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PREDATION BY *ACHAEARANEA TEPIDARIORUM* (ARANEAE: THERIDIIDAE) ON *ANOPLOPHORA GLABRIPENNIS* (COLEOPTERA: CERAMBYCIDAE)

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ABSTRACT

Anoplophora glabripennis is a large wood-boring cerambycid beetle that has recently invaded North America and Europe from Asia. We discovered the common house spider, *Achaearanea tepidariorum*, in large cages housing *A. glabripennis* on trees and confirmed the ability of *A. tepidariorum* to prey upon adult *A. glabripennis* by placing the two species together within smaller containers where they could be more easily observed. Adult *A. glabripennis*, up to 600% of the spiders' body length, exceed the maximum relative size of prey previously reported for *A. tepidariorum* or for solitary webbuilding spiders in general.

The large wood-boring cerambycid beetle *Anoplophora glabripennis* (Motschulsky) is native to China and Korea (Lingafelter and Hoebeke 2002) and has become an invasive pest in North America and Europe (Haack 2003; Tomiczek 2003). Larvae of this beetle bore in the wood of a wide variety of hardwood tree species, killing limbs and, eventually, whole trees. Because of the serious threat posed by *A. glabripennis* to urban shade trees and, potentially, hardwood forests, a large amount of research has been focussed on this species in recent years (Haack 2003; Luo et al. 2003), including a search for natural enemies that might serve as biological control agents (Smith et al. 2003). As a part of this overall research effort, we are evaluating various species of hardwood trees as potential hosts for *A. glabripennis*, using living potted trees in large (ca. 3 m high, 3 m long, 2 m wide) walk-in cages within a quarantine greenhouse (Morewood et al. 2003).

In the course of these experiments, we occasionally found beetles entangled in cobwebs in the lower corners of the cages and on two occasions found a spider feeding on the captured beetle. On the second of these occasions, the spider was collected alive and identified as the common house spider, *Achaearanea tepidariorum* (C.L. Koch) (Araneae: Theridiidae). This spider was held in a 1.14-L (one-quart) screen-topped glass jar, in which it established a small web, and was provided with a fresh, living adult beetle every three to five days for the next eight weeks, at which time it was sacrificed and submitted to the Frost Entomological Museum, Pennsylvania State University, as a voucher specimen.

Two weeks after the original spider was collected and identified, four additional individuals were collected from the walk-in cages and placed in an empty 75 x 75 x 75 cm cage, where they were allowed three days to establish webs. Two living adult *A. glabripennis* were then added to the cage to confirm that the beetles would encounter the spiders' webs, be restrained by the silk, and be subdued by the spiders. These four spiders were further provided with one to four beetles at a time, at approximately five-day intervals, depending on the availability of surplus beetles, for a total of six weeks. Time required for the

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spiders to capture the beetles was not measured; however, it was observed to range from less than one minute to more than 24 h, depending on the time taken by the wandering beetles to encounter a web. In most cases, the beetles became trapped in the spiders' webs in less than one hour, and all beetles were eventually killed. The beetles were often found raised above the floor of the cage and the spiders fed by penetrating the intersegmental membranes of the beetles' cuticle, most often between segments of the antennal flagellum (Fig. 1). Spiders were observed to feed repeatedly on a given beetle over the course of two or three days, leaving the beetle and resting in a different part of the web between feeding bouts, but showed no further interest in the cadaver after approximately three days.

Venom (Boevé and Meier 1994) and extra-oral digestion (Cohen 1995) allow spiders to utilize relatively large prey items with tough cuticles; however, most spider species prey upon individuals smaller than themselves (Nentwig 1987). Nentwig and Wissel (1986) reported peak acceptance of prey items within a size range of 50-80% of the spider's body length, with most non-webbuilding species able to subdue prey items of not more than 200% of their body length and a maximum prey size for solitary webbuilding spiders of 500% of their body length. The web of *A. tepidariorum* is usually described as an irregular tangle (e.g., Comstock 1912; Headstrom 1973) but is constructed in an organized manner (Benjamin and Zschokke 2003), forming a very effective trap (Riechert and

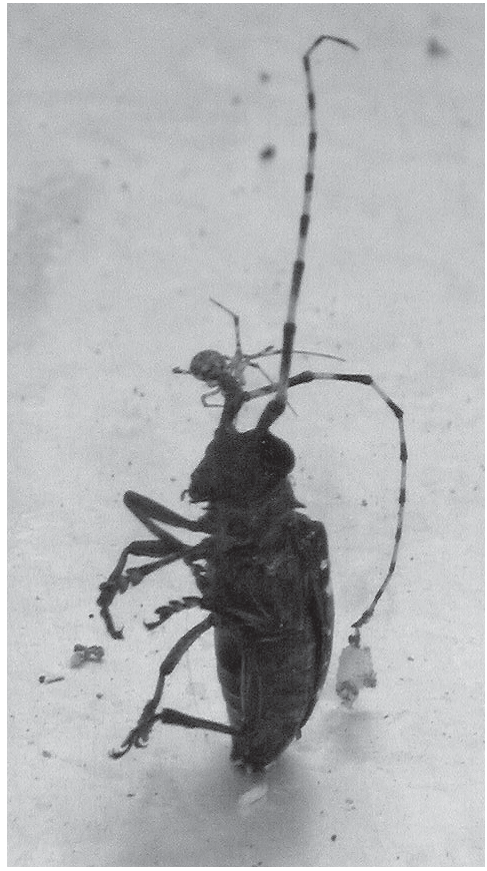

Fig. 1. *Achaearanea tepidariorum* feeding on *Anoplophora glabripennis* in July 2003. Note the beetle has been raised almost completely off the floor of the cage.

Cady 1983). In addition, as is typical of Theridiidae, *A. tepidariorum* throw silk over entangled prey to aid in subduing it (Comstock 1912). Using this effective system, *A. tepidariorum* are known to prey upon insects larger than themselves (Fitch 1963) and to take generally larger prey than other spiders within the same habitat (Riechert and Cady 1983).

Although *A. tepidariorum* are known to utilize relatively large prey, it is remarkable that these small spiders (ca. 5 mm body length) are capable of subduing the large (20-30 mm body length) adults of *A. glabripennis*, which exceed the maximum size of prey reported previously for solitary webbuilding spiders in general (Nentwig and Wissel 1986; Nentwig 1987) or *A. tepidariorum* specifically (Fitch 1963; Riechert and Cady 1983). *Achaearanea tepidariorum* are very common (Headstrom 1973) and cosmopolitan in distribution (Levi 1963), but prefer to spin webs in sheltered locations, often within buildings (Comstock 1912; Fitch 1963; Levi 1963; Headstrom 1973; Riechert and Cady 1983). In contrast, *A. glabripennis* live in hardwood trees, usually in open settings, and are quite capable of flying directly from tree to tree. With both species favoring urban habitats, it is possible that they may occasionally have encounters in nature; however, their differences in habits and habitat make it unlikely that *A. tepidariorum* will have any real impact on populations of *A. glabripennis*.

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