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Eradication of an invasive alien pest, *Thrips palmi*

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Abstract

Thrips palmi Karny, the melon thrips, is a polyphagous pest that has spread widely in tropical and subtropical regions. It is absent from Europe, although outbreaks have occurred in the Netherlands (1988–98), the UK (2000–01) and most recently Portugal (2004). An outbreak of *T. palmi* occurred in Sussex in 2000. It was already well established when the UK Plant Health Service first notified. High populations were discovered in two glasshouse sites on the same nursery, growing all-year-round chrysanthemums. An intensive, largely chemically based eradication programme was carried out, with applications of aerosol 'space' treatments, systemic and foliar insecticides. Other measures included the use of sticky yellow sheets, methyl bromide fumigation of flowerbeds and plastic mulches. Together, these controls resulted in the collapse of the outbreak, within 7 months. Eradication was subsequently declared after freedom from the pest had occurred over two complete cropping cycles.

Keywords: *Thrips palmi*; Eradication; Insecticides; Control measures

1. Introduction

1.1. Pest status

Thrips palmi Karny (Thysanoptera, Thripidae), the melon thrips, is listed in Annex IAI of the EC Plant Health Directive (2000/29/EC) and as such requires eradication wherever it is found in the EU. Similarly, introduction of *T. palmi* into Great Britain is banned under the Plant Health (England) Order 2005 (Anon, 2005). *T. palmi* is a vector of alien tospoviruses (Moritz et al., 2004), and has been implicated in the transmission of at least six plant viruses (Jones, 2005). If these viruses were introduced to the UK, other tospovirus vectors that are already present—such as the western flower thrips, *Frankliniella occidentalis* (Pergande)—could potentially redistribute them. Furthermore, there is the potential for *T. palmi* to become an additional vector of other plant viruses already present in the UK.

1.2. Life-cycle and damage symptoms

T. palmi adults are small (>2–3 mm), yellow-winged insects and both sexes are capable of flight. The females are capable of sexual or asexual reproduction, producing many eggs that are deposited into plant tissues. Eggs give rise to translucent first instar 'larvae' that are barely visible with the naked eye; this stage is largely responsible for the uptake of tospoviruses from infected host plants. Together with adults and first instars, the larger, yellow, second instar nymphs are mobile and responsible for direct feeding damage. In chrysanthemums, second instar nymphs are found in the small curled leaf buds where the fully expanded leaves join the main stem. When the second instar has completed development, it becomes a propupa and subsequently, a pupa. These relatively sedentary, non-feeding stages are found in loose soil, growing substrates,

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Plate 1. Photograph of *T. palmi* damage to chrysanthemum leaf.

plant debris, on host plants, or in moist, enclosed environments. The winged adults subsequently emerge and begin to feed, and reproduce soon after.

Larvae and adults feed by piercing individual plant cells and sucking the cell contents. This gives damaged tissues a speckled appearance (Plate 1: chrysanthemum leaf damage). Where the cells coalesce, a shiny scar may develop, which can be sufficient to reduce the marketability and value of ornamental crops or fruits. If sufficient damage occurs at early stages of plant growth, then distortion, scarring and malformation of tissues can result and productivity can be greatly reduced. Leaves and terminal shoots become stunted and fruit can become scarred and deformed (Smith et al., 1997).

When *T. palmi* populations are high, feeding typically causes a silvery or bronzed appearance on the surface of the leaves, especially along the midrib and veins. In Japan, *T. palmi* was a problem in autumn chrysanthemums, and although only occurring at low densities, damage was reportedly severe (Kawai, 1990; Miyashita and Soichi, 1993). Adults aggregate to the growing points of the chrysanthemum plant before flower differentiation and then disperse to other parts later (Miyashita and Soichi, 1993).

High developmental and reproductive rates of *T. palmi* at glasshouse temperatures allow rapid build-up of populations, even from small numbers of females. To develop from egg to adulthood, *T. palmi* requires 194 day-degrees above a thermal threshold of 10.1 °C, and development from egg to adult takes between ca. 10 (at 30 °C) and 40 days (at 15 °C), (McDonald et al., 1999).

2. Materials and methods

2.1. Identification

In the UK outbreak, adult thrips were sent to the Central Science Laboratory (CSL), for identification, on the sticky traps on which they were trapped. The traps were scanned under a binocular dissecting microscope (Wild M10, Leica Microsystems, Wetzlar, Germany) at 80 magnifications. Putative *T. palmi* were recognised using characters such as: the number, size and location of setae on the head, pronotum, forewing, abdominal sternites and abdominal tergite II; as well as colouration characteristics.

However, in order to confirm the identity of the putative *T. palmi*, individual thrips were removed from each trap (the smaller the number of thrips caught on any one trap, the greater the proportion that were removed and slide mounted) and microscope slide-mounted in Heinz Mounting Medium (Heinze, 1952). Mounting the thrips in Heinz Mounting Medium rather than Canada balsam allowed more thrips to be critically examined at high magnification more quickly. This was essential with sticky traps from both sites being sent to the laboratory for examination on a regular basis throughout the eradication campaign, fortnightly at the height of the campaign. The thrips were floated free from the trap in a drop of white spirit, transferred to fresh white spirit in a watch glass, agitated gently to get rid of the remaining glue, transferred to a dilute detergent solution, gently heated for 15 min at 70 °C, slide mounted, and heated at 70 °C for 30 min. The thrips were then examined at magnifications of up to 500 using a Leitz Diaplan compound microscope (Leica Microsystems). Individual specimens were confirmed as *T. palmi* using diagnostic characters as outlined in the literature (e.g., Sakimura et al., 1986; zur Strassen, 1989; Anon, 2001). All other thrips species were also identified from slide-mounted specimens using the keys provided by Mound et al. (1976). In all cases, only adult material was examined and confirmed to species.

The numbers of *T. palmi* present were recorded by counting the specimens caught on each trap. When only a few thrips had been caught, all were removed for slide mounting. When very large numbers were being trapped, an estimate was made, based on counting the numbers of putative *T. palmi* present on just one third of the sticky trap and multiplying that figure by three. Only a very small proportion of thrips were in too poor a condition on the traps for a putative identification to be assigned to them. In comparison to the very large numbers of thrips individually confirmed as *T. palmi* between April and December 2000, only very small numbers of the very similar species *Thrips flavus* Schrank were ever recorded at either site. This suggests that the estimates were reasonably accurate and not inflated by erroneous inclusion of the similar species.

2.2. Crops and site

Chrysanthemum production at the nursery in Sussex where *T. palmi* was reported in 2000, accounted for ca. 30% of the total UK production at the time: ca. 100,000 stems per week. The company operated two glasshouse sites—referred to hereafter as Site 1 and Site 2—which were separated by ca. 100 m at their nearest points. There were