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THE EFFECT OF TYPES OF GREENHOUSE SCREENS ON THE PRESENCE OF WESTERN FLOWER THRIPS: A PRELIMINARY STUDY

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Summary

The thrips population prevailed on the flowers outdoors year round, with a clear peak during April-June and a smaller one in autumn. A general positive correlation was found between thrips population density outdoors and indoors. In laboratory tests, the thrips freely penetrated the commercially used whitefly-proof screens. In the field, the thrips population was reduced considerably when traps were covered by the same screens. In high 'walk-in' tunnels covered by various types of screens, the commercial woven screens reduced thrips penetration considerably, compared with the outside population, in the traps and on the flowers. A loose shading net of aluminium color through which whiteflies penetrated freely in the laboratory, reduced thrips penetration very much in the high tunnels but, under an identical shading net of white color, WFT populations were much higher than outside. Blue sticky traps caught significantly fewer WFT when placed outdoors on a background made of the aluminium-colored shading net, or of whitefly-proof screen, than in control traps placed on bare soil. In traps placed on a white-colored shading net background, catches were higher than in the control. The WFT is strongly affected by color, and its appearance can be reduced considerably by using a proper screen.

Introduction

The WFT is an economically important pest. It was introduced into Israel accidentally, most likely on imported ornamentals. It was first found on chrysanthemums and on ornamentals in a greenhouse near Tel Aviv in 1988 (Brosh, 1989). It has since spread throughout the country, attacking vegetable crops, flowers, ornamentals and wild plants. Covering tomato greenhouses with screens was found to be a very efficient whitefly control measure (Berlinger et al., 1991). Thus a series of experiments was performed to investigate the possibilities of using screens also against the WFT, especially since the color of the screen may affect - attract or repel - the thrips (Brown and Brown, 1992).

The purpose of this work was to investigate the possibilities and potentials of using screens to control the WFT.

Materials and Methods

Thrips monitoring by traps

The appearance of WFT populations was studied at Gilat with blue sticky traps, and at Besor also on *Ageratum* flowers. The traps were arranged vertically, approximately 50 cm above the ground. In some cases yellow sticky traps were used despite the fact that they catch fewer WFT than did blue traps. Still, in practice they have some advantages: it is easier to count thrips on yellow traps, and they also trap whiteflies, aphids, leaf miners, etc.

Monitoring thrips by removal from flowers

Thrips prevailing in the flowers were monitored by sampling flower inflorescences. They were placed in a funnel which was closed tightly. Two or three drops of turpentine were applied to a small piece of cotton. The thrips, repelled by the turpentine, were collected in attached glass tubes containing 70% ethanol.

The screen mesh

The mesh of woven screens is indicated by the number of holes/inch in the length and the breadth. The size of the hole (mm^2) was calculated.

Thrips penetration through screens

Two types of screens were tested: woven screens, and unwoven shading nets. Thrips penetration was tested in the laboratory using two halves of a petri dish (90 mm in diameter). The tested screen was stretched between them as a barrier. Approximately 50 thrips were introduced into one compartment. After 24 hours the thrips were counted in both compartments.

Semi-laboratory tests were performed in the field. The bottom of a petri dish was smeared with insect-glue (Rimi-, or Tangle-foot). A piece of the tested screen was then stretched tightly over the opening of the dish, which was placed on a thrips-attracting background.

Field tests were performed by covering both sides of a 'walk-in' tunnel, at a height of 2 m, with the tested screen. The roof was covered with a greenhouse-plastic cover. *Ageratum* flowers were planted in the tunnel in September and two to four blue sticky traps were placed among them. The experimental layout consisted of 36 high tunnels, each 6 m long by 6 m wide, and 2.5m at the highest point. The treatments were arranged in a randomized block design. Two experiments were carried out, one in 1991/92 and one in 1992/93.

Effect of background colors

Blue sticky traps were placed in the center of squares (1.5 x 1.5 m each) representing various backgrounds: a shading net of aluminium color, a screen with the same texture but colored white (identified as 1.5% or 2.5% white), a piece of a used and a piece of a new commercial screen; and a transparent plastic sheet. Each background was tested in four replicates, which were arranged on a clean field in randomized blocks. The traps were renewed four times between 20 September and 11 October.

Results and Discussion

1. Phenology

At both sites, Besor and Gilat, a clear peak of the WFT population was detected by trapping, from the end of April to mid June; from late June to late September the catches were very low. A second, smaller peak was in October- November. During winter the numbers of thrips were again at a very low level.

On the flowers at Besor the thrips population prevailed outdoors all year round, and its presence was similar to that in the traps. After winter, during March-June, it rose to a clear peak. From August to late December the population level was low, 3-4 thrips/flower.

2. The effect of screening on thrips presence

2.1. Laboratory and semi-laboratory tests

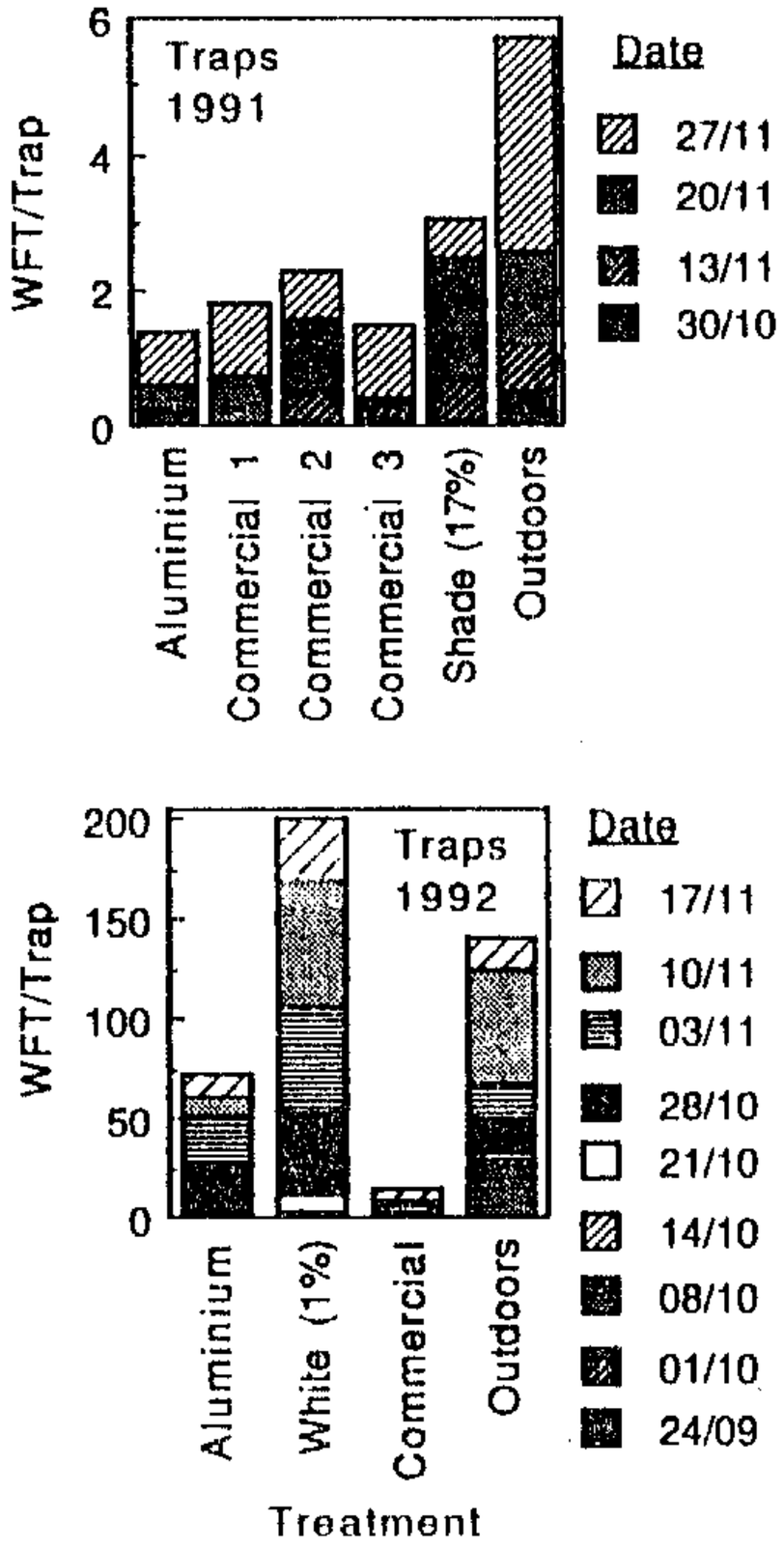
In the field 21.0% of the control penetrated through a screen the hole size of which was 2.18 mm^2 (Table 1, Expt. 1). Commercial 'whitefly-proof' screens, with smaller holes (0.17-0.23 mm^2) reduced thrips penetration only to 11.8-19.7% of the control. In the laboratory, over 90% of the thrips penetrated through the commercial screen No. 1. The penetration rates were somewhat smaller (68.4-88.0%) when the hole size was further reduced (Table 1, Expt. 2). Whereas, in the field only 3.2-6.5% of the thrips penetrated through the same screens. The screen holes differed in their general size but also in their XxY mesh and both characters seem to be important in thrips penetration. On the upper sticky surface of a screened yellow trap 47% of the control were caught *i.e.* although the thrips could detect the yellow trap through the screen, still about half of tits population was repelled visually by the screen. Hence, the screens may have a combined mechanical/visual effect.

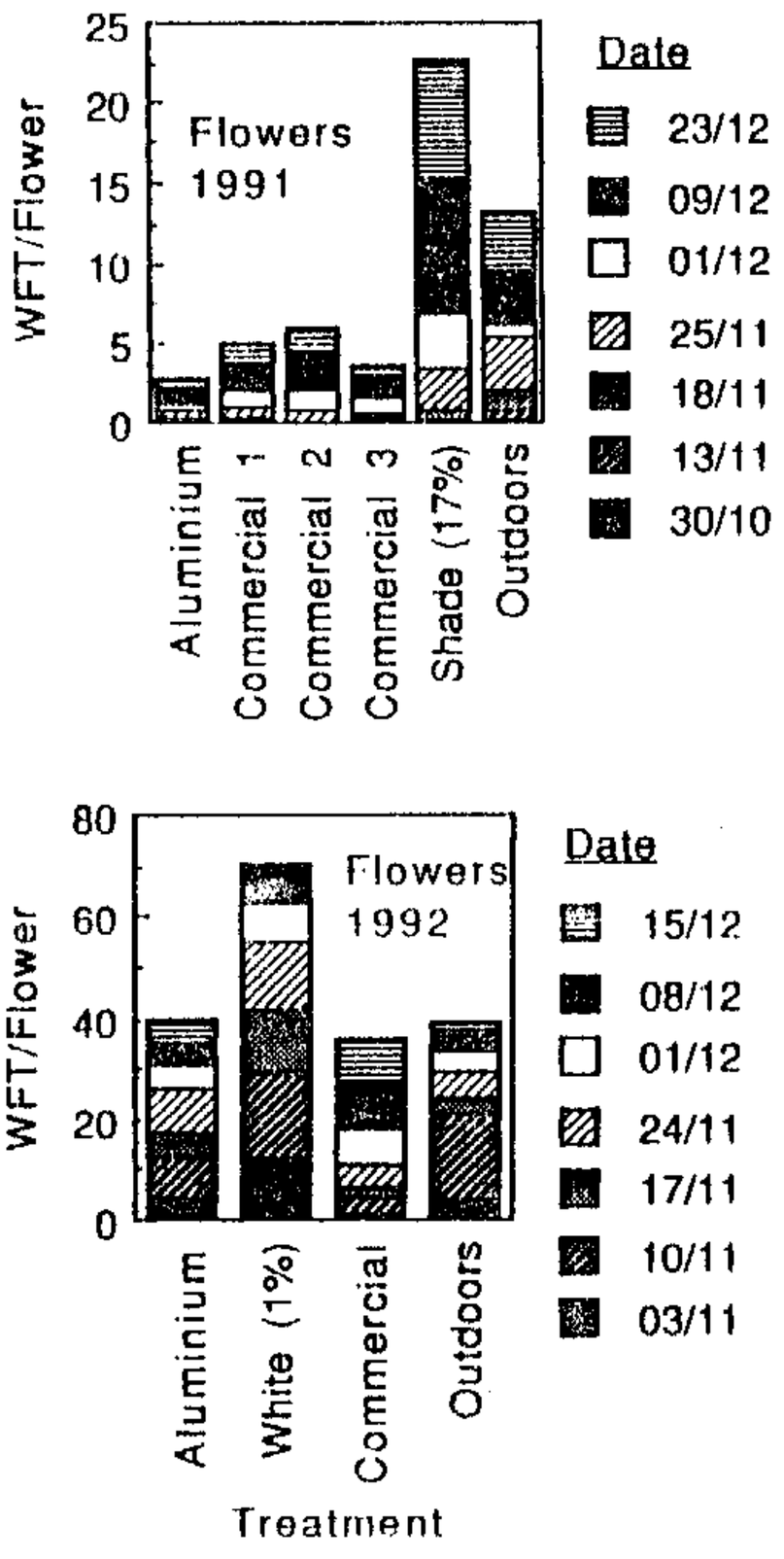
Table 1. Thrips penetration (% of control) through various screens in the laboratory and in the field

Treatment	Screen Mesh (X x Y)	Hole size mm^2	Thrips - % of control Testing site: Laboratory	Field
Experiment 1:				
Shade screen (17% shade)	14x16	2.18	-	21.0
Commercial screen No. 1	28x58	0.17	-	19.7
Commercial screen No. 2	25x50	0.23	-	15.8
Commercial screen No. 3	25x54	0.20	-	11.8
Commercial screen No. 1+Glue			-	47/0*
Unscreened Yellow Control	---	--	-	100
Experiment 2:				
Commercial screen	28x58	0.17	93.7	5.7
Experimental screen 1	66x66	0.15	68.4	4.3
Experimental screen 2	46x61	0.14	88.0	6.5
Experimental screen 3	36x76	0.07	69.1	3.2
Unscreened control	----	---	100	100

* thrips were found sticking to the glue on the external surface of the screen, and none passed through it into the trap.

Fig. 1. Appearance of the western flower thrips in screened tunnels at Besor





2.2. WFT in screened high tunnels

In 1991, there were fewer WFT in traps in all screened tunnels than in the unscreened outdoor control (Fig. 1). Comparing among the screens, more thrips were trapped under the screen with the bigger holes (2.18 mm^2) than under the commercial screens or even under the aluminium-colored shading net. A similar trend was found on the flowers, with the exception that under the screen with hole of 2.18 mm^2, more thrips were found than in any other treatment.

In 1992 the experiment lasted almost 2 months (24/9-17/11) compared with less than a month (30/10-27/11) in 1991 (Fig. 1). Accordingly, the total number of trapped WFT was higher in 1992. Nevertheless, the trapped thrips population was remarkably lower under the aluminium and commercial screens than in the unscreened control. The highest numbers of WFT were trapped under the white shading net. Accordingly were the numbers of WFT in the flowers also lower under the aluminium and commercial screens than under the white shading net. The low numbers found in outdoor flowers were probably due to the unprotected, less favorable conditions. In general, screens may reduce the WFT populations, not only in traps but also in the crop, but by themselves they are not a sufficiently effective control measure. Nevertheless, the reduction in WFT pressure on the crop may increase the efficiency of complementary control measures, like biocontrol.

3. Effect of the trap background color on trapping

The number of trapped WFT was strongly influenced by the background (Table 2). When the traps were placed on a shading net of aluminium color, on a piece of commercial screen, or on a transparent plastic sheet, significantly fewer thrips were caught (3.3-5.0%), compared with traps placed on the bare soil (control), and on a piece of 1.5% or 2.5% white shading net. Hence, some backgrounds reduced WFT trapping. These results may explain the relatively scarce appearance of WFT in the high tunnels covered by the commercial whitefly-proof screens and aluminium colored shading net compared with the relatively high population under the white-colored shading net cover (Fig. 1).

Table 2. Mean number of trapped WFT in blue traps placed on various backgrounds or on bare soil (control).

Treatment	Mean WFT/Trap
Aluminium (shading net)	3.3 a
Commercial screen	4.3 a
Transparent plastic sheet	5.0 a
Control (bare soil)	17.3 b
White (1.5%) shading net	18.5 b
White (2.5%) shading net	22.5 b

Figures followed by different letters differ significantly at p=0.05.

In Conclusion:

The WFT is affected by the screen mesh but it is also strongly affected by colors. Thus the population can be reduced very much by using a proper screen. A reduction in population density will obviously contribute to the control of this pest and will make complementary control measures, like biocontrol, more efficient.

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