A THESIS

entitled

SUSCEPTIBILITY AND RESISTANCE OF TWO VARIETIES OF RICE, IR 8 AND WARANGAL 1263, TO ATTACK BY THE GALL MIDGE, *PACHYDIPLOSIS ORYZAE* (WOOD-MASON) (DIPTERA: CECIDOMYIIDAE)

presented by

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SYNOPSIS

The two varieties of rice studied are IR 8 and Warangal 1263 (W 1263). When IR 8 is attacked by P. oryzae almost all the plants develop galls, but in the case of the W 1263 plants used for this work only about 50% of the plants develop galls.

The larvae of P. oryzae feed at the shoot apex. Feeding arrests the normal growth and differentiation of the growth cone, leading to the formation of a gall because of abnormal growth of the sheath of the youngest leaf primordium. Plants with galls do not develop panicles, and this results in losses in yield.

Rice seedlings of the two varieties were grown from seed in the laboratory. Infestation of the seedlings with P. oryzae was carried out by caging 10-13 days old seedlings with gravid adult females. The seedlings were then kept in a humidity chamber to allow hatching of the eggs laid on the leaves, and migration of the larvae to the sites of feeding.

20-30 plants of each variety were examined daily and the eggs, larvae, pupae and galls on each plant were counted. There are three larval stages, and a prepupal stage. The lengths of the larvae, pupae and galls were measured.

There was no significant difference between the two varieties in the number of eggs laid on the leaves, in the time taken for their hatching, in the number of larvae reaching the terminal and axillary apices and in larval activity. In the susceptible plants of both varieties the first instar to second instar transformation occurred 9-10 days after infestation. On about 50% of the W 1263 plants the first-instar larvae do not transform into the next stage. The mean length of these untransformed larvae were significantly different from that of the first-instar larvae (on both varieties) which moult at the usual time, namely 9-10 days after infestation. The lengths of the second-instar larvae, third-instar larvae, pupae and galls were not significantly different on the two varieties.

In order to calculate the rates of mortality, the logarithm of the number of insects in each stage plus the number of insects in subsequent stages (accumulated totals) was plotted against days after infestation. It was found that mortality rates could be calculated for successive pairs of developmental stages (say, first-and second-instar larvae) from the slope in that part of the graph where the numbers of individuals of other stages (in this example, eggs and third-instar larvae) were zero or negligible. However, in the case of pupae,

the mortality rates of pupae only could be calculated in this way. Therefore, the rates of mortality for every other stage could be obtained by difference.

Similarly, the plot of the logarithm of the numbers of individuals in each stage alone (non-accumulated totals) against days after infestation allowed the calculation of the rates of mortality, plus the rates of transformation of each stage into the next stage. Therefore the rates of transformation for each stage could be obtained by difference.

A high mortality (about 20% per day) was observed only in the case of the first-instar larvae on both varieties of plants. In the case of the second- and third-instar larvae and pupae on both IR 8 and W 1263 the mortality was negligible. The rate of transformation of the first to second instar, on those W 1263 plants which allowed this transformation, was significantly lower than the rate of transformation of the first instars in the IR 8 plants. The rates of transformation between the subsequent stages on these W 1263 plants were also lower than those between the same stages on IR 8.

From these studies it emerged that on resistant

W 1263 plants first-instar larvae do not moult into second-instar larvae. These inhibited larvae linger on for about 22 days before they die.

Since the first to second instar moult is inhibited it was thought that the hormones in the insect regulating growth and metamorphosis might be involved. Moulting hormone is a sterol and since in general insects cannot synthesise sterols they have to obtain sterols from their diet and modify them. Therefore the shoot apex extracts of the two varieties were analysed for sterol content using thin layer chromatography.

Of the spots given by each extract, one sterol spot from the IR 8 extract was consistently more intense than the corresponding spot from the W 1263 extract. A further quantitative colorimetric analysis was carried out with shoot apex extracts, but no difference in total sterol content in the shoot apices of the two varieties was detected.