Spring 5-2-2024

The Effect of Temperature on the Invasive Asian Needle Ant

Kaylee Mulligan '25

The Effect of Temperature on the Invasive Asian Needle Ant

Kaylee Mulligan, Dr. Rachel Bonoan, Dr. Peter J. Rogers,

Biology Department of Providence College, Providence, RI

Background

The Asian Needle Ant (*Brachyponera chinensis*) is an invasive species currently spreading on the Eastern Coast of the United States. They were first reported around the 1930s in Florida and have since migrated to Massachusetts (1). As an invasive species, this pest originating from Asia has a negative impact on environment ecosystems and other species of ants (2). Asian Needle Ants displace resident ant colonies, taking over nesting sites by consuming food sources and decreasing the amount of space other ant colonies can use (2). They are also known to have a sting that contains venom more likely to result in a fatal allergic reaction in humans when compared to the average honeybee (2). In the past six years, the spread of Asian Needle Ants has increased at an extremely fast rate, an observation made clear by comparing the sparse observations collected by iNaturalist in 2016 to the abundant number that can be viewed today (Fig. 1a, Fig. 1b). **I hypothesize that one factor responsible for the expansion of Asian Needle Ants in the United States is an increase in temperature over the past few years** (3). In this project, I studied the relationship between the Asian Needle Ant colony presence and the annual temperature of counties in Maryland from 2016-2022.

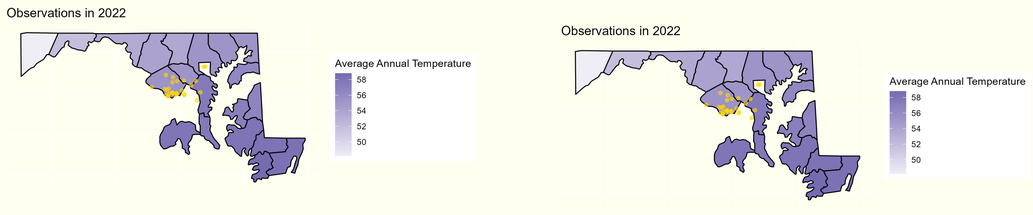

Figure 1: a) Map displaying the average annual temperature for Maryland counties in 2016 and the number of Asian Needle Ant iNaturalist observations in 2016. **b)** Map displaying the average annual temperature for Maryland counties in 2022 and the number of Asian Needle Ant iNaturalist observations from 2016 – 2022.

Methods

Asian Needle Ant Observations

All ant observations were collected via iNaturalist, a program promoting citizen science. Observations were filtered before data analysis to “research-grade” identifications, verified by three or more users on iNaturalist (4).

Average Annual County Temperature

The temperature data used for this experiment was collected from the National Center of Environmental Information, a website that allows for data access on climatology as collected by satellites and uploaded as datasets (5).

Results and Data Analysis

Presence

The presence of the Asian Needle Ant in Maryland between the years of 2016-2022 did not significantly vary depending on temperature (Anova on GLMM, df = 1, X^2 = 0.17532, p = 0.6754) or years (Anova on GLMM, df = 6, X^2 = 7.5446, p = 0.2734).

Temperature

The average annual temperature in Maryland counties did not significantly vary between the years 2016 and 2022 (Anova on LMM, df = 6, F = 1.092, p = 0.3707).

County

The presence of Asian Needle Ant variation was not especially significant among counties over years (Anova on GLMM, df = 22, F = 123.44, p = 0.08497).

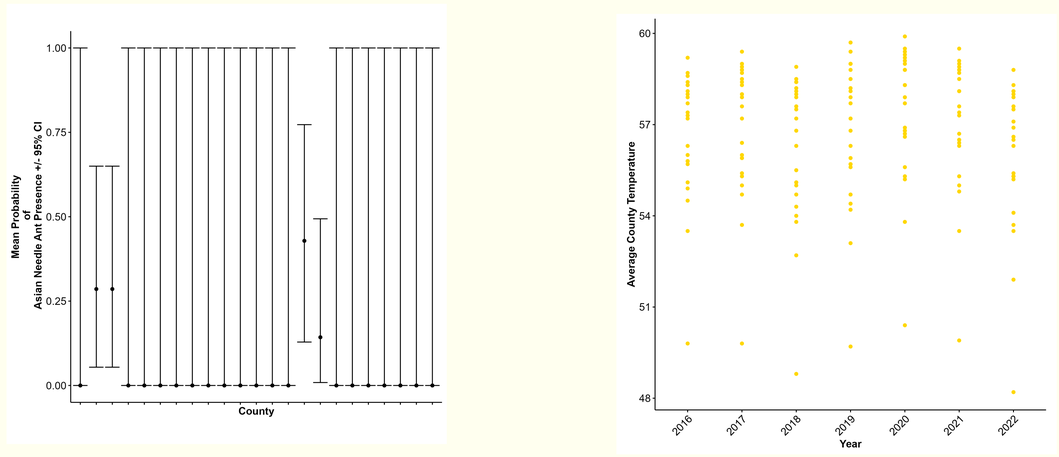

Figure 2: a) The probability of Asian Needle Ant presence among counties in Maryland shows little significance. **b)** The average annual county temperature does not vary significantly from 2016 – 2022.

Conclusion

While it appears that temperature does not have a significant effect on the spread of Asian Needle Ant colonies in Maryland counties from 2016 - 2022, other factors that may explain the increase have yet to be explored. Examples that have been discussed that may be correlated with the increased spread of these ants are the increase of CO2 emissions and the abilities of foreign ant colonies to more efficiently disperse seeds to allow for a higher chance of survival (6, 3). Studying the causes behind the spread of Asian Needle Ant colonies is pertinent, as once a cause is defined, cutting off the spread becomes more possible. Some solutions on how to manage the invasion have been tested, including feeding termites treated with fipronil to the colonies, which can be done without using toxic bait systems that disturb the environment (7). Thanks to citizen science, the spread of these ants will continue to be monitored by ordinary people who live in the United States. Using these observations makes researching Asian Needle Ant presence more possible and are an important part of bringing the invasion to a halt.

Photo by: Benoit Guenard 2010

References

1.Guénard B, Wetterer JK, MacGown JA. 2018. Global and Temporal Spread of a Taxonomically Challenging Invasive ant, Brachyponera chinensis (Hymenoptera: Formicidae). Florida Entomologist. 101(4):649.
2.Fessenden M. 2013. Ant Invasion! Scientific American. 308(5):20.
3.Bertelsmeier C, Guénard B, Courchamp F. 2013. Climate Change May Boost the Invasion of the Asian Needle Ant. Gordon DM, editor. Plos One. 8(10).
4.Observations. iNaturalist. [accessed 2024 Apr 18]. https://www.inaturalist.org/observations?place_id=any&taxon_id=367034.
5.Climate at a Glance | National Centers for Environmental Information (NCEI). wwwnceinoaagov. [accessed 2024 Apr 18]. https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance.
6.Meadley-Dunphy SA, Prior KM, Frederickson ME. 2020. Invasive ants disperse seeds farther than native ants, affecting the spatial pattern of seedling recruitment and survival. Oecologia. 192(1):119–132.
7.Buczkowski G. 2015. The Trojan horse approach for managing invasive ants: a study with Asian needle ants, Pachycondyla chinensis. Biological Invasions. 18(2):507–515.

Acknowledgements

Acknowledgements to Dr. Rachel Bonoan and Dr. Peter J. Rogers for support and assistance in dataset exploration and data wrangling.