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Exploitation of artificial light at night by a diurnal jumping spider

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Abstract

Platycryptus undatus (De Geer 1778) (Araneae: Salticidae) stalked and seized insects attracted to porch lamps at night at two sites on Cape Cod, Massachusetts. Ordinarily this spider hunts during the day.

Key words: salticid, night light niche, artificial lighting

Few animals exploit artificial lighting at night for tasks that they ordinarily perform exclusively during the day. An example is *Platycryptus undatus* (De Geer 1778), a moderately large (9—12 mm) jumping spider common in the eastern and midwestern United States (Comstock 1940). The author and two others (Robert L. and Eric H. Edwards) have observed members of this species stalking and pouncing on prey near an artificial light at night.

Solitary males and females of this species attacked insects attracted to a porch lamp at night at a suburban house at Quisset near Woods Hole, Massachusetts. This house is the residence of one of us. The spiders have hunted at the lamp every summer for several decades. In 2002, we noted this behavior at a porch lamp on another house, 6 km away near East Falmouth. This paper reports our observations during July and August of 2002 at Quisset.

The porch lamp contained one frosted 60—watt incandescent light bulb face down in a close-fitting clear glass housing a few centimeters from the wall. It was mounted on a wall covered with roughly textured cedar shakes. Between the wooden shingles were crevices just large enough to accommodate mature *P. undatus*. The wall faced a yard with gardens and trees. The lamp attracted flying insects, including Diptera, Homoptera, Lepidoptera, Coleoptera, and Neuroptera.

P. undatus attacked members of all of these orders, except Coleoptera, which it avoided. Typically, a single individual stationed itself on the wall beside the base of the lamp shortly after dark. It pivoted toward prey moving around the lamp and lunged at insects within reach. It stalked and pounced on insects that were beyond reach. Because of the high concentration of insects attracted to the light, it had to select prey from a chaotic array of moving targets. It often turned toward a succession of insects without launching any attacks. Even so, it usually seized its prey when it did attack. It used no webs for capturing prey.

The spiders confined their hunting to a brightly illuminated patch on the wall within 12 cm of the lamp. Most of the attacks occurred when prey were sighted at a distance of 8 cm or less. One male, however, pursued a moth sighted at a distance of 50 cm, and captured it. This occurred at 20:15, ten minutes after it crept out of a crevice where the night before it had carried a lacewing (Neuroptera: Chrysopidae) that it had seized at the lamp.

The spiders tracked and attacked prey at the lamp over periods ranging from ten minutes to more than two hours per night. For example, one male seized three small (2 mm) flies and a leaf hopper (Homoptera: Cicadellidae) (length 3 mm) in its first hour at the lamp. It stopped pivoting toward prey for about 2 minutes each time it fed on a fly. It remained at the lamp while it fed. It spent 15 minutes feeding on the leafhopper. During this time, a beetle bumped into it, and the spider crawled into a crevice; it returned to the lamp when it had finished feeding. In the second hour, it seized a moth with a body size bigger than its own. It fed on the moth for an hour at the lamp, then carried the moth 25 cm away and continued to feed in relative darkness until our observations ended after another two hours.

The spiders used different kinds of shelters at the lamp. When disturbed during hunting or feeding, they hid in shallow crevices on the wall close to the porch lamp. They spun no silk in these shelters. In contrast, when one of these spiders molted, it used a retreat consisting of a few loosely woven silken threads behind an object hanging on the wall. This site was located a meter away from the lamp and was completely shielded from light. The spider remained hidden in this shelter for two days and nights.

Based on size, the salticids at the lamp were either mature adults or late instars. We did not collect or mark them. The exuvium of a male that seized prey at the lamp and then molted was from a penultimate instar. Using a flashlight, we searched for *P. undatus* hunting at night on tree trunks and other vertical wooden structures nearby, but failed to find them. During the day, we have frequently observed them hunting at these sites. We have not observed *P. undatus* capturing prey on the wall by the lamp during the day.

Three other salticids have been reported to hunt at artificial light, but few details of their behavior at the light have been described. They are *Sitticus fasciger* (Simon 1880) (Wolff 1981), *Plexippus paykulli* (Savigny & Audouin 1827) and *Menemerus bivittatus* (Dufour 1831) (Edwards 1979). All four salticids that hunt at artificial light have been associated with buildings (Edwards 1979, Kaston 1981, Guarisco 1999).

The nocturnal hunting appears to constitute a true shift in timing of activity by salticids in response to the artificial light. The author could find little published evidence that salticids seize prey at night, except under artificial light. Two *Phidippus otiosus* (Hentz 1846) were observed on Spanish moss outside their retreats in a hammock in Florida at 22:50, two and one-half hours after sunset. One was feeding on a moth (Reiskind 1982), but the capture of the moth was not observed. Levels of natural light at night may be too dim for salticid hunting. Natural light outdoors on clear nights varies from 0.0009 lux at the new moon (just starlight) to 0.215 lux when the full moon is at its zenith (Austin *et al.* 1976). In the laboratory, *Trite planiceps* Simon 1899 required light of at least 1 lux to begin to orient to prey, and 50 lux for normal visual hunting (Forster 1982b). In darkness broken only by a red photographic safelight used for observation, *Phidippus johnsoni* (Peckham and Peckham 1883) completely failed to capture prey that it efficiently captured in white light (Jackson 1977). Tactile (Jackson 1977, Taylor *et al.* 1998) and vibratory (Forster 1982a) sensation has enabled salticids to capture prey in darkness in the laboratory, but only in close confinement within petri dishes. Chemoreception may help some salticids hunt but only in combination with vision (Clark *et al.* 2000).

The stimulus that activated *P. undatus* at night is unclear. Artificial light may have induced the spiders to hunt at night, either by extending their daytime behavior or by inducing them to leave their nocturnal retreats. Alternatively, vibration of insects contacting the wall near the lamp may have aroused the spiders from their shelters. Hunger or another internal stimulus may have initiated nocturnal locomotor activity by this salticid, like spiders in other families (Suter 1993). Positive phototaxis (Nakamura and Yamashita 1997) or response to sight of prey (Gardner 1964) could have directed the spiders to the lamp. The term "night light niche" has been applied to sites where lizards hunt insects attracted to artificial light (Henderson and Powell 2001). The night light niches of salticids appear to be limited to habitats where the species involved are commonly found, such as man-made structures. Night light niches of *P. undatus* may require a particular architecture. Both sites where we observed *P. undatus* hunting at artificial light at night featured a lamp mounted on a shingled wall with a coarse surface texture and many crevices. This architecture bears similarities to the spider's natural habitat—tree trunks (Edwards and Edwards 1997).

Published reports probably under-represent the number of species of salticids that hunt at artificial light. We overlooked *P. undatus* hunting at one of the porch lamps until we became interested specifically in this behavior. Nevertheless, the behavior appears to be taxonomically limited in scope. We witnessed this behavior in only one of the more than 40 species of salticids found in southwestern Cape Cod (Edwards and Edwards 1991). The lack of early instars hunting at the light indicates that the behavior is restricted developmentally as well, at least in the case of *P. undatus*.

By illuminating and concentrating prey in small areas, artificial lighting has presented salticids with a rich source of food. Salticids have succeeded in exploiting this opportunity, but only to a limited degree.

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References

Austin, R. H., B. F. Phillips and D. J. Webb. 1976. A method for calculating moonlight illuminance at the earth's surface. Journal of Applied Ecology 13: 741—748.

Clark, R. J., R. R. Jackson and B. Cutler. 2000. Chemical cues from ants influence predatory behavior in *Habrocestum pulex*, an ant-eating jumping spider (Araneae, Salticidae). Journal of Arachnology 28: 309—318.

Comstock, J. H. 1940. The Spider Book. Cornell University Press, Ithaca, New York.

Edwards, G.B. 1979. Pantropical jumping spiders occurring in Florida (Araneae: Salticidae). Florida Department of Agriculture and Consumer Services, Division of Plant Industry. Entomology Circular 199: 1—2.

Edwards, R. and E. Edwards. 1991. Spiders (Araneae) Associated with rural delivery mailboxes, Mashpee, Massachusetts. Entomological News 102: 137—149.

Edwards, R. and E. Edwards. 1997. Behavior and niche selection by mailbox spiders. Journal of Arachnology 25: 20—30.

Forster, L. M. 1982a. Non-visual prey-capture in *Trite planiceps*, a jumping spider (Araneae, Salticidae). Journal of Arachnology 10: 170—184.

Forster, L. M. 1982b. Vision and prey-catching behavior in jumping spiders. American Scientist 70: 165—175.

Gardner, B. T. 1964. Hunger and sequential responses in the hunting behavior of salticid spiders. Journal of Comparative Physiology and Psychology 2: 475—478.

Guarisco, H. 1999. House spiders of Kansas. Journal of Arachnology 27: 217—221.

Henderson, R. W. and R. Powell. 2001. Responses by the West Indian herpetofauna to human-influenced resources. Caribbean Journal of Science 37: 41—54.

Jackson, R. R. 1977. Courtship versatility in the jumping spider *Phidippus johnsoni* (Araneae, Salticidae). Animal Behavior 25: 953—957

Kaston, B. J. 1981. Spiders of Connecticut. Bulletin 70. State Geological and Natural History Survey of Connecticut, revised edition. Connecticut Department of Environmental Protection, Hartford, Connecticut.

Nakamura, T. and S. Yamashita. 1997. Phototactic behavior of nocturnal and diurnal spiders: negative and positive phototaxes. Zoological Science, Japan 14: 199—203.

Reiskind, J. 1982. Observations of night activity in *Phidippus otiosus* (Hertz). Peckhamia 2:40.

Suter, R. B. 1993. Circadian rhythmicity and other patterns of spontaneous motor activity in *Frontinella pyramitela* (Linyphiidae) and *Argyrodes trigonum* (Theridiidae). Journal of Arachnology 21: 6—22.

Taylor, P. W., R. R. Jackson and M. W. Robertson. 1998. A case of blind spider's buff?: Prey-capture by jumping spiders (Araneae, Salticidae) in the absence of visual cues. Journal of Arachnology 26: 369—381.

Wolff, R. J. 1981. Noctumal activity under artificial lights by the jumping spider *Sitticus fasciger*. Peckhamia 2: 32.

Other jumping spiders take detours, but Portia is unusual in its readiness to use long detours that break visual contact. Laboratory studies show that Portia learns very quickly how to overcome web-building spiders that neither it nor its ancestors would have met in the wild. Portiaâ€™s accurate visual recognition of potential prey is an important part of its hunting tactics.Â However, experiments that pitted Portias against "convincing" artificial spiders with arbitrary but consistent behavior patterns showed that Portiaâ€™s instinctive tactics are only starting points for a trial-and-error approach from which these spiders learn very quickly. Nonetheless, they seem to be relatively slow "thinkers", as they solve tactical problems by using brains vastly smaller than mammalian predators'. When discussing visual systems, jumping spiders (Salticidae) are of particular interest because it is among salticids that we find both some of the most intricate vision-based predatory strategies (Nelson and Jackson, 2011) and intraspecific display behavior (Crane, 1949; Jackson and Pollard, 1997; Girard and Endler, 2014).Â However, the assumption that salticids are diurnal has largely deflected interest away from the investigation of dim-light vision in this family. This is despite electrophysiological evidence that sensitivity in the photoreceptors of the secondary eyes is remarkably high for the size of the corneal lens â€“ attributed to having a camera-type eye capable of collecting photons more efficiently than the individual facets of compound eyes (Hardie and Duelli, 1978). Instead, we arc diurnal creatures, meaning our eyes are adapted to living in the suns light. This is a basic evolutionary fact, even though most of us donâ€™t think of ourselves as diurnal beings any more than as primates or mammals or Earthlings.Â Migrating at night, birds are apt to collide with brightly lit buildings; immature birds suffer in much higher numbers than adults. Insects, of course, cluster around streetlights, and feeding on those insects is a crucial means of survival for many bat species.Â 2. Most light pollution is caused by the direction of artificial lights rather than their intensity. 3. By 1800 the city of London had such a large population, it was already causing light pollution. 4. The fishermen of the South Atlantic are unaware of the light pollution they are causing.