. PERCENT OF TOTAL ARTHROPODS CAPTURED (N = 1609) IN FLORIDA SCRUB, CLASSIFIED TO ORDER. AERIAL INTERCEPT TRAPS (N = 24) WERE OPERATED FOR 6 NIGHTS EACH IN JUNE 2001, OCTOBER 2001, AND FEBRUARY 2002 AT THE ARCHBOLD BIOLOGICAL STATION, HIGHLANDS CO., FL.

Order	% Total capture	Order	% Total capture
Araneae	5.3	Hymenoptera	18.0
Blattaria	<0.5	Lepidoptera	2.9
Coleoptera	10.7	Neuroptera	<0.5
Collembola	<0.5	Orthoptera	0.6
Diptera	47.9	Psocoptera	1.7
Hemiptera	1.6	Thysanoptera	<0.5
Homoptera	9.9	Trichoptera	0.9

glas®, was about four times more than mine and it was susceptible to high winds. My traps withstood winds gusting to 70 km/h during a few storms and all retained the collecting fluid in the bottoms of the bottles. In addition, even though two storms each deposited ~5 cm of rain, the reservoirs in the traps did not fill completely, so trapped specimens were not lost.

To evaluate the efficiency of the traps, I divided the number of arthropods collected (1609) by the effective surface area of each trap (550 cm^2) times the number of trap-days they were operated (432), which yielded a value of 0.007 arthropods/cm^2/trap-day. This value was intermediate between the values reported by Canaday (1987) and by Chapman and Kinghorn (1955) using standard "window" traps in northern forests (0.002 and 0.030 arthropods/cm^2/trap-day, respectively). Hence, the new trap appears to be about as effective as more traditional models.

SUMMARY

I designed an inexpensive flight-interception trap consisting of a platform of plywood from which four clear, polycarbonate beverage bottles were suspended so that arthropods moving horizontally could enter a large opening in the side of each and fall into collecting fluid in the bottom. The platform was mounted on two pieces of vertical rebar placed into the soil and it was adjusted to be 0.5, 1.0, or 1.5 m above ground. When used in Florida scrub, I captured arthropods belonging to 14 orders at a rate comparable to those reported for "window" traps used in forests.

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