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EFFECTS OF HYDROXAMIC ACIDS ON THE RESISTANCE OF WHEAT TO THE APHID SITOBION AVENAE

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1. Introduction

Sitobion avenae F. is a sporadically damaging pest of wheat in temperate climates. Wheat extracts contain hydroxamic acids (Hx) which have ben shown to be important in resistance against insects in several Gramineae (Niemeyer & Perez, this symposium). The most abundant of these acids in wheat is 2, 4 - dihydroxy - 7- methoxy - 1, 4 - benzoxazin - 3 - one (DIMBOA). This compound has also been shown to be involved in the resistance of several wheat cultivars to a number of aphid species but resitance to **S. avenae** has not been investigated in the same context.

The main objective of this investigation was to assess a range of wheat cultivars, previously assessed for hydroxamic acid levels, in order to measure and rank them for antibiotic and antixenotic (non-preference) resitance to **S. avenae**.

2. Materials and methods

Seed samples of six wheat cultivars representing a range of known Hx levels were grown under permanent light at c.26°C with a 10°C range in a glasshouse at the University of Chile, and harvested at the two-leaf stage (G.S. 12; Zadoks). The Hx content of the tissue was estimated using a method based on the formation of a blue complex with ferric chloride solution (Bohidar et al., 1986).

For assessment of aphid performance at Southampton, seeds of the same cultivars were grown in conditions similar to the above. They were transferred after c.5 days to a culture room and kept at 20°C with a 2°C range, 60-70% r.h. and 16 h photoperiod.

Stock cultures of **S. avenae** were clonal, and were maintained on wheat (cv. Hobbit) in the culture room under the above conditions. Adult apterous viviparae of unknown age were placed individually on the test seedlings (30 of each cultivar) which were at the two-leaf stage; these were then covered with transparent plastic cylinders 30 cm high with a Terylene mesh top. These aphids were left for 24 h to reproduce and then removed together with all but two first-instar nymphs. The latter were left undisturbed until they moulted to the adult stage, but were checked daily during this period. One was then removed and the daily fecundity of the remaining singly-caged aphids (up to 30 on each cultivar) was recorded for 10 days. Progeny of these were removed daily, using a fine paint brush, during the same 2 h period per day.

The intrinsic rate of natural increase (r_m) was then calculated (Bohidar et al., 1986).

3. Results and discussion

Estimates of r_m were calculated at daily intervals. On all cultivars, nymph production during the first few days of reproduction contributed most to the value of r_m, a pattern similar, to those found for other aphid species. Values of r_m based on 10 days'recording were used in subsequent analysis.

There was a highly-significant negative relationship between the r_m value achieved on the cultivars and the concentration of hydroxamic acids in their tissues; the proportion of the variation in r_m values explained by acid levels was up to 96% depending on whether the variables were arithmetic or one, or both variables, were logarithmically transformed. The confidence limits for r_m were very low.

Of the components fo r_m, mortality did not begin on any cultivar until 16 days after birth; this was well after the highest daily fecundity had been reached (8-12 days after birth). This pattern agrees with that found by Frazer (1972) for two aphid species on **Vicia faba** L. cultivars. In addition to the correlation shown using logarithmically transformed variables, the age of the aphids at the time of the peak in age-specific fecundity was positively related to acid levels ($\log y=2.17 + 0.17 \log x$; $P<0.05$ $r=0.86$).

This preliminary investigation has revealed that hydroxamic acids appear to play a major role in seedling resistance to **Sitobion avenae.** Recent work has involved the study of antixenosis (non-preference) but no evidence has been found of any correlation between antixenosis and Hx content. We are now screening a wide genetic range of material for aphid resistance and hydroxamic acid content at seedling stage. Preliminary analysis by Niemeyer and Perez (this symposium) has shown extreme values of hydroxamic acid concentration are to be found in wild diploid species: highest in **Aegilops speltoides** and lowest in **A. squarrosa.** Modern polyploid wheats sharing a common genome had relatively uniform and low values. The ancient diploid species **Triticum monococcum** also had low levels. These results suggest that genomes B and G produce the wheats with high Hx concentrations. The genome D present in modern hexaploids may also have a suppresor affect. It is hoped that the wide genetic screen may reveal promising material suitable for incorporation into a plant breeding programme.

References

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