# BARLEY ALLELOCHEMICALS AS SELF DEFENCE PROPERTIES AGAINST VERTEBRATE ANIMALS

A thesis submitted for the degree of
Master of Rural Science
of the University of New England

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March 1996

# Declaration

*I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree.*

*I certify that to the best of my knowledge any help received in preparing this thesis, and all source used, have been acknowledged in this thesis.*

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March 25, 1996

# Acknowledgments

First of all, I gratefully appreciate my academic supervisors Prof. John V. Lovett and Dr. Juliet R. Roberts for their patient, friendly guidance, never-ending encouragement and, particularly, their assistance in English language usage.

I also express my deep gratitude to Mrs. Anne H. C. Hoult, Mr. Walter Redlich and Mr. Dan Alter for their technical assistance in the laboratory analyses of gramine and hordenine; Mr. Grahame Chaffey, Ms. Jo Andrews, Mr. Suratman, Mr. Asril and Mr. Chalid Thalib for their help in tissue collection; Mr. John Smallshaw and all staff of the UNE Animal House for their kind assistance during all my animal house work; Ms. Annette McLeod and Ms. Isabelle Coulon for their assistance in histological techniques; Ms. Shirley Dawson (Media Resources Unit, UNE) for her guidance with the micrographs of liver tissues.

My sincere thanks also go to Dr. Bob Hamilton of Agriculture Canada for his assistance with reading materials. I also wish to thank Mr. Dahlanuddin of the Department of Animal Science for his assistance with statistical analysis and word processing; Department of Agronomy and Soil Science; Department of Physiology and my colleague postgraduate students in both departments for being helpful and friendly; all Indonesian friends in Armidale for providing a family-like environment.

Finally, I must acknowledge that my study would not have been possible without a study grant from the Australian Agency for International Development (AusAID), formerly known as AIDAB, and permission from the Indonesian government. All personal support and assistance from AusAID's staff, particularly Mrs. Sheila Soebroto (Jakarta office), Mr. Bruce O'Brien and Mr. Maris Veidelis (Sydney office), both during my preparation in Indonesia and during my study in Australia, was very much appreciated.

# Summary

Plant secondary metabo ites have been demonstrated to act as self defence agents against other species. Allelochemicals found in barley, gramine and hordenine, have similar effects on other plants, fungi, bacteria and insects (invertebrates). However, there has been a lacl: of evidence for barley allelopathy as a self defence mechanism against vertebrate an mals.

Four experiments were carried out to study the effects of the secondary metabolites of barley, gramine a id hordenine, on the growth of two vertebrate species (laboratory mice and broiler chickens). The objectives of the study were to provide information on the potential valiie of these metabolites in self defence of barley against vertebrate pests. All experiments were conducted at the Animal House of the University of New England, Armidale, NSW. Water and feed were provided *ad libitum*. There were two diffierent levels, 50 and 500 ppm, of both gramine and hordenine which were incorporated into the feed of the treatment groups.

The first experiment was designed to assess any possible adverse effects of both alkaloids on mice. Laboratory mice were given feeding choice between standard laboratory feed and alkaloid-containing feed. In the second and third experiments, animals (both mice and broiler chickens) were not given feeding choice but were provided with different concentrations of either gramine or hordenine in feed. The last experiment studied possible synergistic effects of the two alkaloids, gramine and hordenine, on broiler chickens.

Overall, the treatments did not significantly affect the growth of mice and chickens. However, gramine 500 ppm in feed significantly reduced feed intake in mice. Small quantities of both gramine and hordenine were recovered from the livers of both animal species through High Performance Liquid Chromatography (HPLC) analysis. However, when mice were given feeding choice, the recovered gramine and hordenine

were detected from high level treatments (500 ppm) only. The amount of alkaloid recovered was associated with the concentration given in feed.

The main finding of the present study is that gramine had more effects than hordenine on the animals tested. A high concentration (500 ppm) of either gramine or hordenine was sufficient to induce changes in liver structure of the chickens. These changes were indicated by cell vacuolation even though they were not necessarily associated with reduced feed intake or growth rate of the animals. The changes are congruent with damage observed in cells of other species exposed to secondary metabolites.

Broiler chickens provided a better model for this study than did laboratory mice. Broiler chickens have a very fast growth rate and are able to seek food immediately after hatch. However, laboratory mice cannot be weaned until three weeks after birth and have attained a significant proportion (up to 80%) of their adult body weight by the time they are introduced to the experimental feeds. Therefore, the effects of allelochemicals on feed intake and growth rate in vertebrates are more likely to be demonstrated in broiler chickens than in mice.

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