

SHORT COMMUNICATION

PREDATION BY *ARGYRODES TRIGONUM* ON *LINYPHIA TRIANGULARIS*, AN INVASIVE SHEET-WEB WEAVER IN COASTAL MAINE

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ABSTRACT. A female *Argyrodes trigonum* (Theridiidae) was observed feeding on a female *Linyphia triangularis* (Linyphiidae), a recently established European immigrant in Maine. Multiple observations of *Argyrodes* spiders inhabiting *L. triangularis* webs suggest that this invasive sheet-web weaver is not immune to web invasions, kleptoparasitism or predation by *A. trigonum*. The potential impacts of *A. trigonum* on the invasion dynamics of *L. triangularis* are unknown, but likely to be minimal.

Keywords: Kleptoparasitism, araneophagy, exotic

Members of the genus *Argyrodes* Simon 1864 (Theridiidae) are known for diverse and flexible foraging strategies. Although capable of spinning small tangle webs of their own, many species forage more often as kleptoparasites, web-stealers or predators of other spider species (Cangialosi 1991, 1997). *Argyrodes trigonum* (Hentz 1850) is common in the eastern U.S. (Exline & Levi 1962), and is also found in Ontario (Levi & Randolph 1975) and Québec (Paquin et al. 2001). Cangialosi (1997) provides a thorough description of the diverse and flexible foraging strategies of this species.

The European Hammock spider, *Linyphia triangularis* Clerck 1757 (Linyphiidae), has recently become established in parts of coastal Maine (Jennings et al. 2002) and apparently is spreading inland. In some coastal habitats, such as those of Schoodic Peninsula in Acadia National Park, the invasion has become severe, with population densities of *L. triangularis* reaching 12 individuals/m². In these high-density areas, native linyphiids, such as *Neriene radiata* (Walckenaer 1841) and *Pityohyphantes costatus* (Hentz 1850), are now scarce (Houser, Jakob, & Jennings, pers. obs.).

During the summer of 2002, while studying the invasion at Acadia N.P., we noticed *A. trigonum* in some webs of *L. triangularis*. On 24 August 2002,

we observed an adult female *A. trigonum* feeding on an adult female *L. triangularis* in the prey's web. The predator-prey habitat was a roadside/coniferous forest-edge on the Schoodic Peninsula (Winter Harbor, Maine). The *L. triangularis* was not extensively digested, suggesting that the capture by *A. trigonum* was recent. Several more *A. trigonum* were found nearby in the superstructure of *L. triangularis* webs. To the best of our knowledge, the earliest observation of *Argyrodes* in the web of *L. triangularis* was on 28 August 1999, when D.T.J. collected a juvenile *Argyrodes* sp. from a female-occupied web of *L. triangularis* in Pittston, Kennebec County, Maine.

During August and September of 2003, surveys of *L. triangularis* webs were conducted at four locations in Maine to determine whether the occupation of *L. triangularis* webs by *A. trigonum* is a common occurrence or better described as a novelty. Surveys were conducted in habitat favorable to *L. triangularis*, primarily seedlings, saplings, shrubs and forbs. At two of the locations, the proportion of webs containing at least one *A. trigonum* was rather high: 11 out of 36, or 30.6% (Dixmont, Penobscot Co.), and 19 out of 35, or 54.3% (Garland, Penobscot Co.). At the other sites, however, the frequency of *A. trigonum* was low; none were found among 33 webs surveyed at Guilford, Pis-

cataquis Co., and only 1 was found among 11 webs at Milbridge, Washington County. Multiple *A. trigonum* (always 2 or 3) were found in 11 of the 115 (9.6%) webs surveyed, or 11 of the 31 (35.5%) webs containing at least one *A. trigonum*. Although not found in these surveys, higher levels of occupancy are possible. D.T.J. observed 5 or 6 *Argyrodes* juveniles co-inhabiting a female *L. triangularis* web in Garland, Penobscot County.

At two of our survey sites, the proportion of *L. triangularis* webs containing *A. trigonum* is comparable to, if not higher than previously observed rates of *A. trigonum* in other linyphiid webs. Overall, 27.0% of *L. triangularis* webs surveyed in 2003 contained *A. trigonum*. In a large study of the foraging strategies of *A. trigonum*, Cangialosi (1997) recorded *A. trigonum* co-inhabiting 6.1% of *N. radiata* webs, 1.9% of *P. costatus* webs and 2.6% of *Frontinella pyramitela* (Walckenaer 1841) webs. Our observed proportions may be high relative to those reported in Cangialosi (1997) due to a variety of factors, including differences in sampling method, date or location, and therefore should be interpreted cautiously.

Our observations support the already considerable evidence that foraging behavior of *A. trigonum* is very flexible. Species of *Argyrodes* have been classified as either host specialists, which use a variety of behavioral techniques to exploit their hosts, or host generalists, which have a more limited behavioral repertoire, but can take advantage of a large variety of hosts (Vollrath 1984; Whitehouse 1988). Cangialosi (1997) has argued that a host generalist would also benefit by having a variety of techniques at its disposal and presents *A. trigonum* as an example. The behavioral repertoire of *A. trigonum* is quite broad; in addition, hosts of *A. trigonum* include (in various geographic locations) linyphiids, agelenids, theridiids, and araneids (Larcher & Wise 1985; Cangialosi 1997). The ability of *A. trigonum* to exploit an introduced exotic species is further evidence that it is a host generalist, and that its foraging success is not, at least at present, likely to be driven by co-evolution with any particular host.

The possible effects of *A. trigonum* on the invasion of *L. triangularis* are unclear. Because *A. trigonum* makes use of both *L. triangularis* and native host webs, it could mitigate or exacerbate the effects of the invader on native populations. It would be useful to know the relative preference, if any, that *A. trigonum* has for native linyphiids vs. the invader. Host-web structure, particularly the amount of barrier silk, affects selection and occupancy potentials of *A. trigonum* (Cangialosi 1997). Superficially, the semi-dome shaped webs of *L. triangularis* are more similar to those of *N. radiata* and *P. costatus* than the bowl and doily webs of *F. pyramitela*. At the Schoodic study site, *N. radiata* and

P. costatus appear to have declined more dramatically than *F. pyramitela*. However, in New Hampshire, Cangialosi (1997) found that *A. trigonum* uses *N. radiata* as hosts more often than either *F. pyramitela* or *P. costatus*. Comparable host-preference data including *L. triangularis* in addition to native hosts are needed to better evaluate the impacts, if any, of *A. trigonum* on this invasion. Because of its host-generalist behavior, we suspect that *A. trigonum* has (and will have) minimal regulatory impacts on populations of *L. triangularis* in Maine. Instead, assemblages of natural enemies (e.g., parasites, parasitoids, predators, and pathogens) may be needed for control or containment of this invasive spider.

The impetus for this note comes from the sharp eye of Adam Porter, who made the initial discovery and observation of the predation encounter on 24 August 2002. The 2003 surveys were conducted with the much appreciated assistance of Nancy Jennings and Frank Graham, Jr. We are grateful to David Manski, Chief Biologist, Acadia National Park, for issuance of collecting permits, and to Park Biologist Bruce Connery for logistical support. Voucher specimens are deposited in the park collection of the Acadia National Park Research Center, Bar Harbor, Maine.

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