Reproductive behaviour of *Aphidius ervi* Haliday (Hymenoptera: Aphidiidae)

a thesis presented in partial fulfiment of the requirements for the degree of

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This is to certify that the research carried out in the Doctoral thesis entitled "Reproductive behaviour of *Aphidius ervi* Haliday (Hymenoptera: Aphidiidae)" in the Institute of Natural Resources at Massey University, New Zealand:

(a) is the original work of the candidate, except as indicated by the appropriate attribution in the text and/or in the Acknowledgements;
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CANDIDATE'S DECLARATION

This is to certify that the research carried out in the Doctoral thesis entitled "Reproductive behaviour of *Aphidius ervi* Haliday (Hymenoptera: Aphidiidae)" is my own work and that the thesis material has not been used in part or in whole for any other qualification.

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SUPERVISOR'S DECLARATION

This is to certify that the research carried out in the Doctoral thesis entitled "Reproductive behaviour of *Aphidius ervi* Haliday (Hymenoptera: Aphidiidae)" was done by Xiong Zhao He in the Institute of Natural Resources, Massey University, Palmerston North, New Zealand. This thesis material has not been used in part or in whole for any other qualification, and I confirm that the candidate has pursued the course of study in accordance with the requirements of the Massey University regulations.

Prof. Qiao Wang

28 August 2008

Abstract

Aphidius ervi Haliday is a cosmopolitan parasitoid species of several major aphid pests on economically important crops. Prior to this research, little information was available on its reproductive behaviour. Emergence of *A. ervi* peaks during the first few hours of the photophase with males being protandrous. Females become sexually mature earlier than males and oviposit primarily in the photophase. Aphids parasitised in their early instars die before reproduction but those parasitised in later instars produce a limited number of progeny. Females prefer aphids of 3- to 5-d-old over the younger and older aphids for oviposition. Females ovipositing in 4- to 7-d-old aphids have more fitness gains in terms of progeny body size and egg load at emergence. Fertilised eggs are more likely deposited in large hosts and unfertilised eggs in small ones. Large individuals have greater longevity, large males father more progeny, and large females have higher fecundity, parasitism and greater ability in host searching. However, with increasing body size females gain more than males in longevity and fecundity but males gain more than females in the number of female progeny. Males can inseminate up to nine females and they carry about 82% effective sperm at emergence and replenish about 18% sperm during their adult life. Females adjust the oviposition and sex allocation strategies in response to increasing host density with higher number of aphids parasitised at higher host densities and lower proportion of female progeny produced at lower host densities. Males play an active role in mating behaviour. Males having mating experience, and being large or younger, respond to females more quickly and perform better courtships resulting in higher mating success. Males prefer larger and younger females for mating probably because the latter have greater reproductive potential. Males optimize the use of their sperm based on the availability of their sperm and the reproductive status (age) of females. The switching-off of female receptivity of male mating attempt after the mating is a gradual process. Some females accept the second males within 1 minute since the termination of the first mating. The shorter mating period in the second mating suggests that females remate probably due to the gradual process of switching-off of female receptivity rather than the insufficient sperm transformation during the first mating. Males prolong their mating duration in male-biased operational sex ratio to reduce the probability of female remating.

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This thesis is dedicated

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