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Orius thripoborus (Anthocoridae), a potential biocontrol agent of *Heliothrips haemorrhoidalis* and *Selenothrips rubrocinctus* (Thripidae) on avocado fruit in the Eastern Transvaal[*]

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The South African avocado industry covers c 8 500 ha and has generated c R100 million and R30 million pa on the export and local markets, respectively, over the last four years (C J Partridge, personal communication). Until recently, South African avocados have had few, and relatively unimportant, pests. In 1982 only four insect species causing lesions on avocado fruit were listed, including red-banded thrips *Selenothrips rubrocinctus* (Giard) and greenhouse thrips *Heliothrips haemorrhoidalis* (Bouché), which were regarded as not serious enough to warrant insecticidal control (Annecke & Moran, 1982).

By 1990, however, the number of recorded species causing lesions on avocado fruit had increased to > 10 and there has been an increase in the importance of some pests. Packhouse surveys in the Nelspruit-Hazyview region during 1990 showed that c 10% of the fruit had to be culled due to insect damage. Coconut bug *Pseudothemptus wayi* (Brown), the pest damaging most fruit (4,7%), was not mentioned by Annecke & Moran (1982) and was subsequently noted as only a potentially serious pest on avocado fruit (Viljoen, 1986). The abovementioned thrips species, S *rubrocinctus* and *H haemorrhoidalis,* together were the second most important pests, accounting for a loss of 2,1% of the fruit. Outbreaks of these two thrips species caused losses of up to 80% of fruit in the Hazyview area (25°S; 31°E) during 1989 (B J Durand, personal communication).

The damage done to the fruit by the two thrips species is similar: by feeding on the pericarps with their piercing-sucking mouthparts they superficially damage the tissue and extract chlorophyll, which causes bronzing of the fruit surface. Heavy infestations cause the pericarp to crack. Fruit damaged by these species are unsuitable for export (de Villiers & van den Berg, 1987; de Villiers, 1990).

The damage caused by the thrips to avocado fruit is unlike that caused by most Thripidae to the fruit of other plant species.

Thrips usually feed in flowers and under the calyces, damaging the bases of the developing fruit. The damaged area eventually appears as a ring or half-moon of scar

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tissue around the mature fruit (Hartwig, 1985). This is well-known in citrus (Annecke & Moran, 1982). In avocados, however, the damage caused by the thrips invariably occurs on the maturing fruit and appears as irregular-shaped bronze patches on the sides of mature fruit. This indicates that the damage is done to the fruit at a later stage than, for example, in citrus.

While developing a monitoring technique for thrips on avocado fruit it was found that, at low population levels, most of the thrips (c 93%) occurred between touching fruit (Dennill & Erasmus, 1992b). The sides of fruit that have developed from fertilised flowers on the same inflorescence usually touch, and this explains why thrips damage occurs on the sides of the fruit. About 17,5% of the fruit in the orchard were touching.

Using stratified random sampling, 36 avocado trees were selected in the same orchard on East Farm in the Hazyview area (25°5'S; 30°59'E) on 9 June and 4 July 1990, respectively. A pair of touching fruit and a single fruit were selected on the northern, eastern, southern and western sides of each tree. A total of 288 and 144 touching and single fruit, respectively, were thus sampled on each date. For each pair of touching fruit, and each single fruit, the presence of thrips was noted as well as the percentage of the fruit surface that was damaged by thrips (0 = no damage, 1 = 1-10% damaged, 2 = 11-20% damaged, etc).

Of the fruit that were damaged and/or infested, respectively 98,5% and 96,1% were touching, on the two sampling dates (Table 1). Of the touching fruit, a high proportion were damaged, but with no thrips present (35% and 63%), while the degree of damage on these fruits was low (median score = 1, maximum score = 3). The proportions of damaged single fruits with no thrips present were higher (100% and 50%), but these samples were small as a result of the thrips' preferring touching fruit.

The absence of thrips on high proportions of single and touching fruit, which still have ample nutrition (as illustrated by the low levels of damage), was inexplicable until a minute pirate bug was found eating a nymph of *H haemorrhoidalis* between touching fruit during June 1990.

During June 1991 more specimens were found between touching fruit and on avocado flowers. The specimens were independently identified by Mr I Millar (National Collection of Insects, Pretoria) and Mr D H Jacobs (University of Pretoria) as *Orius thripoborus* (Hesse) (Hemiptera: Anthocoridae). This anthocorid, which was first found preying upon citrus thrips *Scirtothrips aurantii* Faure (Hesse, 1940), was originally described as *Triphleps thripoborus* (Hesse, 1940).

TABLE 1 The number and percentage of touching and single avocado fruit damaged and/or infested by thrips, *S rubrocinctus* and *H haemorrhoidalis*, the percentage of damaged fruit with no thrips present and the degree of damage on these fruit

Parameter	Touching fruit (n = 288)	Single fruit (n = 144)
Date 1: 9.6.90		
Number infested/damaged	66	1
% infested/damaged	22,9	0,7
% damaged with 0 thrips	35,3	100,0
Median score for damage	1	3
Maximum score for damage	3	3
Date 2: 4.7.90		
Number infested/damaged	98	4
% infested/damaged	34,0	2,8
% damaged with 0 thrips	63,3	50,0
Median score for damage	1	1
Maximum score for damage	2	2

Orius thripoborus may be partly responsible for the rarity of thrips outbreaks and has the potential to control thrips on avocados. The small size of *O thripoborus* allows it to prey on thrips between touching fruit and may therefore partly account for the absence of thrips between mildly damaged, touching fruit. Other predatory arthropods on avocado fruit, namely larvae and adults of *Micromus africanus* vd Weele and *Micromus sjoestedti* vd Weele (Neuroptera: Hemerobiidae), ladybirds (Coccinellidae) and spiders (Salticidae), are too large to feed on thrips between touching fruit. In addition, outbreaks of thrips have occurred in areas where insecticides have been applied, a practice not recommended by the South African Avocado Growers' Association.

Insecticide applications may be responsible for the reduction of predatory and parasitic arthropods such as *O thripoborus.* The Anthocoridae are all predacious, feeding on small arthropods, including phytophagous mites, lepidopteran larvae, thrips, leaf hoppers and scale insects (Jacobs, 1985) and the economic significance of this taxon may be underestimated (I M Millar, personal communication).

Lastly, *O thripoborus* may have potential for the control of thrips in other countries. *Heliothrips haemorrhoidalis* was recently recorded as the most important pest of avocados in California (Bekey, 1986; Goodall *et al,* 1987) and it is a pest of economic significance in Israel (Swirski *et al,* 1988;

Wysoki & Izhar, 1978). Since *O thripoborus* is indigenous (Hesse, 1940; Jacobs, 1985), while *H haemorrhoidalis* and S *rubrocinctus* are cosmopolitan species (Annecke & Moran, 1982), the use of this anthocorid to control these thrips elsewhere would involve the establishment of a 'new association'. The value of biocontrol agents in 'new associations' with their prey, as opposed to classical biocontrol agents in 'old associations' with their prey, has recently been recognised (Hokkanen & Pimentel, 1984; Dennill & Moran, 1989; Hokkanen & Pimentel, 1989; Dennill & Hokkanen, 1990).

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