

(E)-8-Dodecenyl acetate: Major component of the female sex pheromone of a Macadamia nut borer, *Ecdytoplopha torticornis*

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Introduction

Costa Rica is the fourth largest exporter of macadamia nuts, *Macadamia integrifolia* Maiden and Betche (Proteaceae), behind the USA, Australia and Kenya (Rosa & Kirby, 1994). Two thousand five-hundred hectares were planted in 1967 and a further 5000 ha in 1993, principally in the Province of Limon. The nuts are harvested by hand with the peak of production between July and October (Gonzales & Chacon, 1986). Attacks by an unidentified Lepidopterous nut borer began to be reported in macadamia orchards from the late 1980s with damage in isolated areas as high as 30%, although at the time, control with insecticides was not considered necessary (D.J. Chamberlain, unpubl.). Initially, the insect responsible for this damage was thought to have been *Cryptophlebia leucotreta* (Meyrick) (Lepidoptera: Tortricidae: Olethreutinae), a pest of macadamia prevalent in Malawi (La Croix et al., 1985). However, traps baited with lures containing blends of compounds attractive to both *C. leucotreta* (Persoons et al., 1977) and the related *Cryptophlebia batrachopa* (Meyrick) (Hall et al., 1984; La Croix et al., 1985) failed to catch any moths in the macadamia orchards. This paper describes the results of preliminary work undertaken to identify the pest species causing the damage and to develop a pheromone-baited trap for monitoring its population dynamics.

Materials and methods

Insect material

Approximately 100 larvae were collected in late April 1989 from the two main areas of macadamia cultivation in

Costa Rica, viz., Finca Kailua, Siquirres and Finca Oriente, Turrialba, and hand-carried to the Natural Resources Institute, UK. Most of the larvae were either last instar or prepupae, the remaining insects were second and third stadium larvae that were maintained on a diet of macadamia nut kernel until pupation. The majority of the larvae pupated during the 2nd and 3rd week of May 1989. Pupae were removed, sexed, separated, and placed in an incubator set on a L12 : D12 reversed photoperiod, temperature of 27 °C (L), 22 °C (D) and relative humidity of 70% (L), 80% (D). Female moths began to emerge in the last week of May 1989 and male moths a few days later. The period of emergence lasted approximately 3–4 weeks. Pinned male and female moth specimens were dispatched to the International Institute of Entomology, London, UK for identification.

Pheromone collection and analysis

Pheromone gland extracts were prepared from a total of 19 3-day-old, virgin female moths, at 3 and 6 h into the scotophase, by excising everted ovipositor in batches of five pheromone glands into microvials containing heptane (100 µl). After 10 min the supernatant was removed and stored at –20 °C until analysis. Pheromone extracts were analysed by gas chromatography linked to electroantennographic recording (GC-EAG) as described by Cork et al. (1990) and GC linked to mass spectrometry using polar (Carbowax equivalent) and non-polar (Methylsilicone equivalent) capillary columns.

Pheromone dispensers

Pheromone dispensers were prepared from white rubber septa (Sigma-Aldrich Chemical Company, catalogue no. Z10,072–2) using compounds obtained by standard Wittig and acetylenic coupling reactions or purchased from Shin Etsu Chemical Co. (Tokyo, Japan). Compounds used for

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