



# The influence of flower color on the foraging selection of the Julia Butterfly, *Dyras uilia*, in a captive habitat at the Minnesota Zoo



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## Introduction

Butterflies are a diurnal species. During their active days they spend time foraging for nectar, mating, and most importantly pollinating. Among other pollinators, butterflies play a vital role in distributing pollen and fertilizing flowers. There are different kinds of pollinating foraging methods used among these pollinators. For butterflies, especially the subtropical *Dyras uilia*, a method called trap-lining is used (ISU, 2008). This type of foraging involves the butterfly creating a map of feeding areas that gets them from point A to point B most efficiently (Ohashi, 2009). Unlike human eyesight, which portrays the visual spectrum of color, butterflies have the ability to see in ultraviolet (Briscoe, 2010). Julia Heliconian (*Dyras uilia*) is a subtropical butterfly that resides in the tropical woodlands or hardwood hammocks of the rainforest. Although mostly found in Central Mexico, this species also occurs in Southern Texas and Florida due to the year round warmer temperatures. The bright orange coloration of the butterfly makes them easily disguised as flowers when darting through the rainforest. They use a Mullerian mimicry to ward off predators they are poisonous (Maharaj, 2016).

## HYPOTHESIS

Taking into consideration their eye sight and foraging technique it was thought to be the color most preferred would be yellow and foraging activity would increase with air temperature.

## Methods

A full week of general observations were made on the butterfly species before the experiment was set up.

### SET UP

- Contained habitat in the Minnesota Zoo Butterfly Garden
- A specific ethogram for this experiment was created (Tbl 1)
- Yellow, blue, green, and purple colored target sticks were set in a line behind a Durango Flame Marigold flower bed (Fig 1)
- The targets were not embellished with nectar or fruit juices
- Observation windows of 30-60 minutes were established throughout the day
- If a Julia heliconian performed the LA behavior for a 3 second Mississippi count a tally was marked for the target color



Figure 1: A photo of the experimental set up with the four colored training target sticks set up behind a bed of Durango Flame Marigolds.

Behavior	Definition
Nectar/Feed (NF)	A butterfly is at rest or fluttering wings while a clear visual of the proboscis is curving and uncurling into the flower, fruit, or nectar source
Bask (BA)	A butterfly is at complete rest in a full sun area with wings folding out flat
Mate (MA)	A male and female butterfly with abdomens connected
Fly (FL)	A butterfly is flapping wings and moving at a constant speed while obtaining distance
Roost (RO)	A butterfly is either upside down or right side up on a tree/bush with the wings completely closed exposing only underside colors
Landed (LA)	A butterfly, most likely on a guest or target, at rest for a 3 second hold before displaying next behavior
Not Visible (NV)	A butterfly is not seen or viewing is obstructed
Other (OT)	Other possible behaviors that may be displayed that don't fall under the above listed behaviors

Table 1: The custom ethogram used to define behaviors observed during experiment.

## Results



- 16.5 hours over 18 days spent collecting data
- Average air temperature was 80.47 F
- Most target hits was yellow with 12 total
- Average air temperature with hits was 85 F

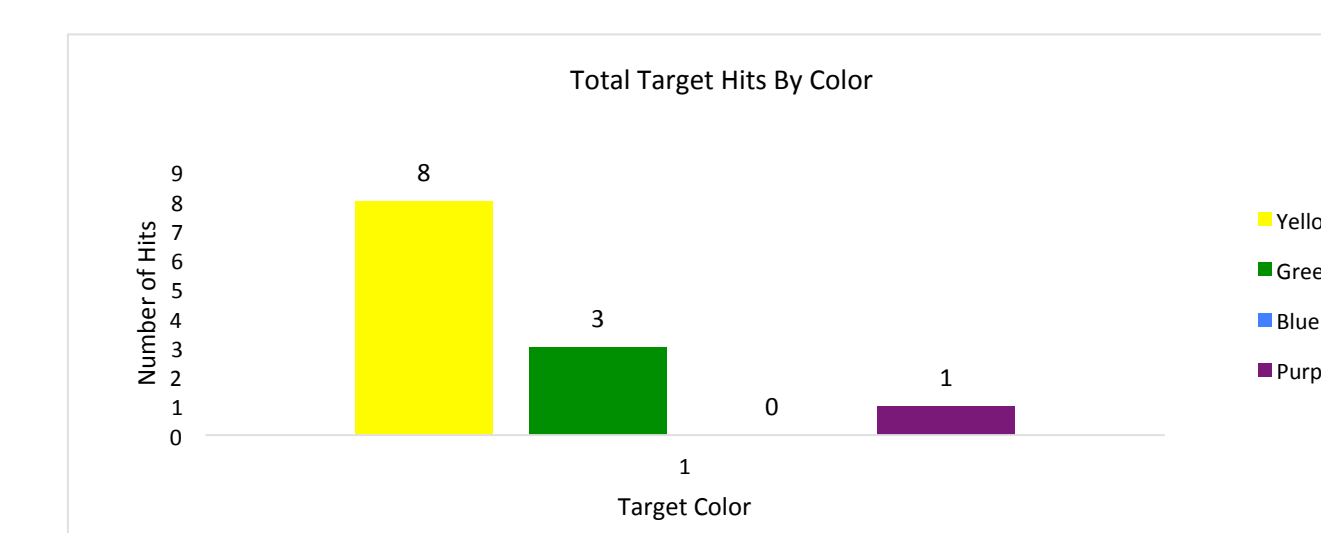


Figure 2: A graph of total target hits throughout the experiment tallied by color.

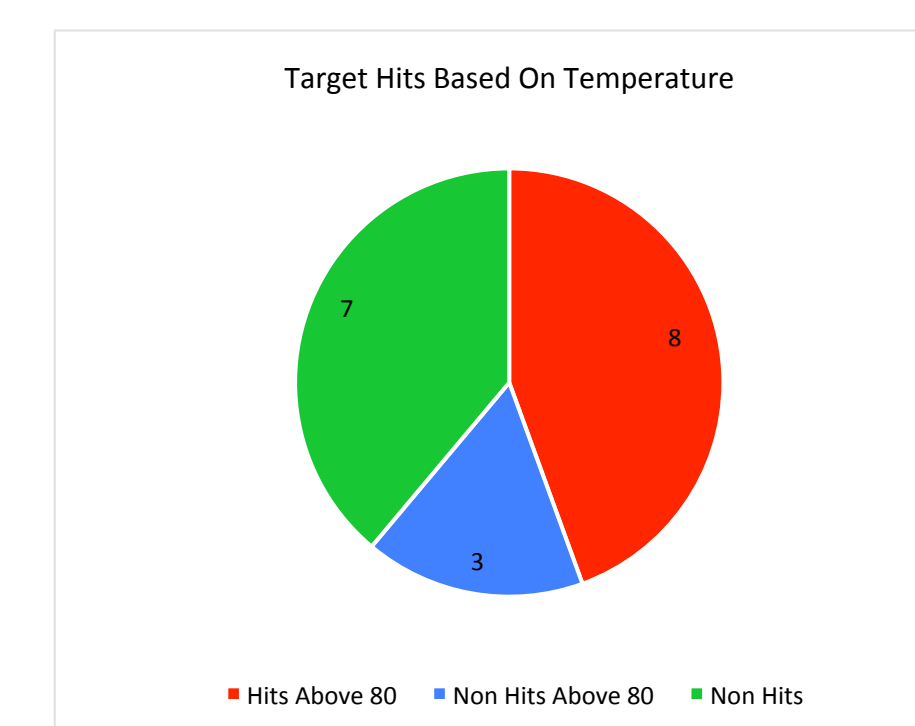


Figure 3: A graph of target hits based on temperatures above 80, below 80, or hits not occurring during the total 18 days of observation. Non hits usually occurring on days temperature was below 80 F.

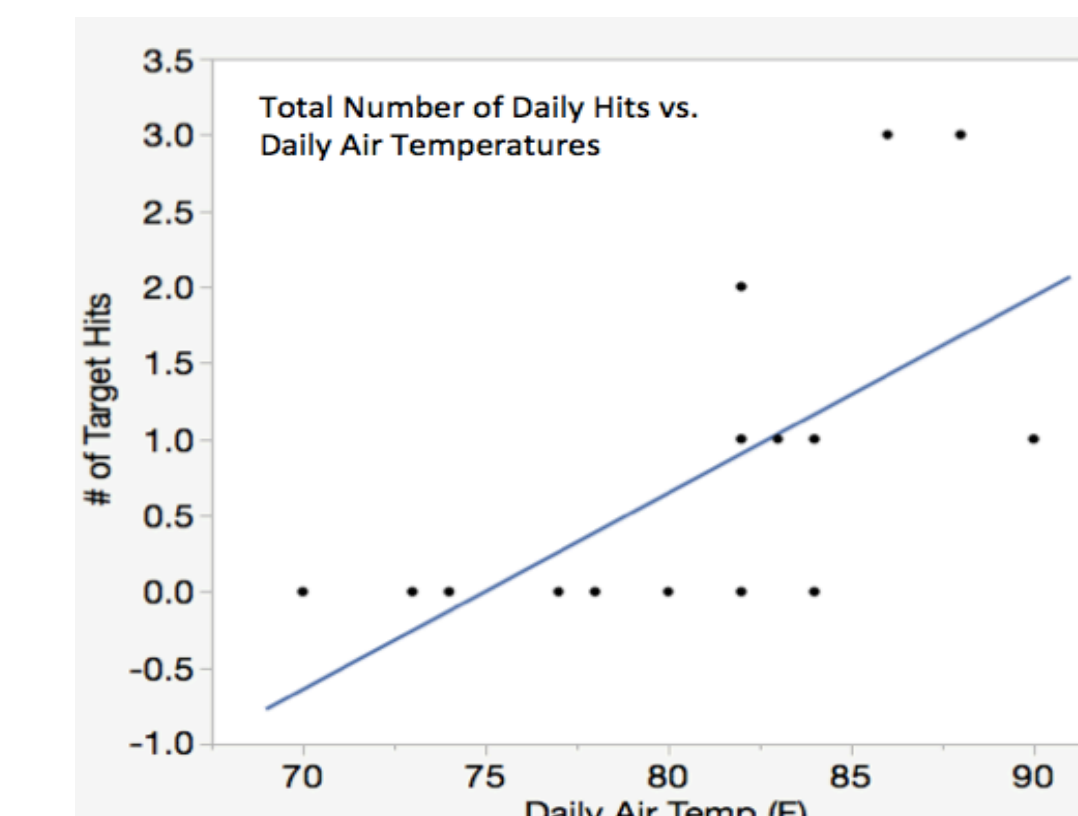


Figure 4: Simple linear regression between the total number of daily target hits by the Julia heliconian and daily air temperatures ( $r^2=0.44$ ,  $F=11.6$ ,  $p<0.01$ ).

## Conclusion

The goal of this study was to determine how flower color and air temperature are associated with the foraging patterns of the Julia heliconian *Dyras uilia* in a captive habitat at the Minnesota Zoo Butterfly Garden. The results agreed with the hypothesis stating the yellow target stick would be the color most preferred. This color is most similar to their own bright orange coloration allowing for camouflage while being vulnerable to prey as they nectar. A larger variety of warm color options for targets could have allowed a more diverse range in hits. Yellow was the only color close to that found in the flowers and fruit the Julia heliconian was nectaring on. This might have allowed a bias decision to be made or allowed a better correlation for the hypothesis being correct.

The correlation between high air temperatures and high butterfly activity was an important finding. This information will allow further research to be done on specifics of foraging methods during specific temperature days. Unlike the tropics where the Julia heliconian is normally found the Minnesota summer weather may have altered their day-to-day routine of pollinating. To perform the same experiment in a more constant tropical habitat would be a good comparison to see if the same results occur.

## References

Briscoe, Adriana D., et al. "Positive selection of a duplicated UV-sensitive visual pigment coincides with wing evolution in Heliconius butterflies." *Proceedings of the National Academy of Sciences*, National Academy of Sciences, 23 Feb. 2010. [www.pnas.org/content/107/8/3628](http://www.pnas.org/content/107/8/3628).

Iowa State University Entomology "Species *Dyras uilia* - Julia Heliconian - *Dyras uilia* - Julia Heliconian - Hodges#4416 - BugGuide.Net, August 30 2008. [bugguide.net/node/view/6358](http://bugguide.net/node/view/6358).

Maharaj, Gyanpriya, "Color-mediated foraging by pollinators: A comparative study at *Lantana camara*" (2016). *Dissertations*. of two passionflower butterflies 42.

Ohashi, Kazuharu, and James D. Thomson. "Trapline foraging by pollinators: its ontogeny, economics and possible consequences for plants." *Annals of Botany*, Oxford University Press, June 2009. [www.ncbi.nlm.nih.gov/pmc/articles/PMC2701764/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2701764/).

A strong positive correlation between target hits and air temperatures over 80 F.

The yellow target was chosen most frequently giving possible insight on a color preference.