Relative population levels of citrus thrips *Scirtothrips aurantii* on commercial citrus and adjacent bush

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Citrus thrips *Scirtothrips aurantii* Faure is a serious economic pest in southern Africa. It is indigenous, breeding on many wild hosts as well as on citrus. In this northern Transvaal lowveld study, bush containing known host plants of *S. aurantii* was not the source of early infestation of a navel orange orchard by adult citrus thrips during September and October. Early-season damage therefore resulted from the activities of citrus thrips which had overwintered in the orchard. In contrast, *S. aurantii* populations on wild hosts could possibly boost orchard populations later in the season and contribute to late damage on the fruit. This is because, in one of the years, adult thrips numbers were higher in the bush than in the orchard during November and December.

Die sitrusblaaspootjie *Scirtothrips aurantii* is 'n ernstige ekonomiese plaag in suidelike Afrika. Dit is 'n inheemse plaag wat op baie verskillende wilde gasheerplante asook sitrus aanteel. In hierdie studie, wat in die Noord-Transvaalse Laeveld uitgevoer is, is aangetoon dat wilde gasheerplante geen gevaar inhou as bron van infestasie vir 'n navellemoenboord gedurende September en Oktober nie. Skade wat vroeg in die seisoen opgedoen is, is dus veroorsaak deur die aktiwiteite van sitrusblaaspootjies wat in die boord oorwinter het. In teenstelling hiermee kan *S. aurantii*-populasies op wilde gasheerplante moontlik boordpopulasies later in die seisoen verhoog, en dit mag bydra tot laatskade op die vrugte. Dit is omdat daar in een jaar gevind is dat blaaspootjiegetalle gedurende November en Desember hoër was in die bos as in die boord.

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Scirtothrips aurantii Faure is a polyphagous African species recorded from over 70 host plants (Faure 1929). It attacks several crops but is considered to be a major pest only on citrus. Adult thrips and larvae cause superficial scarring by feeding on the surface of the fruit rind. Severely blemished fruit are not suitable for exporting. Damage, in the form of leaf malformation and stunting of growth, is also caused to young citrus foliage.

During an examination of the relationship between thrips populations in citrus orchards and adjacent natural vegetation in the western Transvaal highveld, Bedford (1943) found acacias to be amongst the most important indigenous hosts. Fruit on citrus trees adjacent to acacias showed more thrips damage than fruit in the centre of orchards. Although this damage was caused during early November, it was suggested that migration from natural bush into orchards might also occur as early as August and September and thus be responsible for the build up of *S. aurantii* which is commonly observed during spring. In contrast, Samways, Tate & Murdoch (1987) showed that densities of this pest were consistently lower in natural vegetation than on citrus in both the eastern Cape Province and eastern Transvaal. Immigration of citrus thrips into orchards was therefore considered to be unimportant.

The aims of the present study were to determine whether early spring damage to citrus fruit is caused by *S. aurantii* populations which have overwintered in the orchards, or as a consequence of a build-up of numbers following migration of citrus thrips adults into the orchard from adjacent bush. In the light of these results the implications for recommended control measures and population monitoring procedures were also examined.

Locality, Materials and Methods

Studies were undertaken from September to December 1986 and 1987, on Letaba Estates, a large citrus plantation of 1 700 ha, approximately 20 km south-east of Tzaneen in the northern Transvaal lowveld. The experimental site was an orchard of 200 mature Washington navel orange trees surrounded by largely undisturbed indigenous vegetation. During the study period, the citrus orchard received no chemical treatments for the control of pests. The surrounding vegetation contained thorn trees, (mainly the Whitethorn, *Acacia polyacantha* Willd. subsp. *campylacantha* (Hochst. ex A.Rich) Brenan), interspersed with smaller plant species including sicklebush *Dichrostachys cinerea* (L.) Wight & Arn. subsp. *nyassana* (Taub.) Brenan, and 'pride of the Cape' *Bauhinia galpinii* N.E. Br..

Hand sampling

Thrips were collected by beating citrus trees and adjacent vegetation to dislodge specimens onto white paper, then stored in 70% alcohol. Care was taken to ensure that identifications were correct in view of the similarity between *S. aurantii* and others of the same genus (Faure 1929; Gilbert 1986). Adults were mounted on slides for detailed examination using the method of Mound & Pitkin (1972). Second instar thrips larvae were collected from plants on which *S. aurantii* adults had been found. In order to confirm that the larvae were *S. aurantii* they were confined within a 'Tashiro' acrylic

cage (Tashiro 1967), containing host plant leaves as a larval substrate. The mature larvae pupated within the cage, and the identity of the emerging adults was subsequently ascertained.

Trapping

Owing to the similarity in appearance between *S. aurantii* and *S. fulleri* Faure, and the likelihood of their confusion during routine censuses, it was decided to monitor the occurrence of both species using attractant fluorescent yellow sticky traps (Samways 1986). Each trap was 25 × 25 cm and consisted of a self-adhesive plastic sheet overlain with an overhead transparency slide smeared with Reverant[R] and supported by a perspex or zinc plate. Thrips were counted within a central area of the trap measuring 160 × 160 mm. In order that the fluorescence of the trap did not fade as a result of direct exposure to the sun six traps were hung on the south side on the outer canopy of trees in each of the two habitats. Traps were placed at a height of 2 m. For commercial monitoring of thrips in citrus orchards a set of three traps per 5 000 trees is sufficient to provide a reliable monitoring system (Samways 1986). Traps were positioned in two rows of three, with approximately 10 m between rows and a similar distance between traps within a row. The orientation of the traps was such that those in the orchard could not be seen from the bush and vice versa. Counts of thrips were recorded weekly.

Table 1 Thysanoptera collected in citrus orchard and bush by hand collection and trapping

	Citrus		Bush	
Species	Hand	Trap	Hand	Trap
Craspedothrips hargreavesi (Karny)	+	+	+	+
Haplothrips articulosus Bagnall			+	
Haplothrips bedfordi Jacot-Guillarmod	+	+	+	
Haplothrips clarisetis Priesner	+	+		
Hydatothrips adolfifriederici Karny			+	+
Mycterothrips laticauda Trybom		+	+	+
Mycterothrips sp. indesc.			+	
Scirtothrips aurantii Faure	+	+	+	+
Scirtothrips combreti Faure		+		+
Scirtothrips dorsalis Hood		+	+	+
Scirtothrips fulleri Faure		+	+	+
Scolothrips hartwigi Priesner	+	+		+
Taeniothrips gowdeyi (Bagnall)	+			
Taeniothrips simplex (Morison)	+			
Thrips tenellus Trybom	+	+	+	+

Results

Thrips species recorded

Table 1 records thrips species collected in the citrus orchard and adjacent bush by trapping, and by hand collection. Four *Scirtothrips* spp. were recorded, *S. aurantii, S. fulleri, S. dorsalis* Hood, and *S. combreti* Faure. Within the orchard the latter three species were trapped on few occasions and not hand collected at all. *S. fulleri* was at times very numerous in samples taken from *Acacia* trees.

Thrips tenellus Trybom was common within citrus flowers along with lower numbers of *Taeniothrips gowdeyi* (Bagnall), and *T. simplex* (Morison). *Haplothrips bedfordi* Jacot-Quillarmod and *H. clarisetis* Priesner were collected on fruit, often associated with *S. aurantii*. *H. bedfordi* is recorded as a citrus thrips predator (Bedford 1943), but *H. clarisetis* is known only as a plant feeder (Zur Strassen 1960). Numbers of *Haplothrips* spp. were generally very low compared with those of *S. aurantii*. *Scolothrips hartwigi* Priesner, collected on

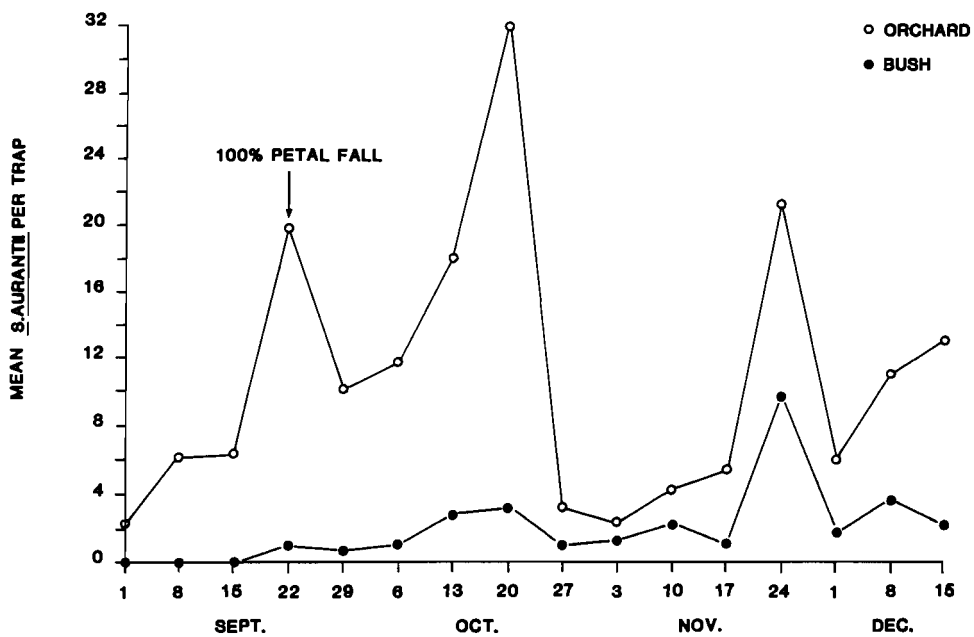

Figure 1 Numbers of *Scirtothrips aurantii* adults caught on sticky traps in a citrus orchard and adjacent bush at Letaba Estates during 1986.

citrus fruit, was observed to be preying on citrus red mite *Panonychus citri* (McGregor), and lowveld mite *Eutetranychus anneckei* Meyer.

Host plants of citrus thrips

In addition to citrus, the following seven plant species were found to support *S. aurantii* adults and larvae in the study area; *Acacia karroo* Hayne, *Acacia polyacantha* subsp. *campylacantha, Bauhinia galpinii, Caesalpinia pulcherrima* (L.) Schwartz, *Dichrostachys cinerea* subsp. *nyaccana, Mucuna coriacea* Bak. subsp. *irritans* (Burtt-Davy) Verdc., and *Ricinus communis* Linnaeus.

Comparison of citrus thrips numbers in the orchard and adjacent bush

In 1986 and 1987 100% petal-fall occurred by the end of the third week in September. At this time materials registered for the control of citrus thrips (e.g. tartar-emetic, triazophos, or isofenphos) would usually be applied in a commercial orchard, in order to prevent early thrips damage which mainly takes the form of ring-shaped scars at the stem end of the fruit.

In 1986 *S. aurantii* numbers built up rapidly within the orchard prior to 100% petal-fall (Figure 1). In contrast *S. aurantii* in the adjacent bush was first detected only

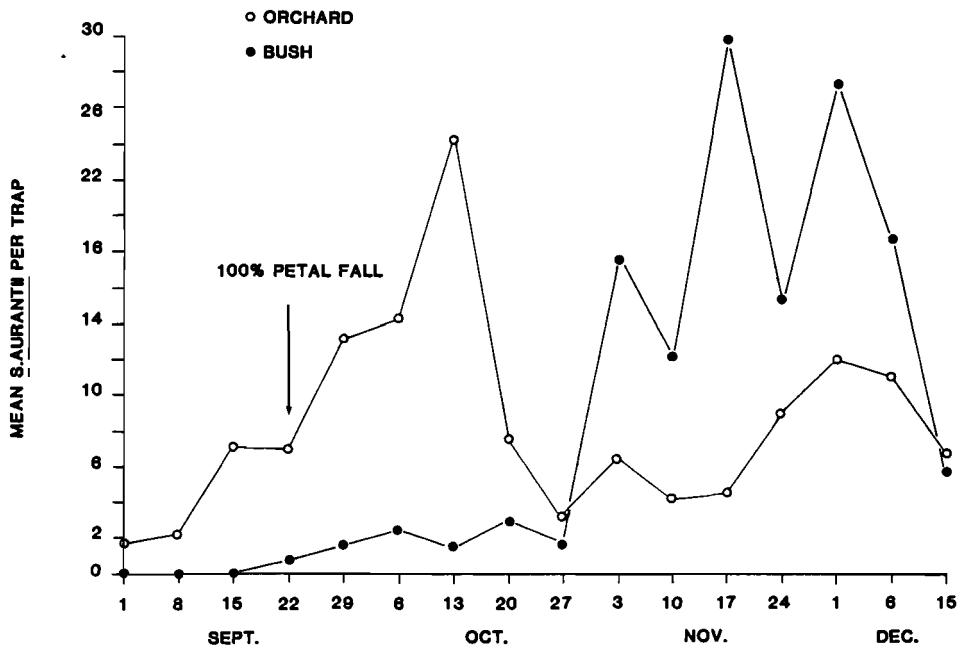

Figure 2 Numbers of *Scirtothrips aurantii* adults caught on sticky traps in a citrus orchard and adjacent bush at Letaba Estates during 1987.

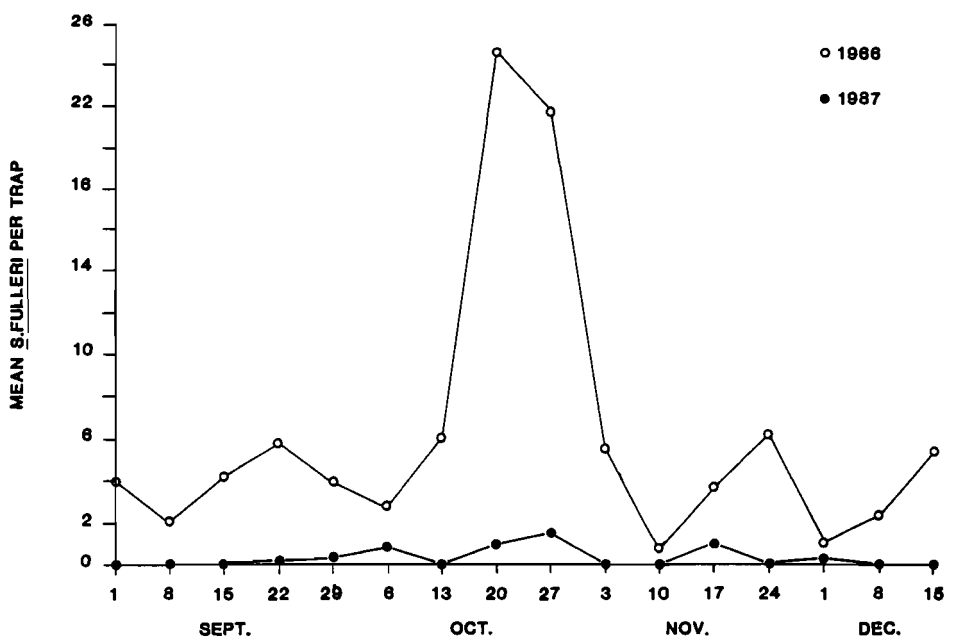

Figure 3 Numbers of *Scirtothrips fulleri* adults caught on sticky traps in bush at Letaba Estates during 1986 and 1987.

during the third week of September and in very low numbers. Major differences in the two populations continued until the end of October. In 1987 citrus thrips increased within the orchard as in 1986 (Figure 2), and thrips in the bush were again detected for the first time in the third week of September. However, in contrast to 1986, later in the season (during November and December) *S. aurantii* numbers in the bush markedly exceeded those in the orchard. During 1986 *S. fulleri* was common in the bush and in October considerably outnumbered *S. aurantii* (Figures 1 & 3), but was only present in insignificant numbers throughout the year in 1987.

Discussion

Samways, Tate & Murdoch (1986), set an economic threshold of nine *S. aurantii* caught per three traps per week; i.e. a mean of three thrips per trap. In the Transvaal, maintenance of catches in citrus orchards below this figure up to the third week in November, and below 20 thrips per three traps from then on until the end of December, was found to result in less than 1% of the fruit being unexportable because of thrips damage. Figures 1 & 2 show that at 100% petal-fall (during the third week in September), the time when thrips control normally begins, numbers of *S. aurantii* in the orchard already exceeded the threshold by over 600% in 1986 and 200% in 1987. Thus severe damage can occur to young fruitlets very early in the season at Letaba if chemical sprays are not timed correctly.

The results show that host plants in bush adjacent to citrus orchards do not support a large population of *S. aurantii* during September and October. The bush population is insignificant compared with that which develops within the citrus orchard itself.

This agrees with Samways *et al.* (1987), who found that citrus thrips numbers were consistently higher in citrus orchards, particularly during September and October.

Bedford (1943) found that citrus fruit on trees adjacent to bush was more severely damaged by thrips than that on trees towards the centre of the orchard. The initial thrips infestation in these orchards was low and two dustings with sulphur further reduced numbers of the pest, such that no damage to fruit occurred during September or October. However, during November *S. aurantii* numbers on citrus trees bordering bush began to increase and damage to fruit also occurred. This was ascribed to thrips migrating from adjacent acacias, of which the leaves were hardening off, making them unsuitable as a further food source for thrips. He speculated that similar citrus thrips migrations onto the crop might occur as early as August or September and be responsible for the initial infestation which causes early season damage to fruit. The results presented here, and those of Samways *et al.* (1987), show that this is not the case.

The results of 1987 do, however, show that, during November and December in certain years, larger numbers of citrus thrips may occur on nearby bush as compared with citrus. They may pose a potential threat to adjacent citrus, and would account for the results of Bedford (1943) at Rustenburg. The danger of high bush populations of *S. aurantii* acting as sources of thrips late in the season was not evident in the results of Samways *et al.* (1987).

The build-up of *S. aurantii* on citrus earlier than in the bush can be related to management practices at Letaba. In order to promote flowering and fruit-set of navels, irrigation and fertilizer are applied during mid-July and new vegetative growth is visible at the end of this month or the beginning of August. This can immediately be used as a food source by citrus thrips which have overwintered in the orchard on out-of-season shoots and fruit. Letaba Estates is in a summer-rainfall area, and the surrounding bush tends to be very dry with no new growth during July and August. Early in the season, conditions for *S. aurantii* population increase are therefore more favourable on citrus than in adjacent bush. Bearing in mind that a certain percentage of navel orange fruitlets can be at risk from thrips during the second week in September, owing to uneven blossoming, the extent of early damage will therefore be related to the size of the pest population within the orchard and the effectiveness of any applied control measures. Later flowering cultivars such as valencias will be at greater risk from immigration of citrus thrips from the bush because their fruit remain smaller and more vulnerable to scarring until later in the season.

S. fulleri was found to be the species most likely to be confused with *S. aurantii*. Although this thrips was rare within the orchard it was common on traps in the bush during September and October 1986. Citrus growers wishing to monitor thrips in adjacent bush, as an aid to pest management, would have to take care to avoid confusing these two species, especially as *S. fulleri* is of no economic importance. Scoring of *S. fulleri* as *S. aurantii* would erroneously increase the apparent importance of non-citrus hosts.

To estimate the severity of a citrus thrips outbreak in an orchard, counts of infested fruit beginning at petal-fall have traditionally been made by growers. As wild host plants are of no importance in early spring, trapping of citrus thrips within the orchard prior to, and during, blossoming will give advance warning of the level of infestation to be encountered before any damage to fruit can occur.

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