Research reports

Seasonal abundance of thrips (Thysanoptera) in capsicum and chilli crops in south-east Queensland, Australia.

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Summary

Thrips can be important pests of capsicum and chilli crops, causing damage through their feeding and by vectoring viral diseases. As different species vary in their ability to transmit viruses and in their susceptibility to insecticides, it is important to know which species are present in a crop. The seasonal occurrence of thrips in capsicum and chilli crops in the Bundaberg district of south-east Queensland was investigated from July 2002 to June 2003. Fifty flowers were collected weekly from crops on seven farms and the adult thrips extracted and identified. *Thrips palmi* Karny and *Frankliniella occidentalis* (Pergande) were collected in the greatest numbers, with *T. palmi* predominant in autumn crops (March to July) and *F. occidentalis* predominant in spring crops (August to November). *Pseudanaphothrips achaetus* (Bagnall) was common, while *Thrips tabaci* Lindeman, *Thrips imaginis* Bagnall and *Frankliniella schultzei* (Trybom) were collected in low numbers.

Introduction

Several species of thrips, principally *Thrips tabaci* Lindeman, onion thrips, and *Frankliniella schultzei* (Trybom), tomato thrips, were long considered minor pests of capsicums and chillis (i.e. peppers) (*Capsicum annuum* L.) in Queensland. However the significance of thrips as pests of peppers increased following the introduction of *Frankliniella occidentalis* (Pergande), western flower thrips, and *Thrips palmi* Karny, melon thrips. *Frankliniella occidentalis* was first recorded in Australia in 1993 (Malipatil *et al.* 1993) and at Redland Bay in Queensland in the same year (Kirk and Terry 2003). *Frankliniella occidentalis* was commonly found in the Bundaberg district, a major vegetable production district based around the city of Bundaberg (24° 52′ S, 152° 22′ E) by 2001. *Thrips palmi,* first recorded in Australia in the Northern Territory in 1989 (Houston *et al.* 1991), is now widespread in Australia (Persley *et al.* 2006), and was first recorded in the Bundaberg district in early 2001.

Thrips are important pests because they damage capsicums and chillis through their feeding, causing scarring and silvering on fruit, and by transmitting the tospoviruses tomato spotted wilt virus and capsicum chlorosis virus that severely affect the plants, resulting in major losses of production (Persley *et al.* 2006).

It is important to know which species of thrips are present in crops. The species differ in their ability to vector tospoviruses, so knowledge of the species present allows some estimate of the risk of viral disease occurring. *Frankliniella schultzei*, *F. occidentalis*, *T. tabaci* and *T. palmi* are vectors of tomato spotted wilt virus, while only *T. palmi* and *F. schultzei* are known to vector capsicum chlorosis virus (Persley *et al.* 2006). Different insecticides may be required to control different species. For example, imidacloprid is effective against *T. palmi* (Walsh 2004) but is ineffective against *F. occidentalis* (Kay and Herron 2010). There also are market access issues, with some Australian states requiring that produce imported from Queensland be free from *T. palmi*.

Annually, there are two main capsicum and chilli cropping seasons in the Bundaberg district, with some seasonal overlap. Autumn season crops are planted from January to April and harvested from April to August; spring crops are planted from mid-July to September and harvested from October to December.

We surveyed the thrips in a number of crops over a 12 month period to determine which thrips species are present, and their relative proportion, in capsicum and chilli crops in the Bundaberg district.

Methods

Samples were collected from capsicum and chilli crops on seven farms in the Bundaberg district from July 2002 to June 2003. At three of the sites, two crops were grown during the 12 months, while only single crops were grown at the remaining sites. In each crop, 50 open flowers were collected randomly from throughout the crop each week during the crop's flowering period. The flowers were collected into paper bags and returned to the laboratory where the thrips were extracted over a white tray.

The thrips were placed into 70% alcohol, and sent to the identification laboratory at Gatton Research Station where the adults were cleared by soaking them in 5% NaOH overnight, then gently squashing the thorax and abdomen with a flattened Number 5 pin before rinsing them in distilled water for 10 minutes. The cleared thrips were mounted in Hoyer's solution on microscope slides and identified using taxonomic keys in an unpublished Queensland Department of Primary Industries thrips identification workshop manual compiled by Laurence Mound and John Donaldson.

Results

Figure 1 shows the number of adult thrips of each species collected at each of the farms. Six species were recorded. *Frankliniella occidentalis* and *T. palmi* dominated, and were recorded at all farms and in both cropping seasons. *Pseudanaphothrips achaetus* (Bagnall), hairless flower thrips, was the next most common species, found on five farms and in both seasons. *Thrips tabaci* was found in low numbers on three farms in the autumn season and a single *Thrips imaginis* Bagnall, plague thrips, was recorded. *Frankliniella schultzei* was recorded in very low numbers at one farm in the spring season.

Figure 2 shows the proportions of each species present throughout the year. *Thrips palmi* was the dominant species from March to July. *Frankliniella occidentalis* was common in May-July and domi-

nated from August onwards. *Pseudanaphothrips achaetus* was recorded commonly from July to November, although the November collection was from just one farm, with *P. achaetus* and *F. occidentalis* the only species recorded.

Discussion

Although there was variation between farms in thrips species composition and abundance (Figure 1), a general pattern of occurrence, with *T. palmi* predominant from March to July and *F. occidentalis* predominant from August to November, is apparent (Figure 2). Occasional collections (three or four per year) of thrips from pepper flowers between 2004 and 2011 have confirmed this pattern of species occurrence (Kay unpublished data).

The differences in species occurrence and abundance between farms might be explained by differences in the pest control philosophies and practices on each farm. Crops on Farms 1, 2, 3 and 6, which had almost exclusively *T. palmi* and *F. occidentalis* populations, were weed free and were sprayed frequently to control *Helicoverpa* spp. and thrips with a range of insecticides including methomyl, spinosad, indoxacarb, methamidophos and bifenthrin.

The Farm 7 crop contained weeds but it was sprayed frequently with insecticides, mainly methomyl and bifenthrin but also methamidophos and spinosad. The diversity of thrips species was higher in the crop on Farm 5, which was moderately weedy and sprayed with spinosad, indoxacarb and abamectin less frequently. Farm 4 had the greatest diversity of thrips species. Its crop was heavily infested with a variety of flowering weeds, and was sprayed mainly with *Bacillus thuringiensis* and very occasionally with endosulfan. It seems likely that the minimal use of insecticides and the presence of weeds allows other thrips species to be present and survive, but only *T. palmi* and *F. occidentalis* can survive in intensively sprayed crops.

Pseudanaphothrips achaetus was recorded from flowers on six farms, and it was common on Farms 4 and 5. Moritz *et al.* (2004) state that *P. achaetus* feeds, and apparently breeds in the flowers of a very wide range of plants of different families and that it is widespread throughout Australia. Wilson and Bauer (1993) recorded it in cotton flowers in the Namoi Valley, New South Wales, and Milne *et al.* (1997) reported that it is commonly found in stonefruit flowers in the Granite Belt area in Queensland. However, there appear to be no reports of it causing damage. It is important to know whether or not its feeding results in damage, and this needs to be studied. Even if it is benign, its presence in flowers may result in an insecticide application unless proper identification is carried out.

Frankliniella schultzei and *T. tabaci* can be important crop pests that vector tospovi-

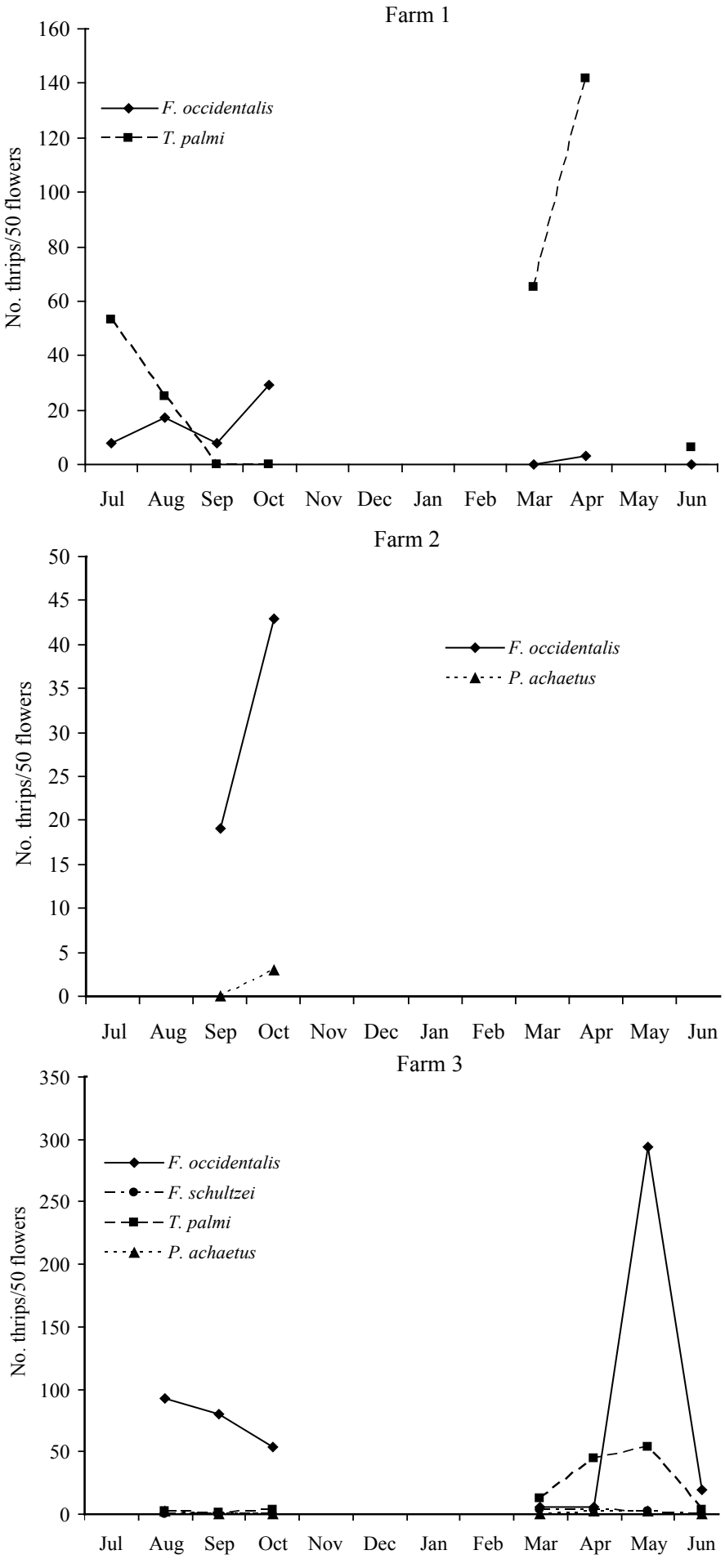
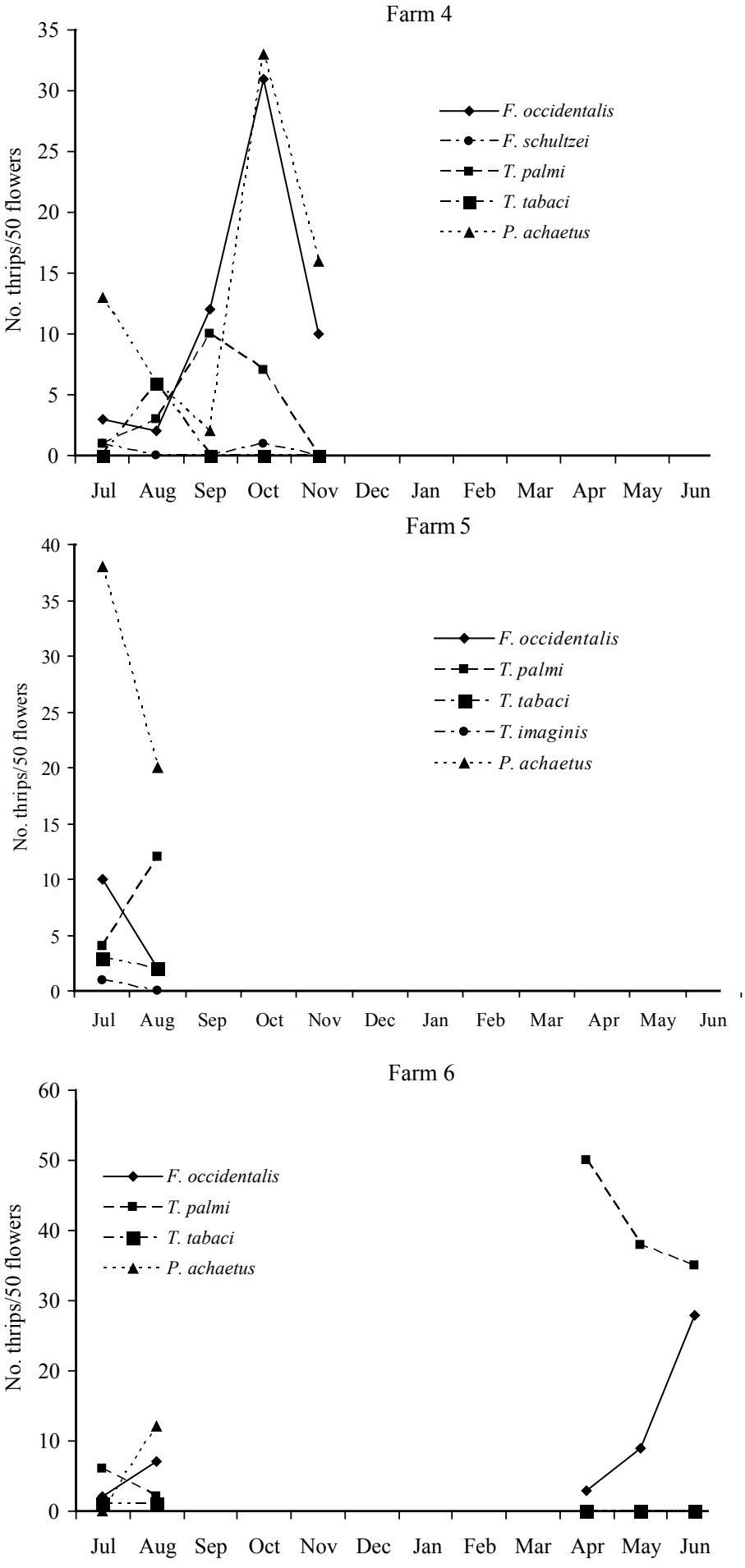


Figure 1. Number of thrips recorded from flowers on each farm in 2002-2003.



ruses (Persley *et al.* 2006) but were scarce in these collections. A single specimen of *T. imaginis* was recorded, on Farm 5. It is possible that this specimen was, in fact, *Thrips safrus* Mound and Matsumoto, the northern plague thrips, which was first described in 2005 (Mound and Masumoto 2005). Mound and Masumoto (2005) state that *T. safrus* is closely related to, and has previously been identified as, *T. imaginis*, which it replaces in northern areas. Unfortunately the specimen has been lost, so its identity cannot be confirmed.

This study has established a general pattern of thrips occurrence in capsicums and chillis in the Bundaberg district, with *T. palmi* predominant in autumn and early winter and *F. occidentalis* predominant in late winter and spring. While this information will help in the management of thrips in crops, it still is essential that crops are checked carefully and the thrips species present identified before management decisions are made. There is some variability in the pattern of occurrence and different species may require different management decisions.

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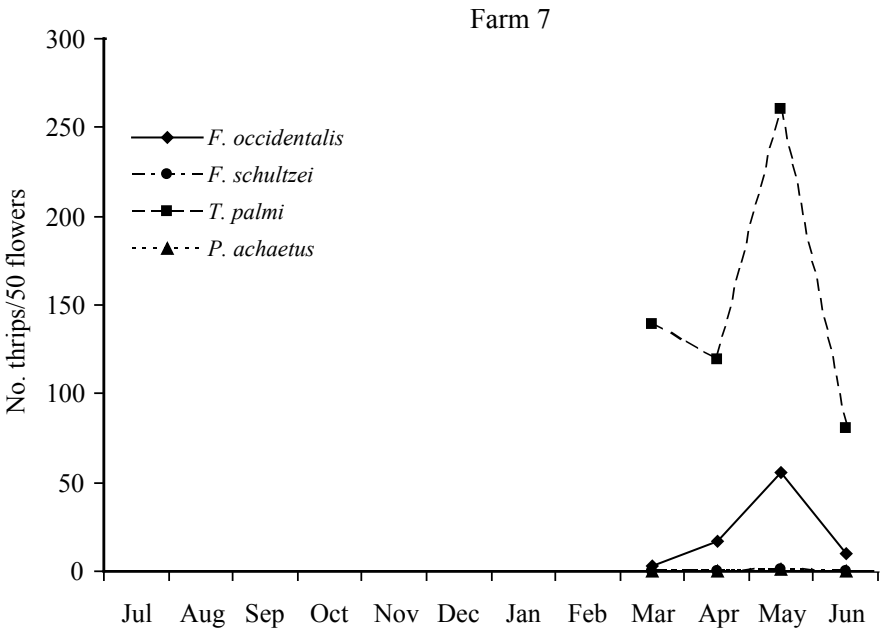

Figure 1. Number of thrips recorded from flowers on each farm in 2002-2003.

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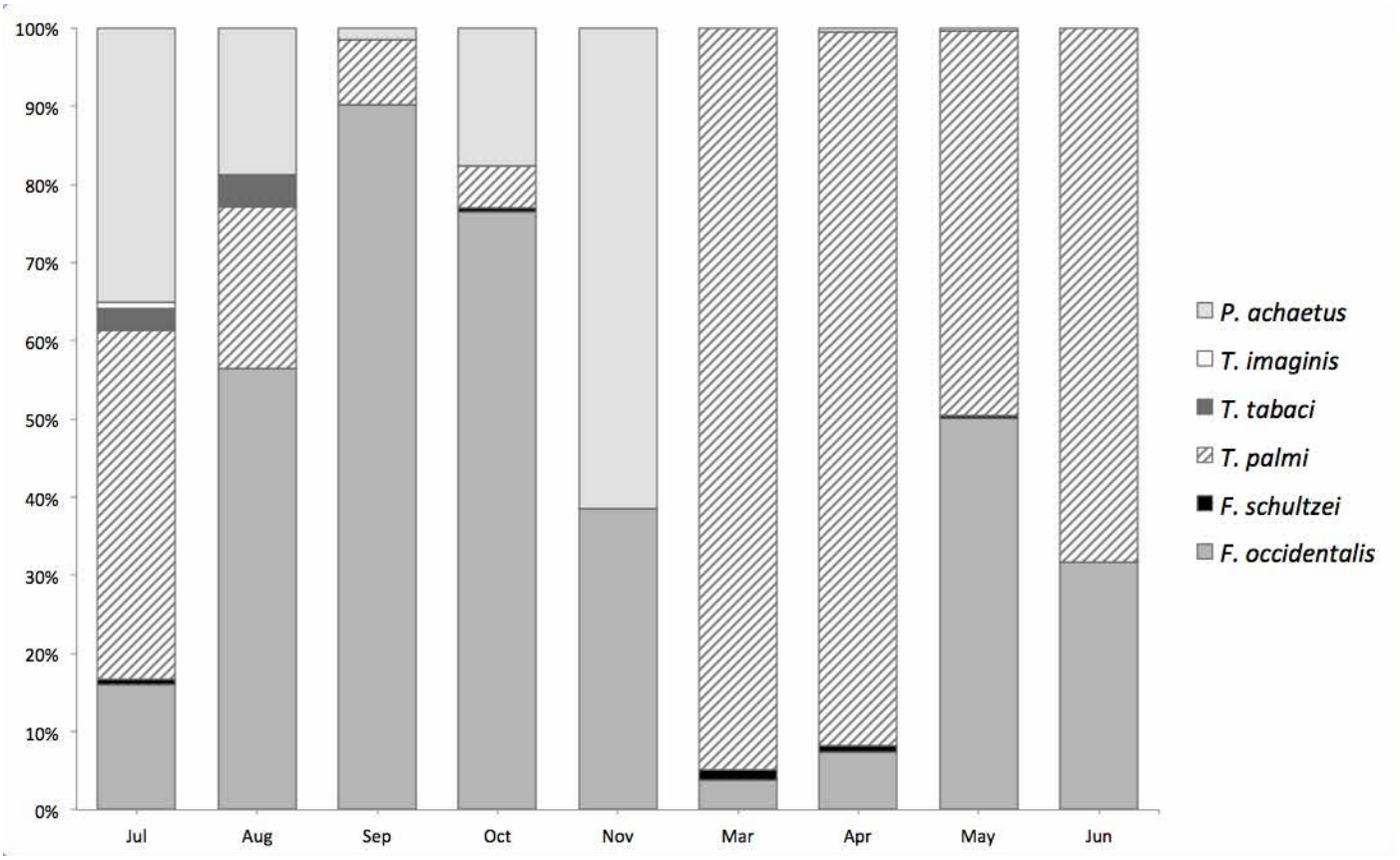

Figure 2. The proportions of each thrips species recorded in capsicum and chilli flowers in south-east Queensland throughout 2002-2003.