Contrasting copulatory behaviours exhibited by *O. coerulescens* and *S. striolatum* and how the headbutt prompt and oviposition in tandem impact female oviposition

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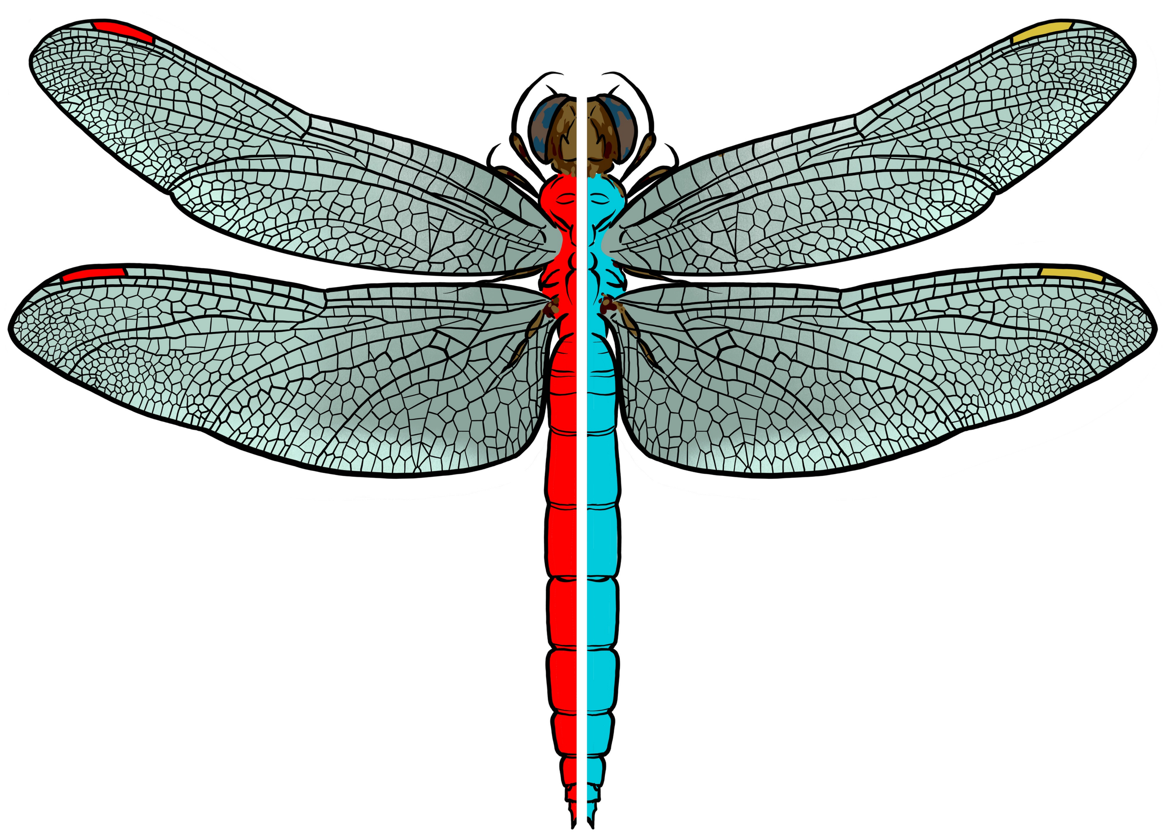
Introduction

Odonata are an ancient clade of *Insecta* with a wide range of behavioural traits which have evolved for the purpose of reproduction.[1] The final stage in the lifecycle of Odonata is limited which puts huge. pressures on the individual to pass their genes on to the next generation.[2] Adaptations vary between species, such as post-copulatory resting (**PCR**) and the headbutt prompt (**HBP**) exhibited by *O. coerulescens,*[3] and oviposition in tandem, exhibited by *S. striolatum*.[4] Typically, insect copulation is performed with the male and female oriented in the opposite directions.[5] However, Odonates remain attached at two points creating the copulatory wheel.[6] Post copulation, Odonata must disperse their eggs through oviposition.[2] This important stages of their reproduction contributes to the inclusive fitness of the species.[7] It is in the male's best interest to encourage oviposition because rival sperm can displace his own within a 24-hour period.[2] This study aimed to determine how these contrasting copulatory behaviours impact oviposition.



Results

S. striolatum released more eggs than *O. coerulescens* due to the increased number of successful dipping actions. There was clear contrast in the amount of time males investment in the oviposition phase. Furthermore, we found the **headbutt prompt** was commonly used by *O. coerulescens.* 70% of the males used this behaviour to end **PCR** and coax oviposition. Significant corelation was observed in the amount of oviposition dips exhibited in relation to increased headbutt prompts.

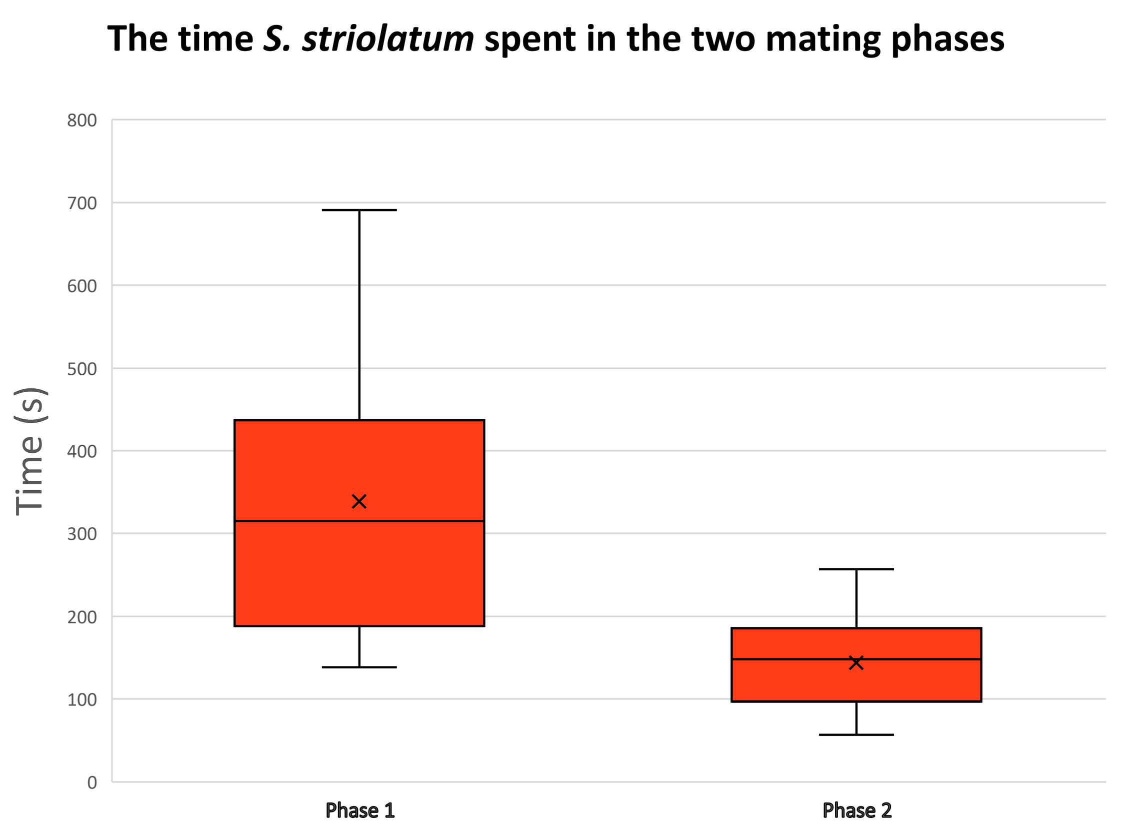


Figure 1. Box and whisker plot representing *S. striolatum* two mating phases. Phase 1 - n = 8, p<.001 Phase 2 – n = 14, p<.01.

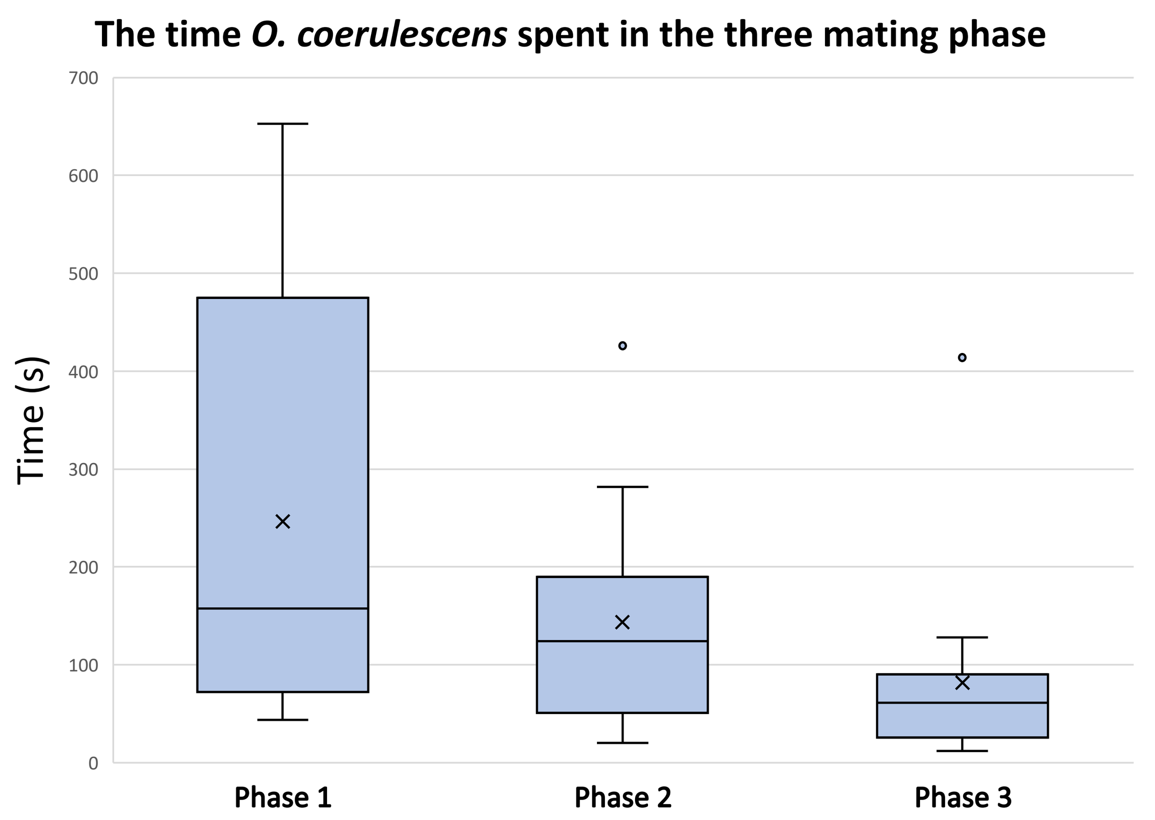


Figure 2. Box and whisker plot representing *O. coerulescens* three mating phases. Phase 1 – n = 18, p<.001. Phase 2 – n = 20, p<.014. Phase 3 – n = 16, p<.001.

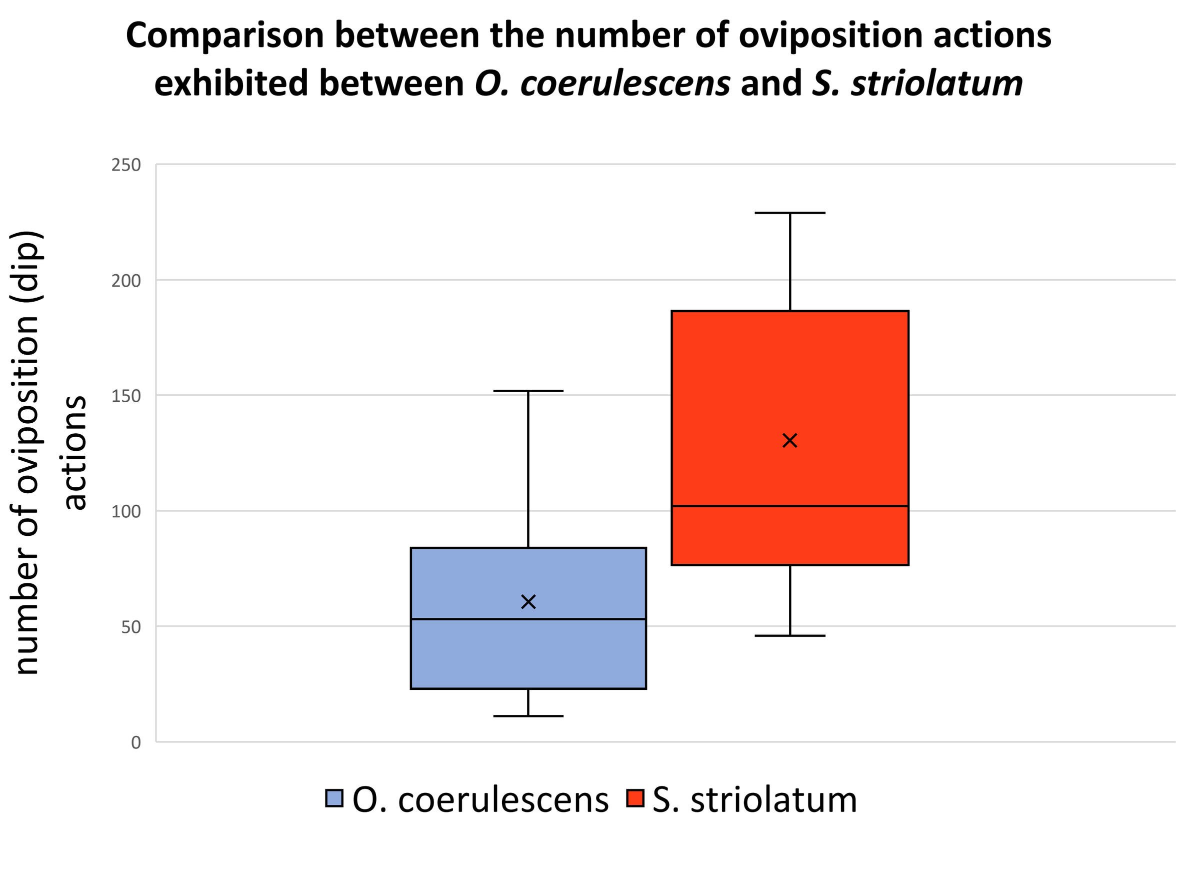


Figure 3. Box and whisker plot representing the number oviposition actions exhibited by *O. coerulescens* and *S. striolatum. O. coerulescens* n = 11, *S. striolatum* n = 13. No mathematical significance between species p>.42.

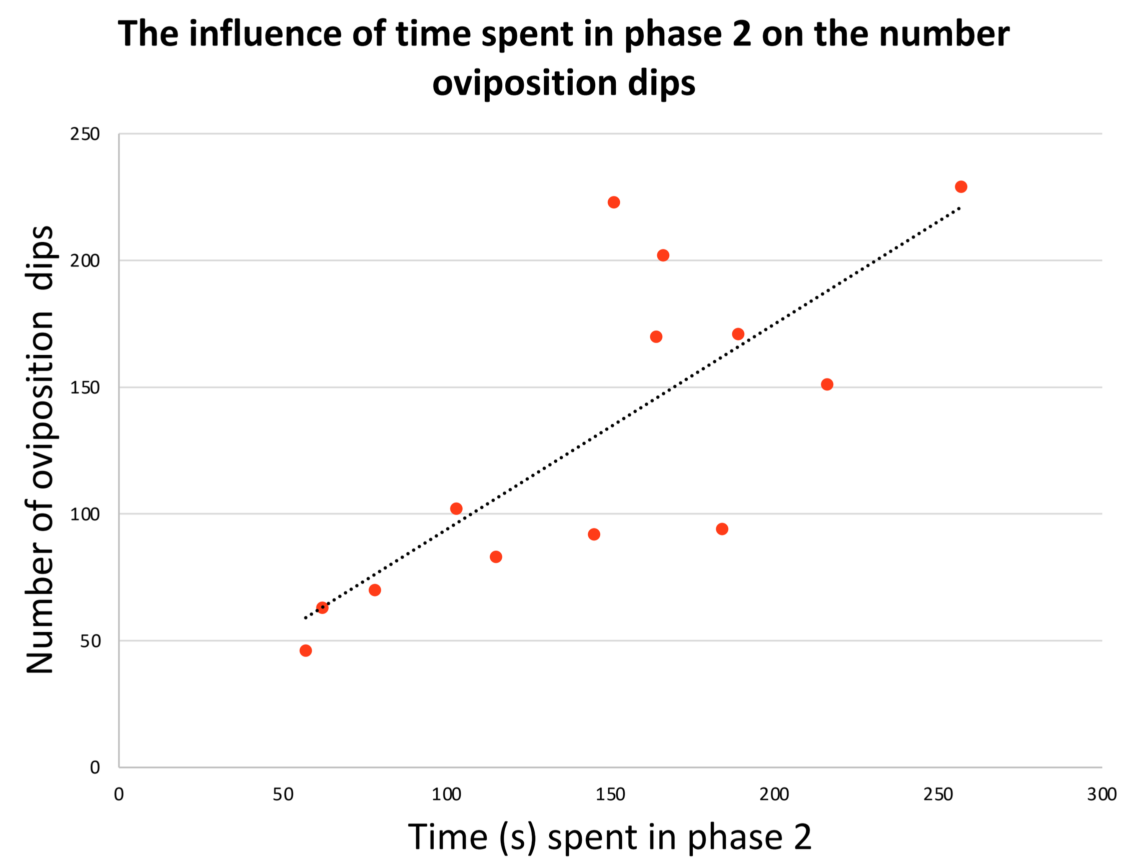


Figure 4: Scatter plot representing statistically significant corelation between increased time in phase 2 on the number of increased oviposition actions. N = 13, p<.01.

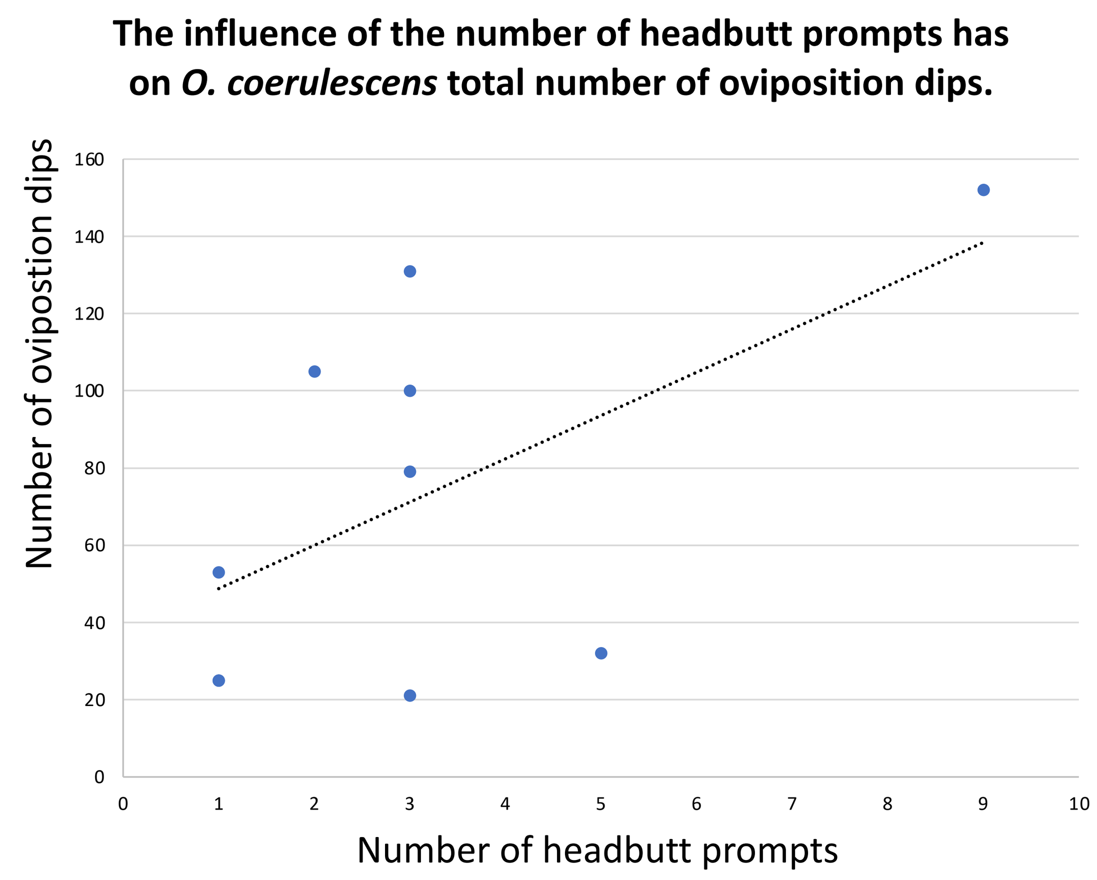


Figure 5: Scatterplot represents mathematically significant corelation between the number of headbutt prompts on the amount of oviposition dips exhibited n = 9, p<.02.

Discussion

The headbutt prompt, exhibited by *O. coerulescens,* was previously documented by Miller, (1989) to end PCR. However, under our observation males exhibited the **HBP** used to end **PCR**, control females during oviposition, prompt female dipping and select oviposition area. Males which exhibit the **HBP** and invest more time in one female may be more reproductively successful than those seeking multiple mates. However, there appears to be a trade-off between interpersonal interactions with females and time spent deterring any outside influence such as rival males.[8] *S. striolatum* which control female dipping were observed performing an increased number of dips while in tandem when compared to females exhibiting non-contact dipping.[9] This behaviour is energetically costly for males. However, this behaviour appears to reduce the risk of losing females to rival males and ensures reproductive success.[9]

Reference list

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[5] **Wickman & Rutowski (1999)** *Oikos* **84(3):** 463.
[6] **Tillyard (1917)** The biology of dragonflies **11:** 212-229.
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[8] **Moore (1964)** *The Journal of Animal Ecology*, **33(1):** 49.
[9] **Convey (1989)** *Animal Behaviour* **37:** 56–63.
[10] **Image:** *Odonata.* Credit: **Eryk Jakubiak.**

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