

Natural history and genetic variation of an introduced European ant-mimicking spider (*Myrmarachne formicaria*) in western New York

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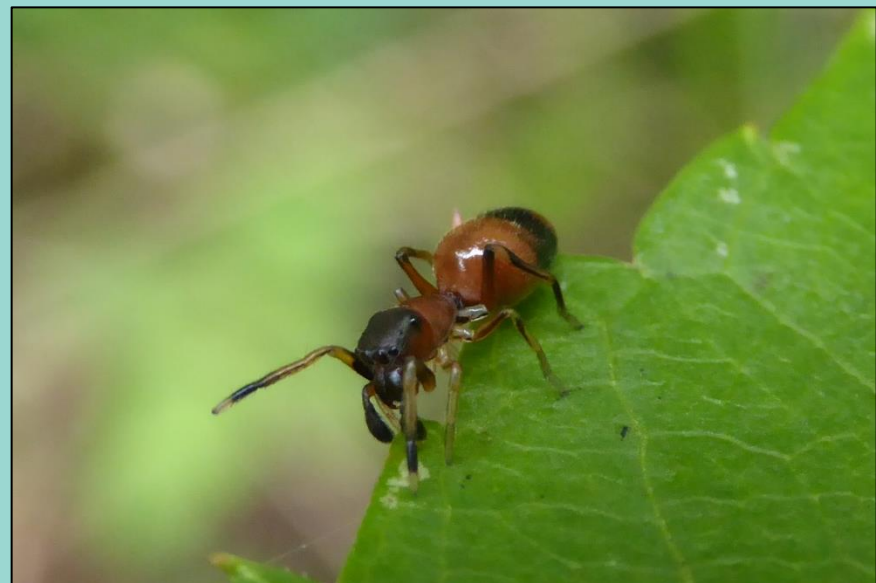


Masquerading on eight legs in a new land

The ant-mimicking spider *Myrmarachne formicaria* (Araneae: Salticidae) is a recent arrival to North America from Eurasia (Bradley et al. 2006). These spiders mimic ants not only in their morphology, but also in their movements and behaviors. They exhibit jerky movements and frequently raise their front two legs in front of them as if they were antennae. Most published accounts of this species in North America are from domestic settings in or near buildings (Barringer 2017, Gall & Edwards 2016). During a long-term study of mound-nesting ants in western New York, we discovered an increasing incidence of *M. formicaria* as they are often seen near ant nests, with silken shelters built on the vinyl flags marking colonies.



Male *M. formicaria*

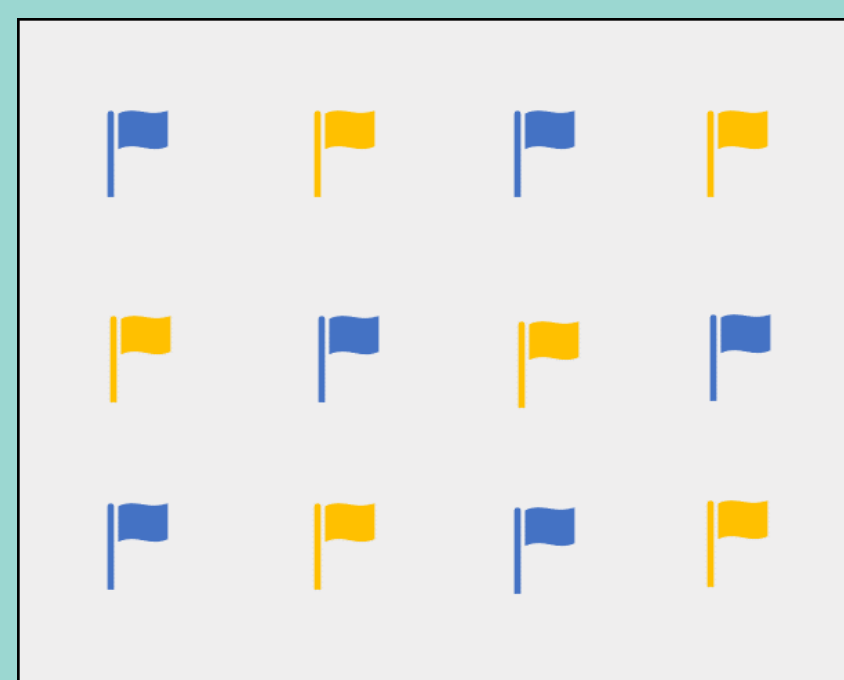


Female *M. formicaria*



Mound of a *Formica* ant colony, marked with a flag; inset shows a shelter of an ant-mimicking spider frequently observed on flags

We used these spiders' propensity to colonize substrates like vinyl flags to determine if they are associated with ant abundance or specific habitats. Grids of 12 flags placed 1.5 m apart were employed to sample spiders in 18 plots in 4 different sites. We visited plots weekly in summer 2019 to check for the presence, stage, and sex of *M. formicaria* on the flags. Ants were sampled two ways: a grid of 12 pitfall traps (50 ml conical tubes filled with 50% propylene glycol, left out for 3 days) and a grid of 12 cookie baits set out for an hour at each site.

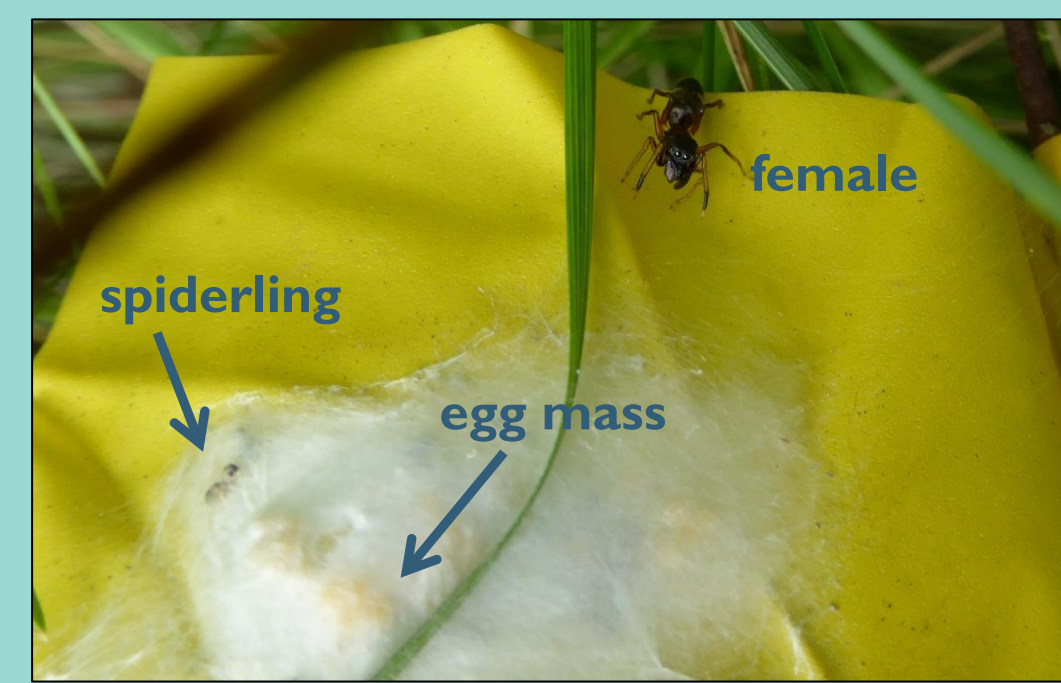


Grid of vinyl flags used to sample ant-mimicking spiders

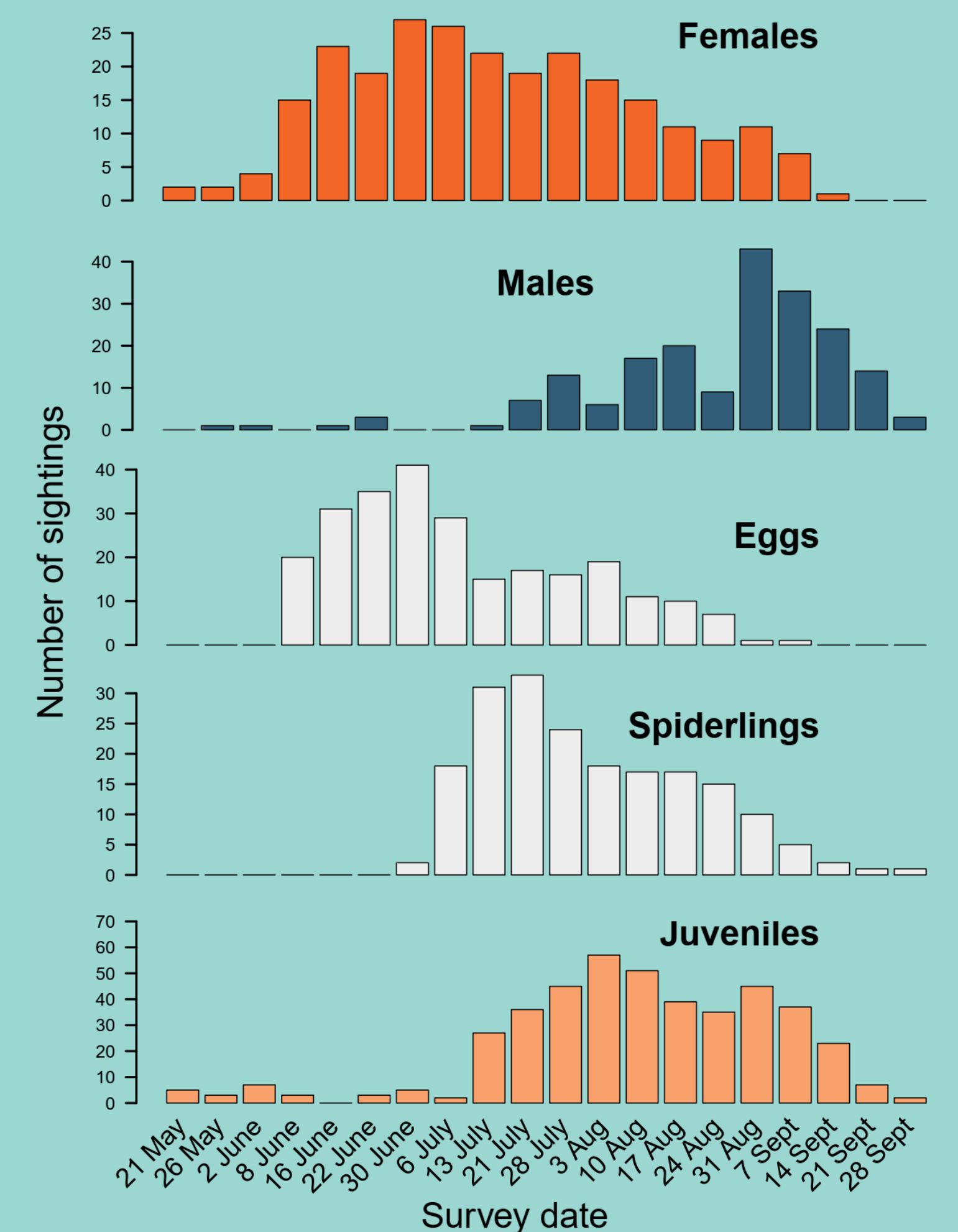
Patterns in time

How does the abundance *Myrmarachne formicaria* vary seasonally in North America?

Females consistently occupied silken shelters on flags throughout the summer. Males, however, did not appear on the flags until mid-summer, after many females had laid eggs which started hatching by early July. Females were often observed to remain in shelters with developing spiderlings. The extended period over which eggs were observed suggest that females may have multiple broods in a season.



Males often established shelters on the same flags with juveniles or females. Such cohabitation has been documented for other salticid spiders, likely a strategy for males to obtain mating opportunities (Jackson 1986.)



Cumulative number of sightings of each stage across all 18 grids for each sampling date in 2020.

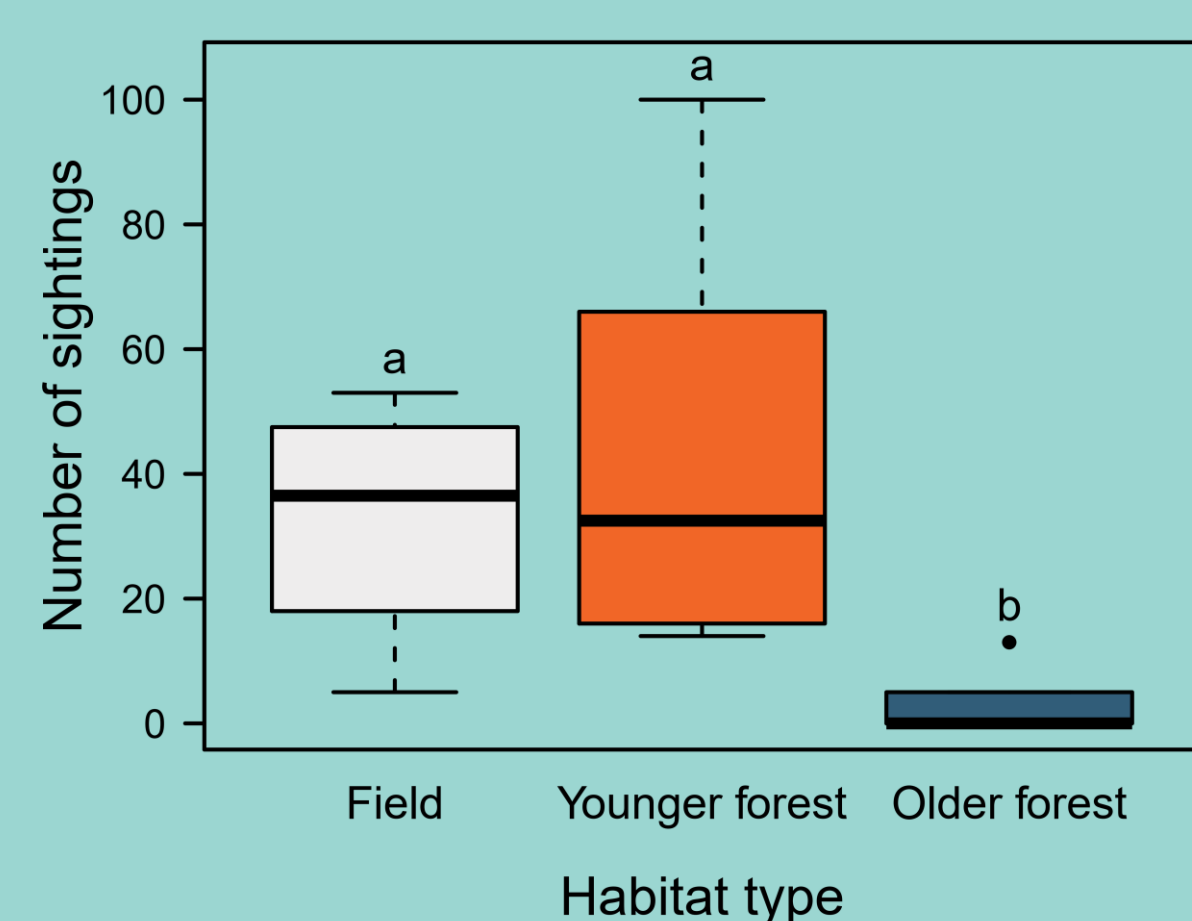


Patterns in space

What natural habitats are favored by *Myrmarachne formicaria* in western NY?

Plots that had dense cover of forbs and little canopy ("field") or a moderate understory of shrubs and forbs with openings in the canopy ("younger forest") had a higher incidence of ant-mimicking spiders than plots with a more complete tree canopy and sparse understory ("older forest").

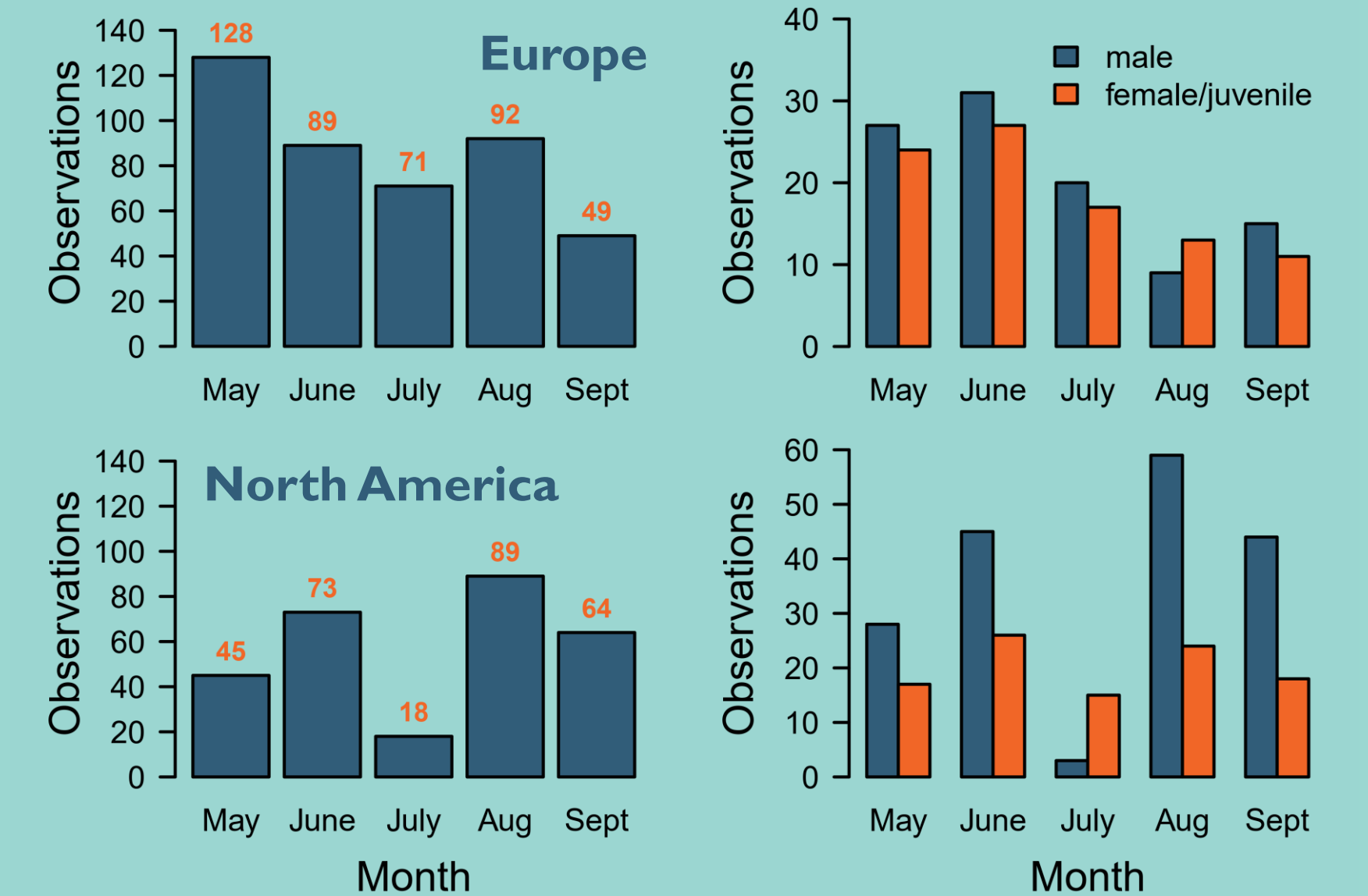
There was no association between the numbers of sightings of adult ant-mimicking spiders and the median number of ants in pitfall traps or at baits, though older forest plots did tend to have the fewest ants. (Spearman's rank correlation: AMS vs. ants in traps, $p = 0.13$; AMS vs. ants at baits, $p = 0.77$).



Cumulative number of sightings of adults across grids in each habitat category. Kruskal-Wallis $\chi^2 = 10.6$, $df = 2$, $p = 0.005$; Dunn's test of multiple comparisons: F vs. OF, $p = 0.03$; YF vs. OF, $p = 0.007$.

Patterns in Europe vs. North America

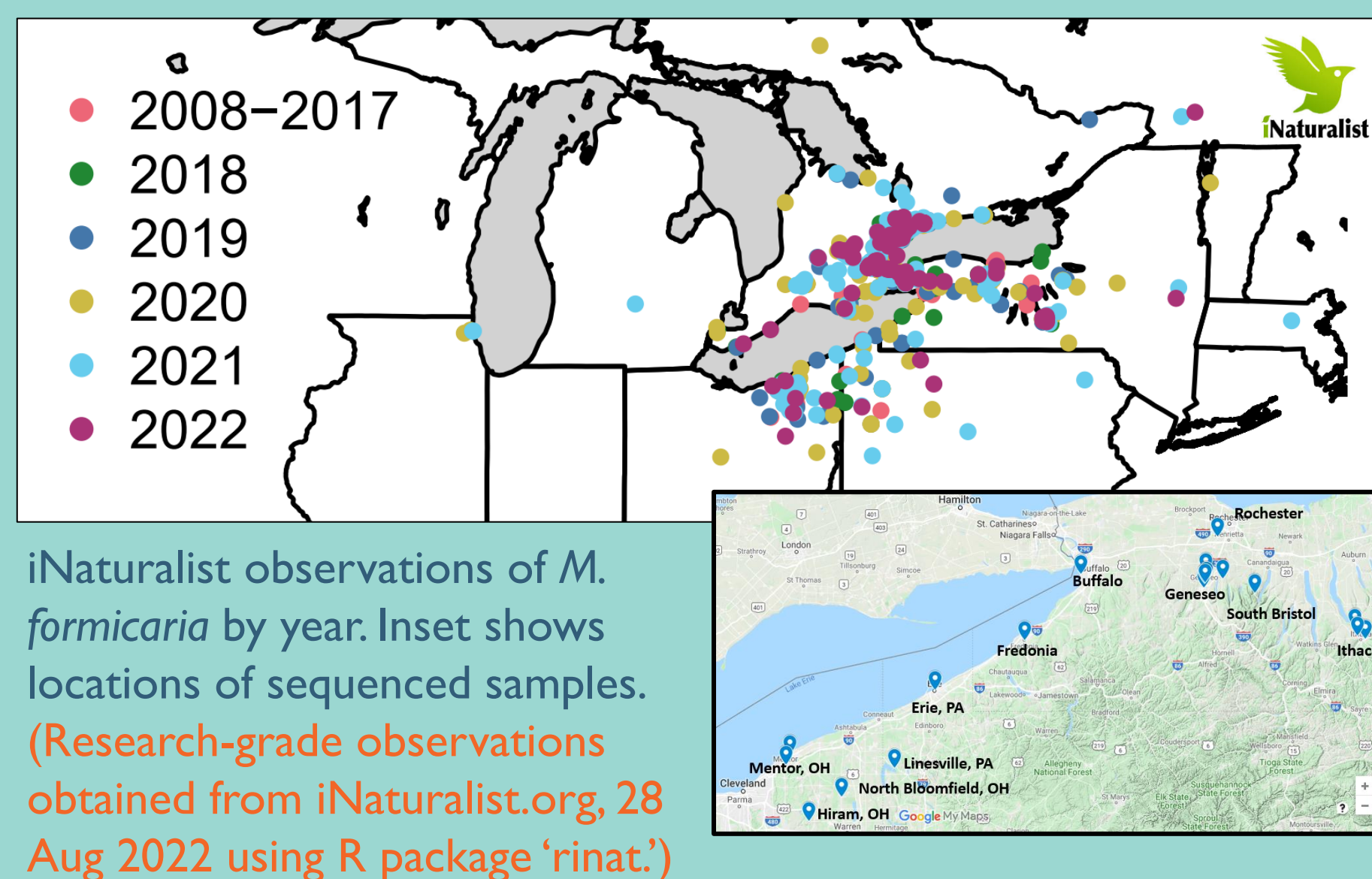
Species occurrence data were obtained from the Global Biodiversity Information Facility (GBIF). In Europe, observations peak in early summer, while North America shows a rise in numbers in late summer, particularly for males. These patterns may reflect real seasonal differences or observation biases. Efforts to collect in Europe vs. New York in August 2022 support more apparent adult activity in North America at this time.



All North American observations are from 2012 or later; on left, European records starting in 2012 were used, while records beginning with 2000 are used on the right. Only a subset of observations had data or photos that could be used to determine sex. Data source: Derived dataset GBIF.org (28 August 2022) Filtered export of GBIF occurrence data <https://doi.org/10.15468/dd.d9czrn>

Dynamics of an invasion...

The first records of *M. formicaria* in North America date to 2001 in Ohio, presumably the result of accidental introduction (Bradley et al. 2006). The species has since been reported widely in western New York, northwest Pennsylvania, and Ontario. To learn more about the history of its introduction, and spread, we assessed variation in mitochondrial DNA in 27 samples from 14 locations in New York, Pennsylvania, and Ohio. We sequenced a 591-bp fragment containing the 16S rRNA, tRNA-leucine, and NADH dehydrogenase I (NDI) genes (Hedin 1997, Simon et al. 1994).

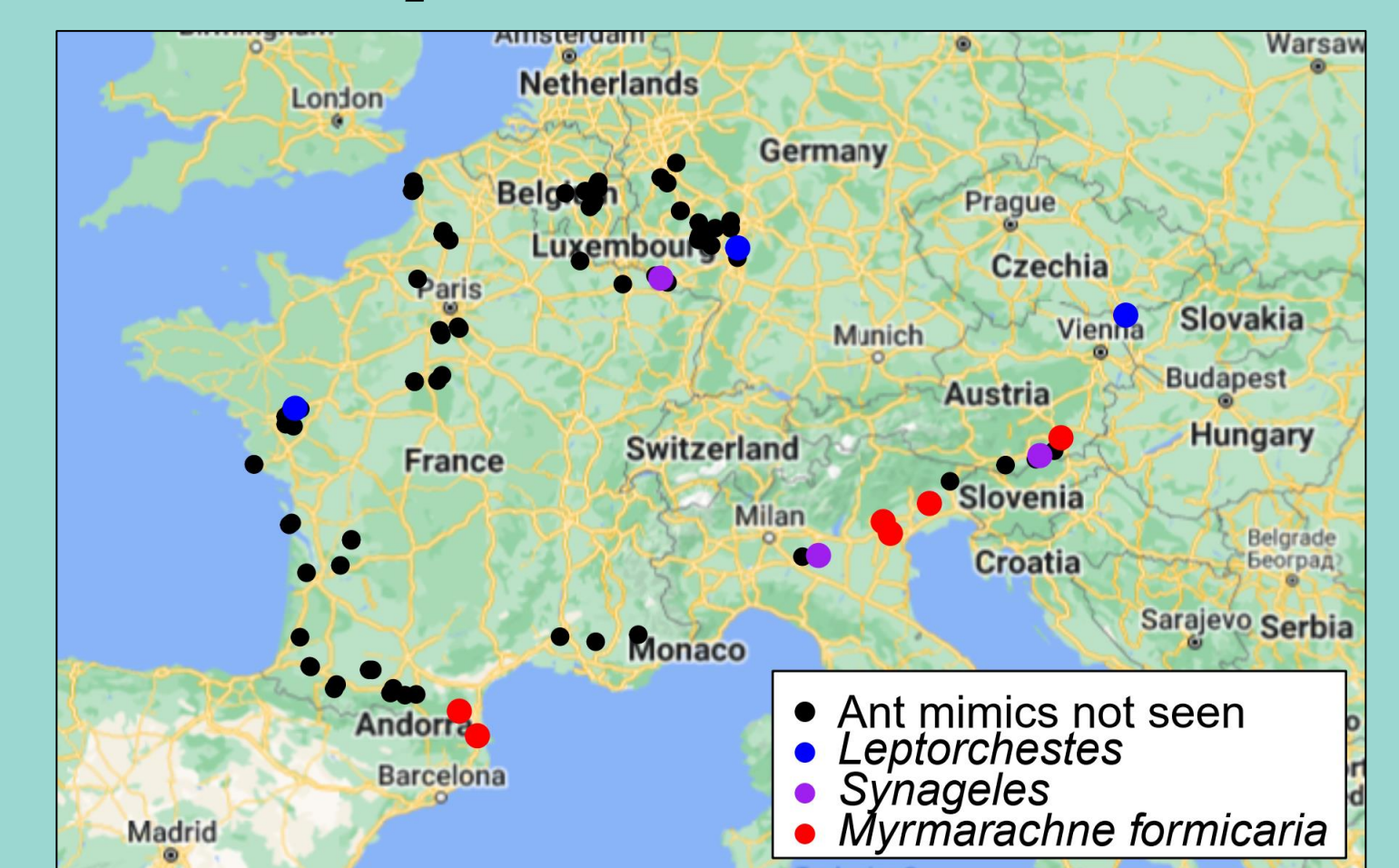


Geographically diverse samples in invaded range exhibit little genetic variation

All sequences were invariant except for a single nucleotide substitution in one sample and an insertion in the non-coding region for several samples (0.3% divergence). These results suggest that *M. formicaria*'s colonization of North America may have involved a single introduction event. However, analyses with more polymorphic molecular markers and more extensive sampling in both North America and Europe are key to understanding the history of *M. formicaria*'s spread.

In search of *Myrmarachne formicaria* in Europe

We searched >90 localities with known occurrences of this species based on GBIF and iNaturalist data and other sites with favorable habitat from 15 July to 15 Aug 2022. Only 22 individuals were observed in 6 locations, including 10 at a single site. All were juveniles except one adult male. In contrast to the apparent rarity of this spider in Europe, in late August, in a single day of sampling 8 grids (5 x 7 m each) in western New York, 103 *M. formicaria* were observed, including 60 adults.



Map of sites searched for *M. formicaria*. Sites where other ant-mimicking salticids were observed are also indicated. (Map prepared using R package 'RgoogleMaps'.)

Questions? More information, including video links and photos, can be accessed by scanning this QR code or at this URL: <https://bit.ly/3e2Kl1f>



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Acknowledgments

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