

Solvent extraction of cues in the dust and frass of *Prostephanus truncatus* and analysis of behavioural mechanisms leading to arrestment of the predator *Teretrius nigrescens*

ALEX STEWART-JONES¹, RICK J. HODGES², DUDLEY I. FARMAN² and DAVID R. HALL²

¹School of Biological Sciences, University of Southampton, Southampton, U.K. and ²Natural Resources Institute, University of Greenwich, Chatham Maritime, Chatham, U.K.

Abstract. *Teretrius nigrescens* is a predatory beetle released into Africa for classical biological control of *Prostephanus truncatus*, currently the most serious insect pest of stored maize on the continent. *T. nigrescens* is arrested by the dust and frass produced by *P. truncatus* boring into maize and it has been concluded that this effect is most likely to be caused by chemicals in the dust/frass. A bioassay is presented in which EthoVision software (Noldus Information Technology, the Netherlands) captures and analyses the movement of individual insects within arenas containing zones to which solvent extracts are applied. The results demonstrate that cues enabling adult *T. nigrescens* to discriminate between maize flour and dust/frass are extractable in hexane, methanol and chloroform, but not water. Such discrimination is manifested by an increase in residence time, distance covered and path sinuosity in the dust/frass zone. Analysis of behaviour demonstrates cues that trigger inverse orthokinetic mechanisms contributing to arrestment in adult *T. nigrescens*. An increase in angular velocity would also suggest a direct klinokinetic component, although this parameter could be affected by postulated tropotactic and/or transverse klinotactic and/or longitudinal klinotactic mechanisms occurring at the edge of the application zone. Development of this bioassay, for the first time, permits responses of larval *T. nigrescens* to prey cues to be assessed. The results show that larvae apparently respond to cues extracted from dust/frass in a stronger manner than adults, with significant increases in the same descriptive parameters of time, distance and path sinuosity. However, unlike in the adults, there is no orthokinesis. It is proposed that strong larval response is attributable to either direct klinokinesis and/or tropotaxis interacting with transverse klinotaxis. Observations of larval backtracking at the zone boundary may also indicate longitudinal klinotaxis. The reasons for the differences in the adult and larval response to prey cues are considered, and how the described behavioural mechanisms combine to improve prey foraging is discussed.

Key words. Arrestant, arrestment, Bostrichidae, Histeridae, kairomone, kinesis, kinetic, larva, larvae, predator, *Prostephanus truncatus*, tactic, taxis, *Teretrius nigrescens*.

Introduction

The larger grain borer, *Prostephanus truncatus* (Horn) (Coleoptera: Bostrichidae), is exotic to Africa, having first arrived in the late 1970s from Mesoamerica (Dunstan &

Correspondence: Alex Stewart-Jones, Ecology and Evolutionary Biology, School of Biological Sciences, Bassett Crescent East, Southampton, Hampshire SO16 7PX, U.K. Tel.: +44 (0)2380 594468; fax: +44 (0)2380 594459; e-mail: asj@soton.ac.uk