

An analysis of the fruit-sucking and fruit-piercing moth complex in citrus orchards in South Africa

M. Goddard^{1,2}, M.P. Hill^{1*} & S.D. Moore^{1,2}

¹Centre for Biological Control, Department of Zoology and Entomology, Rhodes University, P.O. Box 94, Grahamstown, 6140 South Africa

²Citrus Research International, P.O. Box 20285, Humewood, 6013 South Africa

Fruit-piercing moths are a sporadic pest of citrus, especially in the Eastern Cape Province of South Africa, where the adults can cause significant damage in outbreak years. However, growers confuse fruit-piercing moths with fruit-sucking moths that do not cause primary damage. In this study we trapped these moths during the 2013–2015 growing seasons. A large number of diverse fruit-feeding moths were collected through weekly sampling in citrus orchards in the Eastern Cape and northern Limpopo provinces. Twenty-three species of fruit-feeding moth were trapped. However, only two were fruit-piercing species, capable of causing primary damage, namely *Serrodus partita* (Fabricius) (Erebidae) and *Eudocima divitiosa* (Walker) (Erebidae). Surprisingly *S. partita*, which has been reported as the main fruit-piercing moth pest of citrus in South Africa, comprised only 6.9 % of trap catches. The categorisation of moths as fruit-piercing or fruit-sucking (causing secondary damage) was confirmed by examining the morphological structures (tearing hooks and erectile barbs) of these moths' proboscides. This study has shown that in non-outbreak seasons, *S. partita* comprised only a small percentage of fruit-feeding moths in citrus orchards. However, growers may misidentify the harmless fruit-sucking species as fruit-piercing species, and thus overestimate the density of fruit-piercing moths.

Key words: fruit-feeding moths, *Serrodus partita*, *Achaea lienardi*, Erebidae, citrus, proboscides morphology.

INTRODUCTION

In South Africa, a number of fruit-feeding moth genera have been recorded on citrus and many other deciduous fruit (Swart *et al.* 1975; Johannsmeier 1998; Moore 2010). There are two main groups of fruit-feeding moths, namely fruit-piercing moths and fruit-sucking moths (Jack 1922; Johannsmeier 1998). The difference between these two groups is in the structure and function of their proboscides. Furthermore, these are the only groups of moths where the adults, rather than larvae, damage the fruit (Hattori 1969; Johannsmeier 1998; Zaspel 2008; Moore 2010; Robinson *et al.* 2012; Grout & Moore 2015). Damage to fruit can range from 70 to 90 % and this is especially so for soft-skinned citrus, during outbreaks of *Serrodus partita* (Fabricius) (Lepidoptera: Erebidae). These outbreaks occur every 5–10 years after good rainfall in the Little Karoo region that results in leaf flushes of their larval host, wild plum, *Pappea capensis* (Ecklon & Zeyher) (Sapindales: Sapindaceae) (Swart *et al.* 1975; Johanns-

meier 1998; Moore 2010; Robinson *et al.* 2012; Grout & Moore 2015).

Several studies have investigated the proboscis structure of fruit-feeding moths using light microscopy (Hattori 1962; Swart 1969; Swart *et al.* 1975; Bänziger 1970, 1973, 1980) or scanning electron microscopy (Cochereau 1977; Büttiker *et al.* 1996; Speidel *et al.* 1996), showing that there are uniquely specialised structures such as cutting ridges, erectile barbs and tearing hooks, moved by haemolymph pressure, on their proboscides. These moths are members of the Erebidae, and the subfamily Calpinae (Swart 1969; Swart *et al.* 1975; Bänziger 1970, 1973, 1980; Pinhey 1975; Zaspel 2008). Tearing hooks are unique to the tribe Cocytiini within the Calpinae, and are characteristic of the genus *Eudocima*, which includes well-known pests of hard and thick-skinned citrus, as well as soft-skinned fruit such as peaches (Swart *et al.* 1975; Johannsmeier 1998).

There are only 10 species of fruit-piercing moth



*Author for correspondence. E-mail: m.hill@ru.ac.za

Received 2 March 2017. Accepted 3 February 2019

ISSN 1021-3589 [Print]; 2224-8854 [Online]
DOI: <https://doi.org/10.4001/003.027.0001>

African Entomology 27(1): 1–9 (2019)
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