Plasticity in Reproduction and Survival under Dynamic Socio-Sexual Environment: Empirical Evidence from *Ephestia kuehniella* Zeller (Lepidoptera: Pyralidae)

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2017
Plasticity in Reproduction and Survival under Dynamic Socio-Sexual Environment: Empirical Evidence from *Ephestia kuehniella* Zeller *(Lepidoptera: Pyralidae)*

A thesis presented in partial fulfillment of the requirements for the degree of

Doctor of Philosophy in Entomology

At

Massey University
Palmerston North
New Zealand

Kambiz Esfandi
2017
Abstract

Using an important pest of stored products, *Ephestia kuehniella* Zeller, I tested a number of theoretical predictions regarding strategies taken by males and females for resource allocations in response to dynamic socio-sexual environment. I demonstrate that males only respond to mean sperm competition levels and euprene sperm are produced both before and after emergence. Lifetime reproductive fitness in males depends on the number of copulations they can achieve, rather than the number of sperm ejaculated in each copulation. Regardless of whether males are exposed to rivals or not during their early adulthood, copulation duration and sperm allocation are not positively correlated, indicating that copulation duration cannot be used as a correct estimate of sperm allocation. Contrary to the previous prediction that males invest more in courting in the presence of rivals, my experiments demonstrate that males allocate more resource to courtship in the presence of additional females, which reduces their lifetime copulation frequency and fecundity. This finding offers a novel explanation for the success of mating disruption strategy using sex pheromones in pest management. Contradicting the previous prediction that females are more promiscuous under a female-biased condition and choosier in a male-biased sex ratio, my results show that perception of additional males makes females more receptive so that they mate more times and fertilise more eggs. Females call more when no additional mates or females are present than when either additional mates or females are present, suggesting that perception of no additional conspecifics by females may trigger them to allocate more energy for calling for further mating opportunities. Although virgin females lay similar numbers of eggs in all treatments, they start oviposition earlier and live shorter in the presence of conspecific males or females, supporting previous predictions that higher reproductive rate may accelerate senescence. Virgin females produce fewer eggs in male-biased than in female-biased sex ratio, suggesting that they reduce reproductive investment during their early life for mating opportunities under male-biased conditions. My studies provide insight into the plasticity in reproduction and survival under dynamic socio-sexual environment for animals with sexual reproduction in general and for this insect in particular.
Acknowledgments

I would like to express my gratitude and appreciation to my chief supervisor, Professor Qiao Wang, for his guidance and unconditional support throughout my research. Qiao taught me how to think out of the box, challenged my critical thinking skills and provided me with the opportunity to develop my independent research skills. I am particularly grateful for his friendship while I was going through one of the hardest stages in my life during which time he patiently listened to me and gave me lifesaving advice.

I would also like to thank my co-supervisor, Dr. Xiong Zhao He, for his valuable time and effort on assisting in data analysis and revising my drafts. Zhao’s thorough knowledge in statistics and programming greatly supported my research. I had the chance to learn the true meaning of the open door policy and down to earth personality while working with him.

I thank Kay Sinclair and Chris Rawlingson for their assistance on E. kuehniella colony establishment and laboratory work. I am very thankful to Denise Stewart for patiently helping with administrative support. Very special thanks to my lovely colleagues, Diwas Khatri, Cecilia Falla, Jana Muller, and Jay Liu. I had one of my best times in my life with them. I would like to thank my best friend Dr. Hossein Ghani Zadeh for being such a great friend who was almost like a brother to me.

I am thankful for the financial support from the Massey University Doctoral Research Scholarship, Helen E Akers Scholarship, and William Hudson Scholarship. I am also grateful to the staff of Massey University Library and IT Service for their help with information access.

I am very thankful to all of my family. Without their support, I could not have achieved anything in my life. My father has always been a role model for me as a hardworking, honest and responsible person. My mother has sacrificed a lot for all of her children. Feeling that her prayers are with me makes me stronger. My beloved sisters have always provided me with unconditional love and support almost like my mother. My elder brother also has been like a father to me, guiding me through the hardest times of my life, and encouraging and supporting me to strive to succeed.

I would like to dedicate my thesis to my beloved family, particularly my parents.
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Figure 6.6 Mean (± SE) daily number of eggs laid by virgin females under different socio-sexual environments. For each category, bars with the same letters are not significantly different (P > 0.05).

Figure 6.7 Number of eggs laid per day by virgin females after emergence in relation to age, under different socio-sexual environments. CONT: 
Eggs = exp (– 4.330 + 0.8109Age – 0.0251Age²) (R² = 0.3504, F2,254 = 68.50, P < 0.0001); +F: Eggs = exp (– 0.517 + 0.4657Age – 0.0194Age²) (R² = 0.1513, F2,190 = 17.18, P < 0.0001); +M: 
Eggs = exp (– 2.550 + 0.8212Age – 0.0331Age²) (R² = 0.3147, F2,199 = 45.69, P < 0.0001).

Figure 6.8 Survival of virgin females under different socio-sexual environments. Lines with the same letters are not significantly different (P > 0.05).