Behavioural changes in *Bolitotherus cornutus* after insemination

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Introduction

Many insects exhibit behavioural changes before and after copulation. Studies have shown changes in social environment preference, remating interval, and changes in their circadian rhythms. It has been demonstrated that there are differences in these behavioural change between the sexes. Most studies examining post-copulatory behavioural changes have been conducted in a laboratory setting where there are limited choices for behaviour.

This study examined possible changes in the forked fungus beetles' *(Bolitotherus cornutus)* behaviour before and after guarding (guarding is a reliable indicator of recent copulation). *B.cornutus* also remain mostly on one log for the entirety of the breeding season, which means that a beetle's behaviour can be compared across time.

We compared five behaviours before and after insemination:

1. Activity (measured by number of observations)
2. Number of female partners.
3. Number of male partners.
4. Number of courtships
5. Number of unique brackets occupied

Methods

Data Collection:

We observed 9 *B.cornutus* populations in the wild in south western Virginia twice a day for two months. We recorded which beetles we saw, their location (which fungal bracket), who they were with, and their behaviour.
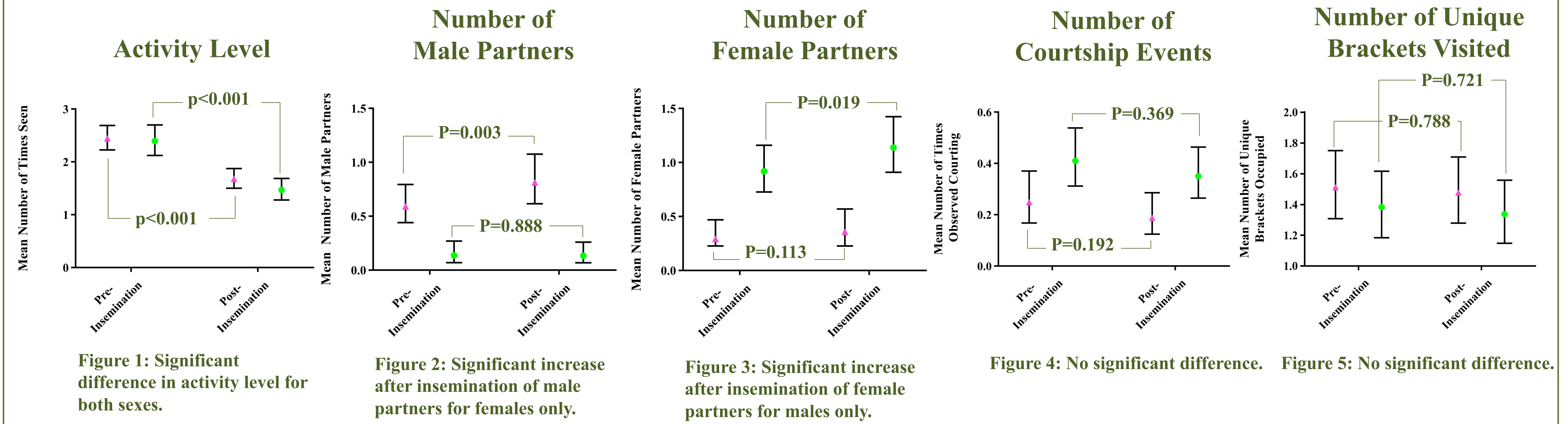
Data Analysis:

•Each behaviour and sex was analysed separately. We compared the behaviours the individuals expressed 96 hours before to 96 hours after an observed copulation. We used a generalized linear mixed model using the lme package (Bates et al. 2014) in R (R Core Team. 2014). For the models including the number of partners we also included the number of times an individual was observed as a covariate.

• Dependent variable: The five behaviours

•Independent variable: pre/post insemination.

•Random effects: individual ID and population.

Results

Key: Green Circles = Males
Pink Triangles = Females

Results showing the difference in behaviour levels before and after insemination between males and females. Error bars represent a 95% confidence interval from the full GLMM.

Figure 1: Significant difference in activity level for both sexes.

Figure 2: Significant increase after insemination of male partners for females only.

Figure 3: Significant increase after insemination of female partners for males only.

Figure 4: No significant difference.

Figure 5: No significant difference.

Discussion

Our results show that there are some behavioural changes in wild populations of *B.cornutus* and that there is a difference in these behavioural changes between the sexes.

1. Both sexes of beetles reduced the number of periods that they were socially active after guarding.
2. Surprisingly female and male beetles increase the number of partners of the opposite sex in their social environment post-insemination.

We can interpret these results as beetles becoming less active after guarding. Males could be replenishing their spermataphore while the females could be fertilizing her eggs and getting ready for laying.

Both females and males increased the number of the opposite sex in their social environment, but the number of courtships remained the same. Females are not being courted by their male social partners nor are males attempting more courtships.

Future Questions

• What are beetles doing when not present on the fungal brackets? Are there physiological changes occurring during this time?

• Why do beetles increase the number of the opposite sex in their social environments?

• Does the size of the beetle (either the focal beetle or the partner) predict behavioural change?

A) A guarding pair. Guarding is a sign of successful insemination..

B) Beetles courting.
Photo taken by: Zhazira Irgebay.

C) Beetle on a bracket..

Figure 6: Images of beetles in the field.

Literature Cited

Bates D, Maechler M, Bolker B, Walker S. 2014. lme4: Linear mixed-effects models using Eigen and S4. Version 1-1.7. http://CRAN.R-project.org/package=lme4

R Core Team. 2014. R: A language and environment for statistical computing. R Foundation for Statistical Computing. http://www.R-project.org/.

Acknowledgements