

## MINOR COMPONENTS IN THE SEX PHEROMONE OF LEGUME PODBORER: *Maruca vitrata* DEVELOPMENT OF AN ATTRACTIVE BLEND

M. C. A. DOWNHAM,<sup>1,\*</sup> D. R. HALL,<sup>1</sup> D. J. CHAMBERLAIN,<sup>1,3</sup>  
A. CORK,<sup>1</sup> D. I. FARMAN,<sup>1</sup> M. TAMÒ,<sup>2</sup> D. DAHOUNTO,<sup>2</sup>  
B. DATINON,<sup>2</sup> and S. ADETONAH<sup>2</sup>

<sup>1</sup>Natural Resources Institute  
University of Greenwich  
Chatham Maritime  
Kent ME4 4TB, United Kingdom

<sup>2</sup>International Institute of Tropical Agriculture  
P.O. Box 08-0932, Cotonou, Benin

<sup>3</sup>Present address: 227 Manwood Road, London SE4 1SF, United Kingdom

(Received December 10, 2001; accepted December 15, 2002)

**Abstract**—The legume podborer, *Maruca vitrata* (syn. *M. testulalis*) (F.) (Lepidoptera: Pyralidae) is a pantropical pest of legume crops. Sex pheromone was collected by gland extraction or trapping of volatiles from virgin female moths originating in India, West Africa, or Taiwan. Analysis by GC-EAG and GC-MS confirmed previously published findings that (*E,E*)-10,12-hexadecadienal is the most abundant EAG-active component with 2–5% of (*E,E*)-10,12-hexadecadienol also present. At least one other EAG response was detected at retention times typical of monounsaturated hexadecenals or tetradecenyl acetates, but neither could be detected by GC-MS. Laboratory wind-tunnel bioassays and a field bioassay of blends of (*E,E*)-10,12-hexadecadienal with (*E,E*)-10,12-hexadecadienol and a range of monounsaturated hexadecenal and tetradecenyl acetate isomers indicated greatest attraction of males was to those including (*E,E*)-10,12-hexadecadienol and (*E*)-10-hexadecenal as minor components. In subsequent trapping experiments in cowpea fields in Benin, traps baited with a three-component blend of (*E,E*)-10,12-hexadecadienal and these two minor components in a 100:5:5 ratio caught significantly more males than traps baited with the major component alone, either two-component blend, or virgin female moths. Further blend optimization experiments did not produce a more attractive blend. No significant differences in catches were found between traps baited with polyethylene vials or rubber septa, or between lures containing 0.01 and 0.1 mg of synthetic pheromone. Significant numbers of female *M. vitrata* moths, up to 50% of total catches, were trapped with synthetic blends but

\* To whom correspondence should be addressed. E-mail: m.c.a.downham@gre.ac.uk

not with virgin females. At present there is no clear explanation for this almost unprecedented finding, but the phenomenon may improve the predictive power of traps for population monitoring.

**Key Words**—*Maruca vitrata*, *Maruca testulalis*, Lepidoptera, Pyralidae, sex pheromone, EAG, wind-tunnel bioassay, field trapping, (*E,E*)-10,12-hexadecadienal, (*E,E*)-10,12-hexadecadienol, (*E*)-10-hexadecenal, *Diaphania indica*.

## INTRODUCTION

The legume podborer, *Maruca vitrata* (syn. *M. testulalis*) (F.) (Lepidoptera: Pyralidae) is a pantropical pest of legume crops, particularly cowpea (Jackai, 1995), pigeonpea (Shanower et al., 1999), and beans (Abate and Ampofo, 1996). The larvae feed on flower buds, flowers, and young pods (Singh and Jackai, 1988). Without control measures, flower infestation rates up to 80% were reported in cowpea in West Africa by Afun et al. (1991), and seed damage rates of 50% by Dreyer et al. (1994).

Although the basic biology of *M. vitrata* has been studied extensively (Taylor, 1967; Singh et al., 1990; Jackai et al., 1990; Onyango and Ochieng-Odero, 1993), there is a lack of information on the behavior and activity of this pest in the field, which has hindered development of IPM strategies in Africa (Jackai, 1995) and Asia (Shanower et al., 1999). Pheromone-baited traps for *M. vitrata* could provide specific devices for monitoring the activity and movements of adults that would assist researchers in this respect. They could also provide simple alternatives to pest scouting by farmers to time application of control measures.

Adati and Tatsuki (1999) reported (*E,E*)-10,12-hexadecadienal (*EE*10,12-16:Ald) to be an EAG-active component in extracts from female *M. vitrata* abdominal tips. Synthetic *EE*10,12-16:Ald was shown to be attractive to male moths in laboratory bioassays at a level equal to that of crude pheromone gland extracts. However, high (99%) isomeric purity was found to be critical to this attraction. The corresponding alcohol, (*E,E*)-10,12-hexadecadienol (*EE*10,12-16:OH), was also noted as being present at 3–4% of the aldehyde. Although no behavioral data were presented in relation to this compound, it was said to produce no increase in attraction when added to the major component. No field testing of the compounds was carried out. In this study we report laboratory and field experiments that confirm *EE*10,12-16:Ald as the major component and extend identification of the blend to include *EE*10,12-16:OH and a third candidate minor component.

## METHODS AND MATERIALS

*Insect Rearing.* *M. vitrata* for laboratory cultures were obtained as pupae from the International Center for Research in the Semi-Arid Tropics (ICRISAT), Hyderabad, India; Tamil Nadu Agricultural University, Coimbatore, India; the