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Artificial spider webs

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Introduction

The relatively standardized and immobile traps of orb-weaving spiders make them appealing subjects for field studies of predation. It has not been possible, however, to obtain accurate samples of prey available to the spiders. Robinson and Robinson (1970, 1973), who tried a variety of techniques, give clear discussions of the problems involved. Existing methods suffer from (a) not confining themselves to insects actually in flight (sweeping), (b) relying on responses of flying insects to trap stimuli which differ from those of spider webs (windowpane, sticky, and malaise traps), and (c) modifying local conditions such as air flow (windowpane and sticky traps). The Robinsons (1970) concluded that "The problem of devising a system of sampling the prey which is actually available to mature large spiders has, we feel, not yet been solved". With the exception of Buskirk's study (1975) of the prey of *Metabus gravidus* flying over a stream, by sweeping the air just over the water, there have been no further developments. This note describes a technique which I believe represents a possible solution, at least for nocturnal orb-weavers.

Construction and use of trap

The trap (Fig. 1) consists of an array of parallel nylon monofilament lines in a rectangular aluminium frame. The threads are evenly coated (Fig. 2) with an inert adhesive. The possibility that flying insects may be attracted or repelled by the sight of the traps is avoided by setting them out only at night, while air flow and the other problems mentioned above are avoided or at least minimized by the trap design. The traps can be prepared for recoating by soaking in gasoline to wash off the adhesive, and then removing the gasoline by soaking in detergent solution and rinsing in water.

The dimensions of the trap can be varied to suit specific needs. Those indicated in Fig. 1 are arbitrary, but convenient, since the trap is both large enough to catch appreciable numbers of prey in a single night (over 150/night in some sites), yet small enough to be easily handled. It would seem desirable that some standard size such as this be used so that data gathered by different workers can be compared.

The cost of the traps is small. A single frame made from the aluminium stripping commonly used for bathroom and kitchen trim costs less than U.S. $1, including monofilament. The adhesive is not cheap ("Tack Trap", U.S. $12/gallon from Animal Repellents, P.O. Box 999, Griffin, Georgia 30224, U.S.A.; this material is preferable to "Tanglefoot" because it

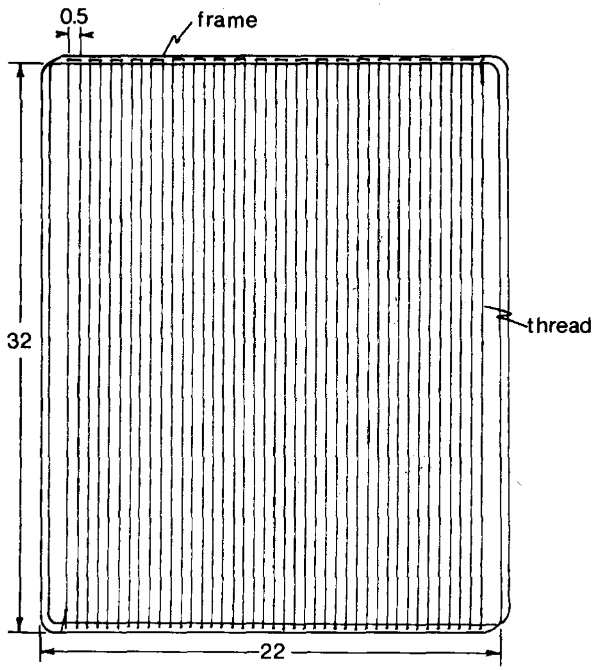

Fig. 1: Artificial web made of nylon monofilament strung in a frame of aluminium stripping, giving 40 threads, each 31 cm long. The monofilament is 3 Kg test, and the stripping 1.25 cm wide and 0.2 cm thick. Dimensions shown in cm.

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is more liquid), but a gallon provides a large number of coatings. A styrofoam ice chest with string dividers added is useful for carrying coated frames to and from the field.

Discussion

The traps do not function exactly like orb-webs, since their threads are much stronger and the glue is much more abundant. Observations of various kinds of insects as they become entangled suggest that except for insects larger than about 40 mg (especially moths), all animals which touch the trap with more than a very glancing blow become securely trapped. With the possible exception of large, strong insects such as beetles, prey seldom or never work their way free.

These differences with respect to orb-webs are probably desirable rather than not, since they minimize the likelihood of prey escapes (to *exactly* mimic a spider web in operation, one would need a spider to rush out and immobilize prey before they worked free). The traps thus give measurements of the maximum numbers of prey available to orb-weavers, not measurements of how much they actually catch.

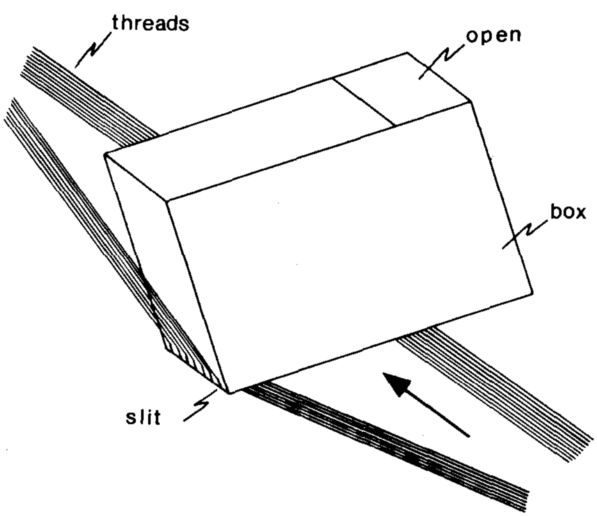

Fig. 2: Coating the threads with adhesive. A plastic box with slits cut in one edge and with part of the top removed is filled with liquid adhesive and then moved in the direction of the arrow, with the threads passing through the slits and acquiring an even coating of glue.

There are two reasons to believe that the traps give overestimates of the prey. Firstly, some insects are rejected by spiders because of repellent tastes, etc. (e.g. Bristowe 1941, Turnbull 1960, Robinson and Robinson 1973), and secondly, many escape from the orb before the spider is able to immobilize them (e.g. Barrows 1915). Approximate corrections can be made for the first factor by experimentally placing the species most commonly captured in artificial webs on real orb-webs to see if they are accepted by the spiders. This factor may be only minimally important in some species, as *Nephila maculata* rejected only a very small percentage of the insects it captured (Robinson and Robinson 1973). The other factor does not seem easily corrected for, however, since the rate of escape from spiders' webs is probably correlated in complex ways with variables such as prey size, strength, agility, web avoidance behaviour, etc. Until the effects of these factors have been studied, the usefulness of the traps will be limited in some cases to prey which only seldom succeed in freeing themselves from real spiders' webs, and it will be necessary to separate catches into different size and taxonomic groups. However, if in comparative studies such as those suggested below, most or all prey present similar tendencies, this limitation can probably be safely assumed to be unimportant.

The technique opens to investigation several factors which may influence numbers of prey available to orb-weavers. For example, the effects of web design (thread density, quantity of glue, web shape, angle of web plane with vertical), height above ground, habitat, wind speed, time of construction, season, and orientation with respect to prevailing winds can all be studied. Artificial webs should be particularly useful when employed in conjunction with studies of selected species of spiders.

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