

Unusual Bedfellows: Observations of Cohabitation Between Two Hyllids and Paper Wasps in Central Wisconsin

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Introduction

Symbiotic relationships, specifically cohabitations, between anurans and arthropods are an interesting curiosity. Possibly the most famous examples, which have become quite memetic in pop science and science communication, are of the relationships between tarantulas and New World microhylids (e.g., between *Aphonopelma hentzi* and *Gastrophryne olivacea*, Blair, 1936; Hunt, 1980; Dundee et al., 2012; and between *Xenesthis immanis* and *Chiasmocleis ventrimaculata*, Cocroft and Hambler, 1989; Orlofske et al., 2012). In these apparent mutualisms, the tarantula keeps a “pet” microhylid frog to defend its burrow from invading ants, which prey upon the eggs of the tarantula (Hunt, 1980). In addition to larger, predator-sized arthropods, cohabitations of some frogs include ants in both South America and Africa (Rödel et al., 2013; de Lima Barros et al., 2016). However, few if any mutualistic relationships or cohabitations between anurans and wasps appear to have been described.

Description

Gray Treefrogs (*Dryophytes versicolor*) have a habit of residing in man-made cavities, as they mimic natural arboreal refugia (Johnson, 2005). As it happens, Northern Paper Wasps (*Polistes fuscatus*) also often build their nests in enclosed man-made spaces which mimic natural cavities (Stanback et al., 2009). In August 2022, JLO observed an unusual cohabitation of the two species inside the hollow metal pipe comprising a swing-gate (Figure 1). This gate is located along the Paper Mill Trail section of the Green Circle Trail in Whiting, Wisconsin (Portage County). The wasps had an established nest in the pipe for some time, but on 15 August, a Gray Treefrog was observed residing just above the nest within the pipe, with the wasps continuing about their behavior, evidently unbothered by its presence. The frog was observed in the pipe for four consecutive days. On 19 August, it was not present, but was seen in the pipe again on the 20th and 21st. After another string of absences, the frog was observed in the pipe one last time on the 30th. The wasps still displayed territorial aggression, as one chased JLO off while attempting to photograph the behavior, yet they never acted aggressively toward the frog.

Additionally, during the summers of 2021 and 2022, RCJ witnessed both Spring Peepers and Gray Treefrogs living with Northern Paper Wasps and their hive inside an outdoor resin deck box (Figure 2) at his property (44.48847°N, 89.78281°W, WGS 84) near Rudolph, Wisconsin. The frogs did not return in the summer of 2023 when RCJ hoped to photograph them with the wasps.

Although both *Dryophytes versicolor* (Gray Treefrog) and *D. chrysoscelis* (Cope’s Gray Treefrog) are found in central Wis-

consin, *D. chrysoscelis* has yet to be detected in Portage County, Wisconsin (Siddons, 2023a) and RCJ has yet to hear a *D. chrysoscelis* on his property (in Wood County, Wisconsin). Therefore, we consider both occurrences of this phenomenon to be in association with *D. versicolor*.



Figure 1. *Dryophytes versicolor* cohabiting with a *Polistes fuscatus* nest inside a metal pipe. Photographs taken by Juniper L. O’Leathlobhair at 10:43 A.M. on 15 August 2022 (top) and 12:44 P.M. on 18 August 2022 (bottom).



Figure 2. *Pseudacris crucifer* inside a Sunbrite resin outdoor deck box (dimensions = 21"L × 46"D × 24"H). On the opposite side of the box was a nest of paper wasps that would regularly occur near these frogs and Gray Treefrogs as they and the frogs moved throughout the summers of 2021 and 2022. Photograph taken by Robert C. Jadin at 9:25 A.M. on 15 July 2021.

Discussion

Why these wasps were living together with adult anurans is not clear. Numerous types of predators on anurans are available (Duellman and Trueb, 1994). However, wasps do not appear to

be documented as a predator to adult anurans (Toledo, 2005; Wells, 2007). Additionally, Gray Treefrogs and Spring Peepers do not appear to actively eat wasps even though they eat a multitude of other arthropod taxa (Sweetman, 1944; Vogt, 1981; Butterfield et al., 2005; Cline, 2005; Badje and Peterson, 2023; Siddons, 2023b), nor did the frogs in this study appear to attempt to prey upon the wasps or their larvae.

Because Gray Treefrogs are likely eaten by a multitude of mammals and birds (Siddons, 2023b), it is possible that these frogs may be benefitting from living in and around wasps that would scare away such predators. But what benefit the frog might offer to the wasp remains unclear. If there is no direct benefit to the wasp, then the question occurs as to whether the frog is tolerated or by which manner the frog remains undetected to avoid the defense response of the hymenopterans in order to safely live within their nest. For example, in the two cases of cohabitation with ants cited above, the South American frog, *Lithodytes lineatus*, and the West-African savanna frog, *Phrynomantis microps*, are known to secrete special chemicals onto their skin that prevent the ants from stinging (Rödel et al., 2013; de Lima Barros et al., 2016), allowing them to dwell within the nests unharmed. We believe future research with this study system might be valuable in investigating ways to reduce aggressive behavior in these easily agitated wasps.

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