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**FACTORS INFLUENCING HOST FINDING
BEHAVIOUR OF HESSIAN FLY**

A thesis presented in partial
fulfilment of the requirements
for the degree
of Doctorate of Philosophy
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Dedicated in loving memory to Donna Louise Beresford,
Marine Biologist

26/ 2/ 1966 - 2/ 7/ 1994

My best friend, confidante and soul-sister.
Without her inspiration and encouragement,
I would never have begun this research.

*Taken from us by the ocean
in which she loved to work and play.*

Abstract

The influence of environmental and plant variables on the behaviour of female Hessian flies (*Mayetiola destructor* Say) during oviposition were investigated. Female behaviour was observed with respect to different spatial and plant variables in a large arena in a greenhouse. The distance between patches of wheat (*Triticum aestivum* L.) plants and the number of plants in patches did not influence the allocation of time to flight, examining and oviposition behaviours on plants, or time spent in a patch and the numbers of eggs laid there. Females did alter their behaviour by partitioning time differently within large versus small patches. When the ratio of wheat to non-host plants, oat (*Avena sativa* L.) was altered, females spent more time and laid more eggs on wheat, despite non-selective alighting.

Influences of wind and plant stimuli on flight and egg-laying decisions were studied in a wind tunnel. As wind speed increased, the time spent on wheat and oat plants before leaving increased and the number of oviposition bouts on the plant increased proportionately. Observed flights showed females losing control of flight direction and less able to reach plants in winds over 0.9 m/s. Under such conditions, females moved in a down-wind direction in the wind tunnel.

The consequences of egg clutch size for a female offspring were studied by manipulating egg clutches on individual plants. Mortality increased and offspring size decreased with increasing clutch size. As adult body size is proportional to fecundity in female Hessian fly, females maximise reproductive fitness by laying small clutches. However, if adult females do not survive to lay all their eggs, reproductive fitness may be increased by laying larger clutches. These different oviposition strategies are visible in female behaviour under differing environmental conditions.

A study of the movement of female Hessian flies in small field plots extended and verified results from lab-based studies. Females moved faster through an area of plants than was predicted by random diffusion models. The percentage of females recaptured from circular arrays of wheat or oat plants using a D-Vac insect sampler decreased as the time since release into a central patch increased. Recapture rates were lower in non-host compared to host plant arrays. Results suggest that female Hessian flies can readily move considerable distances in the field, and if eclosing in a non-host field habitat, will move extensively in search of host plants.

The degree to which spring wheat crops in New Zealand are presently under threat from Hessian fly was ascertained through a field survey. Some areas of mid and south Canterbury showed high pupal numbers. All cultivars presently sown in New Zealand appeared to be susceptible to feeding by Hessian fly larvae.

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COMMENT ON BIBLIOGRAPHIC STYLE

The bibliographic style of chapters 1 through 5 of this thesis conform to those required by the Journal of Ecological Entomology, produced by the Royal Entomological Society. In the case of chapter 6, the style conforms to the requirements of the New Zealand Plant Protection Society Proceedings in which it is published.