MEASUREMENT OF SEX PHEROMONE IN ORCHARD AIR USING ELECTROANTENNOGRAM APPARATUS

G. KARG¹, D.M. SUCKLING² and E.R. RUMBO³

¹Univ. of Kaiserslautern D-6570, Kaiserslautern, Germany

²DSIR Plant Protection, Christchurch, New Zealand

³CSIRO Division of Entomology, Canberra, ACT, Australia

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A portable electroantennogram (EAG) system for pheromone detection in the field has been developed in Germany (Sauer *et al* 1990). The equipment uses the insect antennae as the detector and was developed for the moth *Lobesia botrana*, with which it has detected both sex pheromones and host plant volatiles in the field. The equipment has recently been operated in New Zealand and shown to work equally well with *Epiphyas postvittana*.

For use in this equipment, moth antennae were excised from the male moth and, with terminal segments removed from the distal end, placed across a 1.5 x 6 mm opening in a perspex holder between two wells containing Ringer solution. An airstream, filtered by coarse charcoal, was then passed over the antenna by suction through the opening at a rate of 600 ml/min. The potential across the antenna was digitised, after amplification, by an analogue to digital card plugged into a lap-top (386SX) computer and stored on disk. Software in the computer allowed the recorded signal to be processed for features such as response peak heights. A signal baseline was initially established with the charcoal filter in place. On removal of the filter, and in the absence of pheromone, an elevated baseline response due to plant volatiles was detected in both species. In *L. botrana* this signal has been associated with specialised receptor cells distinct from those used to detect pheromone components (Karg *et al* 1990). Responses to pheromone, present in the surrounding air sucked into the equipment were recorded as further excursions from the baseline. The responses were calibrated by injecting pulses of air containing pheromone into the inlet glassware of the system.

A portable EAG has also been developed independently by the CSIRO Division of Entomology in Australia. This instrument, which is still undergoing tests, shares some features with the German apparatus but is distinctly different in others. This apparatus was designed to measure EAGs of *E. postvittana* and *Cydia pomonella*. Detailed information on this instrument is currently not available due to patent considerations.

A recent scientific meeting in Australia enabled the authors of this note to meet and compare the two machines. One aspect of interest was the method of calibration of the EAG response against pheromone concentration. With the German apparatus dose response curves were originally obtained using a stepping-motor driven syringe to inject pulses of equilibrium saturated air produced by solutions of pheromone in oil (*L. botrana*). An alternative method, which is easier to use under field conditions, using impregnated bond papers inside miniature Pasteur pipettes and delivered by pressing a rubber bulb has now been tested on both machines using *E. postvittana*. Sources were prepared by applying 10 µl aliquots of a range of concentrations of E-11-tetradecenyl acetate in cyclohexane onto 2 x 20 mm pieces of high quality bond paper, inserted into the pipettes and allowed to equilibrate for at least 24 hours. A calibration series obtained for *E. postvittana* using the German equipment is shown on Fig 1. This type of dose-response calibration series, which has been normalised to the response at 10-5 (v/v), can be used to calculate relative pheromone concentration in the field. Field responses are normalised with responses to regular pulses from a point on the standard curve. Absolute calibration is also possible, but is not necessary

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for many applications.

It will now be possible to use devices such as these to study the ultra-structure and concentration of pheromone plumes in the field, pheromone transport processes, and other factors affecting the success of mating disruption. To this end the CSIRO apparatus was tested with single and multiple polyethylene pheromone dispensers (Shin-Etsu Chemical Co., Tokyo) designed for disruption of *E. postvittana* (Suckling and Clearwater 1990) (Fig 2). At its current stage of development this system is capable of resolving pheromone concentrations in outdoor air differing by a factor of about 2. This type of portable equipment offers significant new research opportunities for pheromone measurements in ambient air.

Fig. 1: A preliminary calibration curve from a portable electroantennogram from *E. postvittana* exposed to air above paper sources of E-11-tetradecenyl acetate (mean of 5 pulses per concentration), using the apparatus described by Sauer *et al* (1990).

Fig. 2: Relative amplitude of electroantennogram responses of male *E. postvittana* located 2 m downwind from 1, 2 or 4 polyethylene dispensers containing E-11-tetradecenyl acetate and E,E-9,11-tetradecadienyl acetate, using the CSIRO portable electroantennogram apparatus.

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