Ghanaian Odonata: Regional Species Distribution, Wing Morphology, and Flight Behavior

Lillian Blanchard, Henry Adamson, Lou Bellinghausen, Rachel Desulme, Eva Gates, Myah Massiah, Malek Stafford
PIs: Dr. Kofi Adu, Dr. Rofela Combey, Dr. Lara LaDage, Dr. Jessica Ware
Penn State University, American Museum of Natural History, University of Cape Coast

Introduction

- Odonates (dragonflies and damselflies) are abundant across Ghana, but their distribution is understudied within the last century
- Dragonflies can be divided into perchers and fliers based on their flight patterns
- All odonates have a pterostigma at the tip of their wings, currently thought to help stabilize flight

Research Questions

- How are Odonate species currently distributed across Ghana?
- What role does the pterostigma play in Odonate flight patterns?

Discussion

- The SDMs of Libellulidae were altered by the more recent data, supporting the need for more recent and diverse data collection to create more accurate SDMs
- The pterostigma of the fliers are significantly smaller than those of the perchers, which is the opposite of the initial hypothesis
- These results raise more questions on the function of the pterostigma in flight, since the species who fly much more often have such small pterostigma

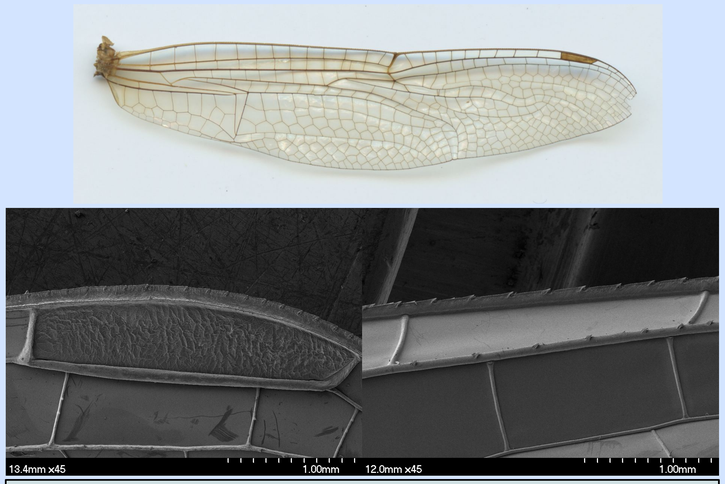

Figure 1: Image of a whole dragonfly forewing (top). SEM images of the pterostigma of a percher (bottom left) and a flier (bottom right)

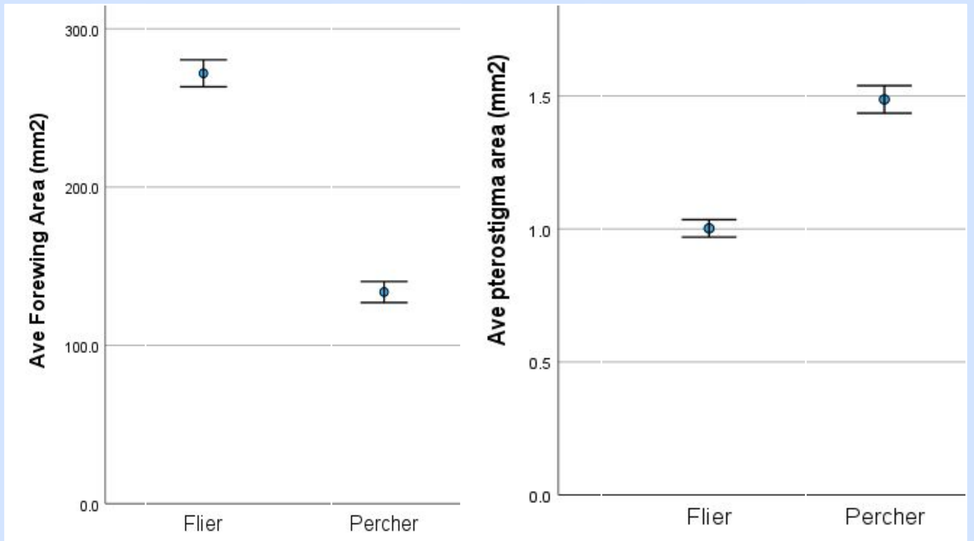

Figure 2: Graph of the average forewing area of Libellulidae flier species and percher species (left). Graph of the average pterostigma area of Libellulidae flier species and percher species (right)

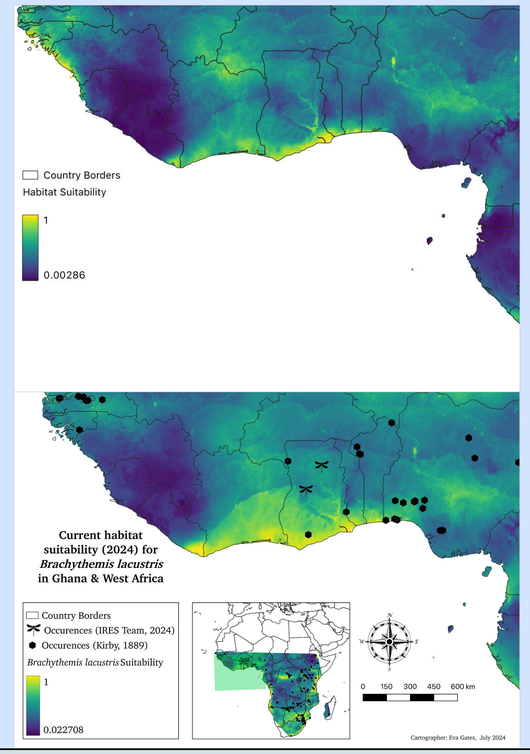

Figure 3: SDM of *Brachythemis lacustris* using previously available occurrence data (above). SDM of *Brachythemis lacustris* using previously available and new occurrence data (below)

Methods

- Collected 1,895 Odonate specimens in five different regions of Ghana
- Noted coordinates, time, weather, and water quality data for each sample site
- Collected wings on the same day of capture to preserve chemical and physical properties
- Identified family and genus (when possible) of every specimen caught; focused on Libellulidae specimens
- Used Scanning Electron Microscopy (SEM) to take images of the pterostigma of each specimen
- Measured the area of the whole wing and pterostigma of each specimen using ImageJ
- Used Raman Spectroscopy and microCT to begin analyzing the chemical composition of the wings and the morphology of the mushroom bodies of the brains, respectively

Results

- The SDMs were changed by the new additional identification data
- The area of fliers' wings are significantly higher than the area of perchers' wings *($F_{5,86}$=52.569, p<0.001)*
- The area of fliers' pterostigma are significantly lower than the area of perchers' pterostigma *(p<0.001)*
- Qualitative differences between the pterostigma of perchers and fliers were observed in the SEM images

Future Directions

- Assess neural morphology differences between perchers and fliers in their mushroom bodies
- Assess differences in wing chemical composition between perchers and fliers using Raman Spectroscopy
- Create updated SDMs of all specimens collected
- Create SDMs of future projections based on climate change predictions

Acknowledgements: NSF, Max and Shirley Kogan Museum Experience Fund, People of Ghana, AMNH faculty and staff, UCC faculty, staff, and students, Penn State Altoona ORE, Penn State SEN, Penn State IDPR