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SHORT COMMUICATION

NEST SITE FIDELITY OF *PARAPHIDIPPUS AURANTIA* (SALTICIDAE)

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ABSTRACT. We investigated the nest building behavior of *Paraphidippus aurantia* (Lucas 1833) (Salticidae) following the experimental destruction of their nests. We located 61 nests on 52 pine saplings (43 saplings with one nest, nine with two nests) and carefully displaced all spiders and destroyed their nests. On saplings with two spiders, we removed one spider. Of the 52 nests in which the resident spider was left in place, 29 new nests were constructed in the identical location as the nests we removed. Of the 9 nests in which the resident spider was removed, no new nests were constructed. There were no nests constructed in new locations. Despite other suitable nest site locations, *P. aurantia* showed extreme nest site fidelity following the disturbance.

Keywords: Nest guarding, anti-predator strategy, jumping spider, retreat

Jumping spiders (Salticidae) build small, compact nests out of silk (Richman & Jackson 1992). Adult and juvenile spiders occupy nests when they are not foraging, adult females lay eggs in nests and spiderlings may remain in nests for several days after hatching. Thus, nest sites may have a strong influence on spider success at foraging, avoiding predation and reproduction. Once constructed, nests may be destroyed by abiotic factors (e.g. rain or wind-blown vegetation) and biotic factors (e.g. grazing vertebrates or predators). While a great deal of attention has been given to spider habitat selection and site fidelity with respect to food availability (Edgar 1971; Kronk & Riechert 1979; Morse & Fritz 1982; Janetos 1986; Riechert & Gillespie 1986), relatively little is know of the responses of spiders to nest destruction.

We studied nest site fidelity of *Paraphidippus aurantia* (Lucas 1833) (Salticidae) in response to the destruction of its nest. *Paraphidippus aurantia* builds its nests at the bases of needle clusters on ponderosa pine (*Pinus ponderosa* Laws. var. *scopulorum*) sapling at the Manitou Experimental Forest (U.S.D.A. Forest Service, Rocky Mountain Experiment Station) in Woodland Park, Colorado USA (39° 06′ 02″ N, 105° 05′ 32″ W, elevation 2400 m). Voucher specimens from this work have been deposited at the Denver Museum of Nature and Science, Denver, Colorado, USA.

On 22 July 2000 and 24 July 2001 we selected 52 small ponderosa pine saplings (< 2 m) with occupied spider nests ($n = 22$ in 2000, $n = 30$ in 2001). Forty-three of these saplings had a single occupied nest, while nine saplings had two occupied nests. In the later case, the two nests were never on the same sapling branch. The 61 nests (43 saplings with one nest and nine samplings with two nests) were built on branch tips at the bases of needle clusters located at varying heights and aspects (i.e. cardinal directions) in the sapling canopies. Each sapling canopy offered many (> 20) potential nest-building sites that to our eye did not in any respects from those supporting nests. Except for occupied nests, there were no other *P. aurantia* or nests on the experimental saplings.

The weather on the days of the nest destruction was clear to partly cloudy, and it neither rained nor was it particularly windy. We coaxed the spiders from their nests using puffs of air from a rubber bulb until the spiders emerged. We waited until the spiders had traveled at least 20 cm before carefully removing all visible silk threads from the pine needles with our thumbs and forefingers. We continued to observe the displaced spiders for at least 60 seconds. The spiders typically remained motionless during nest removal and this subsequent observation period. In no instance did the spider jump from the branch or flee more than 50 cm during the time

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Table 1.—Fate of *Paraphidippus aurantia* nest sites following nest destruction.

	Spider left in place (n = 52)	Spider removed (n = 9)
No nest built	45%	100%
Nest built on original site	55%	0%
Nest built on new site	0%	0%

of our observation. For the nine saplings with two nests, we collected one of the two spiders, but removed both nests. The nest sites can thus be divided into two groups, (1) those where the occupying spider was left in place (n = 52), and (2) those where the occupying spider was collected (n = 9).

We placed flagging on the ground immediately below each nest site to mark its location. We then monitored the nest building activity on the entirety of each sapling on each of the following two days, and at three to four day intervals thereafter, for a total of 33 days in 2000 and 34 days in 2001. Because we did not mark the displaced spiders, we do not have direct evidence that the spiders observed on subsequent days were the same individuals we displaced. While we do not know the life stage or sex of the displaced spiders, we have these data on 60 spiders collected from the branches of trees surrounding the experimental saplings at the time of the experiment: 22% were adult females, 78% were juveniles, and there were no adult males (Mooney unpub. data).

Forty-two saplings had evidence of nest construction on the day following nest destruction. Thirteen of these 42 nests were abandoned by the second day, leaving 29 saplings with nest sites under active construction for two or more days. No additional nest construction began after these first two days. Furthermore, when nest construction was not initiated within these first two days, we never again observed *P. aurantia* on the saplings. In 2001 we destroyed 20 newly rebuilt nests 21 days after the first experimental destruction, and four of those nests were rebuilt a second time. Thus, in total we observed 46 instances of new nest construction following removal.

The most notable result from our study was that every new nest was constructed in precisely the same locations as destroyed nests of spiders that we had left in place (Table 1). In one particular case we observed that a nest that originally spanned several needles and a flake of bark was again constructed to incorporate the bark and needles. No nests were constructed on the nine nest sites from which we removed the spiders, and no nests were constructed elsewhere on the saplings (Table 1). While we did not mark spiders, these results provide strong, indirect evidence that the same spiders whose nests we destroyed also built the new nests; had a previously undetected spider or an immigrant spider built these new nests, some of the new nests would have been constructed on those nine sites. It is unlikely the nine nest sites of removed spiders were neglected by chance alone ($\chi^2_{(1)} = 219$, $P < 0.0001$).

Our results also show that this extreme level of nest site fidelity was not for lack of other suitable nest sites on the saplings. Nine saplings originally supported two spiders, yet the nest sites of the removed spiders were never re-used by those spiders we did not remove. In addition, to our eye there were many unused sites on each tree that were indistinguishable from those actually utilized (see above).

Paraphidippus aurantia thus showed extreme nest site fidelity, despite (1) their previous nests having been destroyed at those sites and (2) alternate, suitable nest sites apparently being available within the area the spiders would routinely travel during foraging. There are at least two possible explanations to this behavior. First, there may be some benefits to re-using a familiar nest site such as (a) more rapid nest reconstruction, (b) improved foraging surrounding the already familiar habitat of an existing nest site, or (c) improved predator avoidance in familiar habitat. Second, the benefit of switching nest sites is predicted to be lower in habitats where risk of future nest destruction is homogeneously distributed (Switzer 1993). Sources of threats from predators may be homogeneous within a sapling. For instance, birds (Gunnarrson 1993; Riechert & Hedrick 1990) and ants (Halaj et al. 1997; Eubanks 2001) are both significant predators of spiders, but there is no reason to believe their effects would vary among nest sites within a single sapling. Future work should experimentally test these hypotheses for *P. aurantia* and investigate whether similarly high nest site fidelity is exhibited by other salticids. In addition, the mechanisms by which the spider recognizes and chooses a particular site for nesting is of interest and deserves further attention.

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