Red Imported Fire Ants (Hymenoptera: Formicidae) are Unsuitable Prey for a Native Antlion (Neuroptera: Myrmeleontidae) in Florida

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Red imported fire ants (Hymenoptera: Formicidae) are unsuitable prey for a native antlion (Neuroptera: Myrmeleontidae) in Florida

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Adventive species often prey on or otherwise have a negative impact on native species. For example, Solenopsis invicta Buren (Hymenoptera: Formicidae), a fire ant native to the grasslands of South America, has become an important pest in the southeastern U.S., where it commonly preys on native wildlife (Allen et al. 2004). Adventive species may also be unsuitable or even toxic prey. For example, the cane toad, Rhinella marina (L.) (Anura: Bufonidae), is native to the Neotropics but is now established in Australia, where it has had severe consequences for many native Australian predators, which naively feed on the toads and then die from the toad’s toxins (Doody et al. 2009). Conversely, Glenn & Holway (2008) found that native ant lions in California fed on a diet of the Argentine ant, Linepithema humile (Mayr) (Hymenoptera: Formicidae), showed increased growth rates and no difference in survival compared with larvae feeding on native ants. In this study, we sought to examine the suitability of S. invicta as prey for the antlion Myrmeleon crudelis Walker (Neuroptera: Myrmeleontidae), which occurs in Florida.

Solenopsis invicta arrived in North America by ship in Mobile, Alabama, in the 1930s and has spread across the southeastern U.S. and northeastern Mexico. More recently, S. invicta has become established in the West Indies and parts of the Old World (Wetterer 2013).

Myrmeleon crudelis larvae are sit-and-wait predators that reside at the bottom of conical pits dug into sandy soils. Small arthropods, such as ants, that fall into the pit are often unable to climb out and are captured by the antlion larva (Farji-Brener 2003). Myrmeleon crudelis is widespread in North and Central America, where it is most often found in sheltered areas (Lucas & Stange 1981).

We collected M. crudelis larvae at 3 sites in southeastern Florida: below building eaves at Bathtub Beach in Stuart (Martin County; 27.186°N, 80.160°W); beneath the boardwalk in Juno Beach (Palm Beach County; 26.895°N, 80.057°W); and at the Abacoa Greenway in Jupiter (Palm Beach County; 26.898°N, 80.115°W). We used a ladle to scoop out antlion pits and put the sand into a plastic tub, which we brought back to the laboratory. In a separate bucket, we collected sand from Juno Beach to use in the experiments.

We sifted the collected sand through a sieve to remove the larger pieces of detritus and mixed the sand to ensure a homogeneous substrate. We labeled 266 mL plastic cups (n = 32) and filled them each about 75% full with the homogenized sand. The room was kept at 26 ± 1 °C and lit by natural sunlight.

After about 36 h in the laboratory, we weighed 32 M. crudelis larvae to the nearest 0.1 mg by using an electronic balance. We placed each larva into a separate cup of sand and sprayed each cup with deionized pH 7 water. We waited 36 h for larvae to build pits before introducing prey.

Using an aspirator, we collected workers of S. invicta and the native pyramid ant Dorymyrmex bureni (Trager) (Hymenoptera: Formicidae) on the Jupiter campus of Florida Atlantic University, where these are 2 of the most common ant species in open areas. Field-collected ants were stored in capped vials; immediately prior to feeding, prey were placed in a freezer for 10 min to immobilize or kill them. To account for the size differences between individuals of S. invicta workers, which are polymorphic, and D. bureni workers, which are monomorphic, we weighed each ant and used only workers of about 3 mg (S. invicta = 3.2 ± 0.4 mg; D. bureni = 2.9 ± 0.2 mg [mean ± SD]). Using forceps, we placed 1 S. invicta worker in each of the 16 even number cups, and 1 D. bureni worker in each of the 16 odd number cups.

The M. crudelis larvae reacted immediately by flinging sand to de-stabilize the ant so that it fell to the bottom of the pit, and larvae demonstrated no noticeable difference in their treatment of the 2 ant species. We fed each antlion 1 ant per week for 12 wk or until the antlion died. Every 4 wk, we weighed each antlion and returned it to the same cup. We then sprayed the sand with deionized pH 7 water to ensure that the antlions did not desiccate during the experiment. We calculated average growth rate of antlions as final live mass minus starting mass divided by number of weeks fed. One M. crudelis larva fed S. invicta workers died before the first re-weighing at 4 wk and was excluded from the analysis.

The average growth rate was lower for M. crudelis larvae fed S. invicta workers than for M. crudelis larvae fed D. bureni workers (~0.2 mg/wk vs. 0.2 mg/wk; P > 0.05; 2-tailed t-test). Mortality was higher for M. crudelis larvae fed S. invicta workers; 5 of 16 died during the course of the study, with no deaths among the 16 M. crudelis larvae fed D. bureni workers (P < 0.05; Fisher’s exact test).

Because the growth and survival rates of M. crudelis larvae fed S. invicta workers were significantly lower than of those fed D. bureni workers, we conclude that S. invicta is unsuitable prey for M. crudelis. If indeed S. invicta is unsuitable prey, it may have a negative impact on M. crudelis and possibly other antlions in areas where it invades. Similarly, Myers et al. (2014) found that northern bobwhite, Colinus virginianus (L.) (Galliformes: Odontophoridae), chicks in Texas that fed on S. invicta had reduced survival and weight gain. In addition, ingestion of S. invicta by fish has repeatedly been implicated in fish-kills in North America (Crance 1965; Contreras & Labay 1999). If S. invicta is also a poor or even toxic food source for ant-feeding predators, this suggests that there may be broader implications concerning the impact of S. invicta on native species than currently recognized.

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In North America, the eastern mole, Scalopus aquaticus (L.) (Eulipotyphla: Talpidae), selectively avoids feeding on S. invicta (Hartman et al. 2000), but many native species have been observed feeding on S. invicta, including southern toads, Anaxyrus terrestris (Bonnaterre) (Anura; Bufonidae) (Moseley et al. 2004); eastern narrow-mouthed toads, Gastrophyrynne carolinensis Holbrook (Anura: Microhylidae) (Deyrup et al. 2013); and nine-banded armadillos, Dasypus novemcinctus L. (Cingulata: Dasypodidae) (Loughry & McDonough 2013). Given the ubiquity of S. invicta in many regions of North America, vertebrate and invertebrate predators may be regularly consuming S. invicta, which may be a previously unrecognized factor influencing predator health and mortality.

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Summary

We examined the suitability of Solenopsis invicta Buren (Hymenoptera: Formicidae) as prey for a native antlion, Myrmeleon crudelis Walker (Neuroptera: Myrmeleontidae), in south Florida. We found that average growth rate was significantly lower and mortality was significantly higher for M. crudelis larvae fed S. invicta workers than for M. crudelis larvae fed Dorymyrmex bureni (Trager) (Hymenoptera: Formicidae) workers. Thus, S. invicta appears to be unsuitable prey for M. crudelis and may have a negative impact on M. crudelis and other ant predators in areas where it invades.

Key Words: biological invasion; exotic species; invasive species; Myrmeleon; Solenopsis

Sumario

Se examinó la idoneidad de Solenopsis invicta Buren (Hymenoptera: Formicidae) como presa para el león de hormigas nativo, Myrmeleon crudelis Walker (Neuroptera: Myrmeleontidae) en el sur de la Florida. Se encontró que el promedio de la tasa de crecimiento fue significativamente más baja y la mortalidad fue significativamente mayor para larvas de M. crudelis alimentadas de trabajadores de S. invicta que para las alimentadas de trabajadores de Dorymyrmex bureni (Trager) (Hymenoptera: Formicidae). Entonces, parece que S. invicta no es una presa adecuada para M. crudelis y puede tener un impacto negativo sobre M. crudelis y otros depredadores de hormigas en las zonas donde la especie invada.

Palabras Clave: invasión biológica; especies exóticas; especies invasivas; Myrmeleon; Solenopsis

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