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TITLE PAGE

Dynamics of Salticid-Ant Mimicry Systems

Thesis submitted by

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in March 2006

for the degree of Doctor of Philosophy
in Zoology and Tropical Ecology
within the School of Tropical Biology
James Cook University

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F. Sara Ceccarelli

ABSTRACT

Mimicry in arthropods is seen as an example of evolution by natural selection through predation pressure. The aggressive nature of ants, and their possession of noxious chemicals, stings and strong mandibles make them unfavourable prey for many animals. The resemblance of a similar-sized arthropod to an ant can therefore also protect the mimic from predation. *Myrmarachne* is an ant-mimicking salticid spider genus, whose species associate closely with their model ant species. The behavioural reactions of *Myrmarachne* to ants were analysed, including instances when there was contact between the spider and the ant. In Townsville the salticid *Cosmophasis bitaeniata* and one *Myrmarachne* species associate with *Oecophylla smaragdina* workers. The *Myrmarachne* mimics the ant visually, and *Cosmophasis bitaeniata* mimics the cuticular hydrocarbons of the *O. smaragdina* worker ants. *Cosmophasis* and *Myrmarachne* also mimic ants through certain types of behaviour, such as the “antennal illusion” and bobbing the opisthosoma up and down. The behaviour of both salticids to *O. smaragdina* was compared. This *Myrmarachne* was also studied with a hemipteran mimic of *O. smaragdina*, *Riptortus serripes*, to see whether the salticid could discriminate between the potentially dangerous ant and its hemipteran mimic. The history of the evolutionary dynamics between *Myrmarachne* and the model ant species were studied by analysing molecular phylogenies of the two animal taxa.

In a confined space, *Myrmarachne* species displayed versatile reactions to sympatric ants that depended on factors such as the position of the ant and the distance between the *Myrmarachne* and the ant. *Myrmarachne* also show interspecific differences in their reactions to ants. All *Myrmarachne* species avoided contact with the ants whenever

possible. Even when there was contact between the two, *Myrmarachne* managed to avoid being attacked by the ant. *Cosmophasis bitaeniata* also avoids contact with ants. *C. bitaeniata* and *Myrmarachne* had the same reaction types to ants, but actions occurred at different frequencies. Overall, there were more similarities than differences between the ways these two salticids interacted with *O. smaragdina* worker ants, even though *Myrmarachne* and *C. bitaeniata* have different methods of mimicking the ants. As for the types of behavioural mimicry, there was a significant difference between *Myrmarachne* species, as well as between the two salticid genera. When *Myrmarachne* was presented with another morphological ant mimic (the alydiid bug *Riptortus serripes*), the spiders' reactions differed from those displayed towards the ants. These differences indicate that *Myrmarachne* can distinguish the ant and the bug using visual cues (perhaps through the structure of the mouthparts, or the way the two insects move around). So behaviourally, *Myrmarachne* is a versatile genus apparently under strong selection pressure and showing a high rate of differentiation and speciation. The phylogenetic study also reflects strong selection pressure, resulting in highly polymorphic species. *Myrmarachne* species have undergone adaptive radiation and speciation as they evolved towards resembling their different model ant species. Therefore the behavioural and evolutionary dynamics of these salticids and their model ants represents a case of plasticity and versatility by the salticids.

ACKNOWLEDGEMENTS

I am grateful to a number of people for their help and support throughout the past three years. First of all I would like to thank my supervisors Richard Rowe and Ross Crozier for their help and guidance throughout my PhD candidature. I would also like to thank Robert Jackson for his encouragement and input on spider-related topics.

For their help in the lab, I am very grateful to Ching Crozier and other people in the Crozier lab. I am also grateful to Simon Robson for bringing back *Myrmarachne* from his field-trips, and to Nicola Peterson for filming the spiders. I would like to thank Sue Reilly for her help with the compound microscope, and Chris Alexander for his help with the Scanning Electron Microscope. I would also like to thank Robert Raven from the Queensland Museum and Michael Rix for their help with *Myrmarachne* taxonomy, Owen Seeman from the Queensland Museum and Graham Milledge from the Australian Museum for access to *Myrmarachne* collections, and Chris Burwell and Rudy Kohout for identifying the ants I have worked with. I am also grateful to Mike Charleston for his help with the program TreeMap. I also wish to thank the two examiners, Simon Pollard and Wayne Maddison for their comments on the thesis.

My Gratitude of course also goes out to my family and friends near and far: [REDACTED]

[REDACTED]

[REDACTED] and all the other friends and relatives all over the world.

Thank you all so much for giving me the love and support I needed!

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STATEMENT ON SOURCES

DECLARATION

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

F. Sara Ceccarelli

RESEARCH QUESTIONS

Mimics are animals that live in sympatry with their models, either to gain protection from predators or to take advantage of their models. In the case of ant-mimicking salticid spiders, the close association means that the spiders are in danger of being attacked by the ants. This raises several questions about the dynamics of salticid-ant mimicry systems, such as:

- Given the fact that ant-associating salticids are preyed upon less frequently than other salticids, are there behaviours and reactions by the ant-associating salticids towards the ants allowing for a safer association between the two?
- And how much do these behaviours and reactions vary between species of one genus, as well as between genera of salticids displaying different types of ant-mimicry?
- Are these ant-mimicking salticids able to recognise ants by distinguishing between the potentially dangerous ants and other (harmless) ant-mimicking arthropods?
- And given the strong selection pressure on ant-mimics exerted by the ants and potential predators, how have these ant-mimics evolved with regards to their model ants, and how has the behaviour of ant-mimics been affected by these pressures?