

A Tale of Two Ridges: Divergence spawning a new trap-jaw ant species in Florida

D. Magdalena Sorger*, Warren Booth** & Rob R. Dunn*

*Dept. of Biology, North Carolina State University, ** Dept. of Biological Sciences, University of Tulsa



Introduction

Florida's inland ridges originated as sand islands at a time when sea levels were significantly higher than they are now. These ridges (some up to 100 miles long) are home to orange trees, but also endemic animals—like the charismatic trap-jaw ant *Odontomachus relictus*. This ant occurs on only two of these sand ridges (Lake Wales Ridge and Southern Brooksville Ridge) and lives in sand hill scrub habitat. The species was only recently described and the authors suggest that it might be a relict species from dry periods in the Pleistocene (Deyrup & Cover 2004). Besides its high habitat-specificity, little is known about the life history of this ant or whether and how it differs between ridges. The two ridges have been separated for up to one million years, sufficient time (given isolation) for divergence to occur. Here, I present preliminary data collected from extensive sampling of populations on each ridge (Fig. 1) to test the hypothesis of species divergence between ridges.

Prediction 1: There will be more aggression between isolated patches than within.

Prediction 2: Isolated patches reflect molecular divergence.

Aggression

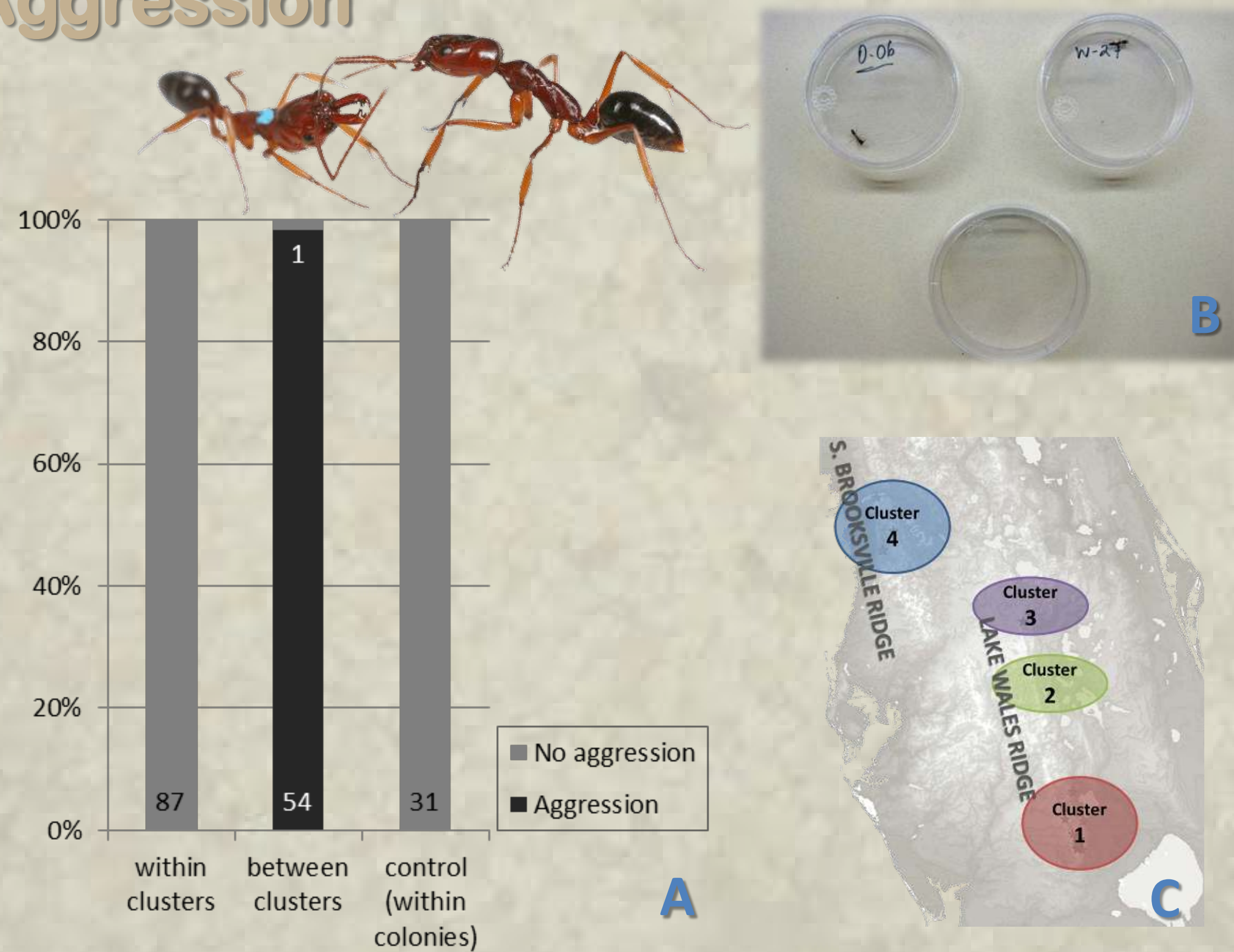


Fig. 2: Results of aggression assays (A), experimental set-up (B), and clusters on ridges (C).

Acknowledgements

Mark Deyrup (Archbold Biological Station), Josh King (University of Central Florida), Zach Prusak (The Nature Conservancy), Eric Elbert (Reedy Creek Improvement District), and Colleen Werner (Withlacoochee State Forest) provided support. Thanks to Lloyd Davis, Dustin Dowless, Amanda Traud, and Britné Hackett for help in the field, and to Lauren Nichols for help with creating the map. Thanks to Amy Savage, Juliana Rangel, Ed Vargo, and David Tarpy (NCSU) for comments. This research is supported by a NSF Career Grant to RRD and funding from USGS.

Florida

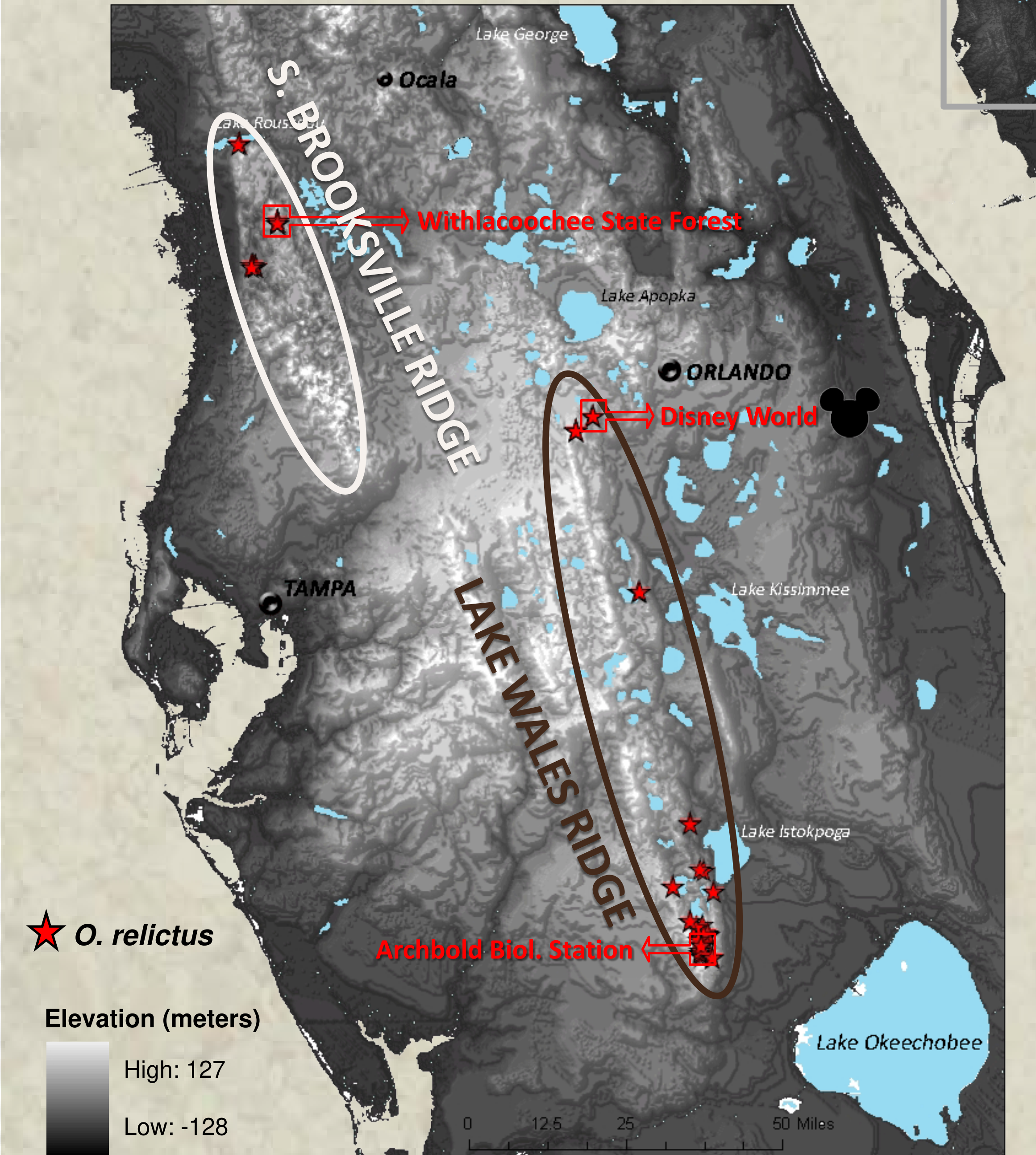


Fig. 1: Elevational map of Florida showing sampling locations (Source: FGDL.org).



Methods

Aggression tests followed Carlin & Hölldobler (1986). 174 paired trials were conducted (87 within clusters, 55 between clusters, and 31 controls, see Fig. 2). Aggression was defined as mandible snapping within one minute of observation. Within-colony trials served as controls. For phylogenetic analysis a fragment of 646 base pairs of the mitochondrial gene CO1 was amplified and sequenced for 10 specimens (5 per ridge). An additional 4 samples from "Disney World" were sequenced and compared but not included in the tree. Phylogenetic relationships were examined using Molecular Evolutionary Genetics Analysis (MEGA). A neighbor-joining tree was constructed.

Results & Discussion

Aggression trials showed a striking pattern of non-aggression within and aggression between clusters (Fig. 2). Samples from each cluster are independent (Chi-Square 137.834, 1 df, p-value < 0.0001). CO1 sequences of samples from "Disney World" were identical to sequences from Archbold Biological Station. Phylogenetic analysis showed 4.84 % divergence between ridges (see Fig. 3). What is now called *Odontomachus relictus* may represent two distinct species, which would be two of America's rarest ants living in a highly threatened habitat. Similar patterns of divergence (and rarity) are likely in other organisms living on these ridges (see Lamb & Justice 2005). Hackett et al. (unpublished data) recently discovered distinct morphological differences in a small dolichoderine ant (*Dorymyrmex elegans*) between these same ridges.

Phylogenetics

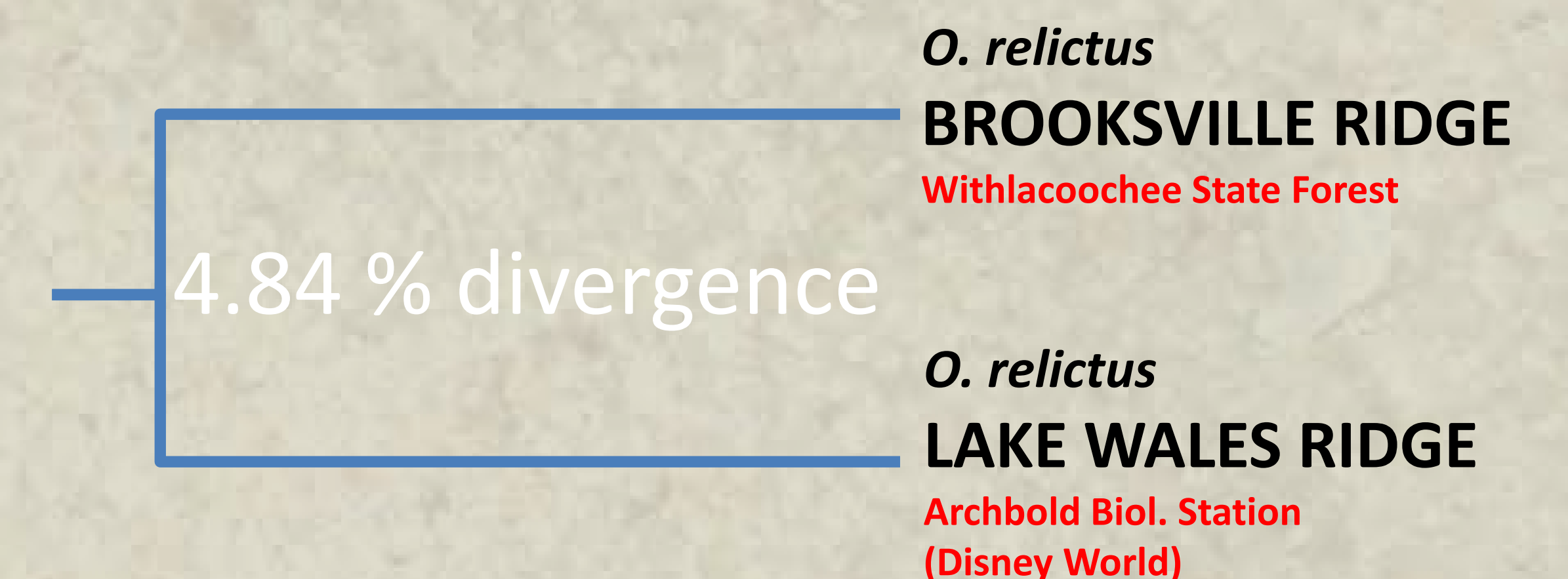


Fig. 3: Neighbor-joining tree (CO1, 646 base pairs).

Next Steps

The immediate next step is to look at morphological differences between ridges and to expand phylogenetic analysis by adding more genes. Another interesting suite of questions includes finding the sister species of the *O. relictus* lineage which will result in an expanded phylogeny that includes all (North) American trap-jaw ant species (*Odontomachus*). In order to understand finer genetic differences within populations on each ridge, we will pursue population genetics research. Microsatellite markers for this line of work are currently being developed.

References

- CARLIN N.F. & B. HÖLLDOBLER (1986): The kin recognition system of carpenter ants (*Camponotus* spp.) 1. Hierarchical cues in small colonies. Behavioral Ecology and Sociobiology 19: 123-134.
- DEYRUP M. & S. COVER. (2004): A new species of *Odontomachus* ant (Hymenoptera: Formicidae) from inland ridges of Florida, with a key to *Odontomachus* of the United States. Florida Entomologist 87(2): 136-144.
- LAMB T., & T. C. JUSTICE (2005): Comparative phylogeography of Florida scrub insects: implications for systematics, biogeography, and conservation. Final report. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida, USA.