VISUAL BEHAVIOUR OF THE WHITEFLY *TRIALEURODES VAPORARIORUM* (WESTWOOD) (HOMOPTERA : ALEYRODIDAE)

by

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March 1981

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SUMMARY

The greenhouse whitefly *Trialeurodes vaporariorum* is a pest of glasshouse crops and ornamentals and is of world-wide distribution. Previous studies on selection of food-plants by this insect have indicated that the initial processes were probably governed by visual stimuli, particularly colour, but the results are difficult to interpret because the role of ultra-violet light has been neglected and the intensities and spectral composition of the visual stimuli were not sufficiently controlled. For these reasons this project examined several aspects of the visual behaviour of the whitefly with particular emphasis on wavelength specific behaviour and colour vision.

A spectral efficiency function of "slow" phototaxis showed a peak at 400nm which contrasted with a spectral efficiency function published previously, which peaked at 550nm, and closely followed the transmission spectrum of a tobacco leaf (a favourable food-plant). This difference was explained by an examination of other aspects of behaviour, namely, flight, landing, take-off and walking behaviour at two standard wavelengths (400nm and 550nm) at a fixed quantum flux level. "Slow" phototaxis, when compared with other responses measured previously, had a different spectral efficiency curve, probably because it is composed of a different set of behavioural responses with different spectral sensitivities. Whiteflies walked faster towards the 400nm monochromatic light, oriented towards the 400nm light and took off more readily when illuminated by the 400nm light. Thus "slow" phototaxis was greater towards 400nm because this response mainly consisted of walking behaviour, whereas other

responses measured previously were composed of flight, landing and take-off behaviour. A "fall reflex", which is probably a prelude to landing, occurred in response to 550nm but not to 400nm.

A "settling" response paradigm was developed which involved the same sorts of behavioural responses involved in food-plant selection, namely, landing after a short flight. Intensity response curves had different shapes at different wavelengths, which indicated that the whiteflies were probably exhibiting wavelength specific behaviour. This was verified by modifying the behavioural paradigm to favour flight towards an illuminated surface. This measure had a different spectral sensitivity and consequently the original "settling" response paradigm measured at least two different behavioural patterns with differing spectral sensitivities.

Conditioning the whiteflies to visual stimuli using shaking as an aversive conditioning stimulus was not successful. However, using the same method, which probably measured "fast" phototaxis and involved measuring the number of insects in the illuminated half of a cylindrical container, the whiteflies clearly exhibited wavelength specific behaviour. Intensity response curves had different signs above threshold. There were no colour contrast effects and whiteflies presented with a constant high intensity of 400nm light on one side of the container and various intensities of 550nm light on the same and/or opposite side of the container, behaved as if there were no interactions of photoreceptor outputs in the central nervous system. Thus there was no evidence for colour vision at least for that particular behavioural paradigm. The "fast" phototactic paradigm at 400nm and 550nm probably measured different and antagonistic behavioural patterns.

The compound eye of *T. vaporariorum* is divided into two halves, a ventral half and a dorsal half. The ventral half has yellow corneal filters arranged in a hexagonal pattern around a clear facet, whereas the dorsal half has clear facets. The possible role of these structures is discussed.