Project Title:	Control of sciarid fly during ornamental plant propagation
Final report:	Final report 1998
Project Number:	PC 147
Project Leader:	Dr J H Buxton ADAS Rosemaund Preston Wynne Hereford HR1 3PG
Location of Work:	Commercial nurseries in Warwickshire
Project Co-ordinator:	Mr Andrew Fuller
Date commenced:	June 1997
Date completed:	October 1998
Key Words:	Sciarid fly, propagation, biological and chemical control, Poinsettia, Intercept 5GR, suSCon Indigo 10G

CONTENTS

A. PRACTICAL SECTION FOR GROWERS

Background and commercial objectives

The quality standards for growers of ornamentals continue to increase; and yet the major multiples dictate that the amount of pesticide used on the crop is kept to a minimum; this may lead to difficulties in achieving quality standards for pest and disease control.

In these circumstances, measures that target pesticides effectively, at low doses, can be invaluable to growers. The pest targeted by this work is the sciarid fly or fungus gnat, which is found to some degree on all nurseries. High levels of this fly can be a nuisance both to workers on the nursery, and to buyers of the finished product, while the larvae can eat the roots of a range of plants, especially young plants grown from seed or cuttings.

In addition to the direct damage caused, both adult flies and larvae have been shown to transmit or spread a range of plant pathogens; e.g. *Pythium, Phytophthora and Thielaviopsis.* Therefore the control of sciarid fly becomes even more important, because as well as improving rooting, disease transmission can be reduced.

Poinsettias have always been very susceptible to sciarid attack and the cutting can be killed by larvae tunnelling into the stem. This plant was used as an "indicator" plant in the trials; but the results are equally applicable to any subject propagated by cuttings.

In this work various insecticide treatments were tested for sciarid control, under commercial conditions, with cuttings rooted in Elle Pots or Gro-plugs.

Summary of results

Commercial propagators normally root cuttings under mist, with bottom heat. The resulting warm, moist conditions are ideal for sciarid flies, with the result that the pest pressure tends to increase over the season, favoured by warm summer temperatures.

At both poinsettia propagation sites, the levels of sciarid attack increased over the season (from June to August) in 1998. This was exactly the same trend as was seen the previous year, and occurred despite regular applications of nematodes. *Steinernema feltiae,* as Entonem or Nemasys was used by the grower at both sites.

Incorporation of either suSCon Indigo 10G at 500gm/m^3, (controlled release starch-based microgranules containing 10% chlorpyrifos) or Intercept 5GR (granules containing 5% Imidacloprid) at 280 gm/m^3 into Elle pots (Vapo-Gro Ltd) or Gro plugs (Roffey Limited) at plug formation gave outstanding control of sciarid fly at the two sites. The amount of granules needed per plug was extremely small (less than 0.2g/plug) and yet, because the active ingredient was placed exactly where larvae would hatch; was extremely effective.

The cost to growers would be minimal, especially compared with the cost and labour of applying nematodes on a regular basis.

Both insecticide treatments gave significant increases in shoot and root weight compared with untreated plugs, and also gave highly significant reductions in the numbers of sciarid flies emerging from the plugs after 2 weeks incubation in the greenhouse.

It is concluded that, when either of these granular insecticides become commercially available (Intercept 5GR is available now, but only in Scotts composts), growers should consider specifying that their Poinsettia cuttings are grown in treated plugs. This would ensure that quality is maintained and losses from sciarid fly kept to a minimum, at little extra cost.

Action points for growers

- Sciarid fly continues to be a difficult problem in plant propagation, especially for poinsettias. Growers should always ask their propagator what active steps have been taken to control sciarid in the cuttings.
- The results of this work showed that incorporation of insecticide granules into the plug gave excellent sciarid control for minimal cost; with concommittant increases in root and shoot weight of cuttings. Growers could ask their supplier to incorporate such products, when they become available.
- It is likely that the results can be extrapolated to other subjects, e.g. begonia, that can be slow-rooting and are susceptible to attack by sciarid fly.

B. SCIENCE SECTION

Introduction

There has been a marked trend over the last 5 years in the production of ornamentals from cuttings (i.e. vegetative propagation) especially with patio plant subjects.

Most of these cuttings are rooted in a plug of some sort, either a jiffy plug, an Elle pot (paper pot system), or a glue-plug. Elle pots have increased in popularity, especially with the larger propagators, because they can purchase their own Elle pot machine, and thus have total control over plug production. The compost used is normally a special mix from Vapo-Gro Ltd, containing peat, perlite, and a small amount of fertilizer. The compost is n-fixed in a hopper and then extruded, wrapped in a special paper tube, heat sealed, and then cut into plugs. The glue-plug system is completely different in that a special liquid polymer is added to a peat compost n-fix, and the resultant slurry poured into plug trays. When "cured", there is sufficient airfilled porosity for root development, and the polymer 'binds' the compost together.

The benefit of both these types of plug production is that it enables insecticide (or other products) to be mixed in evenly <u>before</u> the plug is formed.

With the jiffy plug, the product is delivered in a dehydrated form, and the plug swells up when wetted, ready for sticking. At present, it is not possible to incorporate insecticide granules into jiffy plugs, as extreme heat and pressure is used in plug formation, which . would tend to deactivate the insecticide. Therefore it was not possible to work with jiffy plugs in these trials; but Elle pots and glue plugs were successfully used.

The cuttings are normally rooted under mist, or fleece, using bottom heat and rooting temperatures of 15-21°C, depending on the subject. These environmental conditions (high humidity, warm temperatures) are ideal for the development and multiplication of sciarid fly *(Bradysia* spp.) on the nursery.

Poinsettias are amongst the most susceptible plants to attack from this pest, because the cuttings are hollow, larvae can tunnel right inside the stem and kill the cutting. Other species, such as begonias, fuchsias, etc. are unlikely to be killed by sciarid larvae, but their feeding on the roots increases production times, and lowers quality of the cutting. In addition, it has been shown that feeding by the larvae on fine roots allows the entry of *Pythium* or other pathogenic fungi, which can either kill the cutting, or reduce quality.

Therefore, good control of sciarid fly during vegetative propagation is very important. Most growers rely on a combination of control methods, including hygiene, chemical control, and biological controls. However, good control can be very difficult to achieve. Because the mist constantly "flushes" the plug, efficacy and persistence of nematodes, or insecticides, may be reduced, and in summer, high temperatures compress the life cycle of the pest, leading to a rapid build-up in population. In addition, high temperatures (above 25°C) significantly reduce the effectiveness of the nematode commonly used by *growers (Steinernema feltiae)* Entonem or Nemasys.

The aim of the second year of the project was to determine the effectiveness of granular insecticides, mixed into the compost before plug formation. The granular products were chosen for their ability to release small amounts of active ingredient over several weeks; thus providing prolonged protection. In addition, it was planned to determine the effect of insecticide treatment on root and shoot weights, to ensure that there was no phytotoxic effect on the cuttings.

MATERIALS AND METHODS

The trials took place at two nurseries, producing poinsettias from cuttings stuck between mid-June and end of August. At both sites, cuttings were rooted under overhead misting systems, and rooting temperatures of around 21°C. The trials took place amongst the commercially propagated crop; no inoculations with sciarid fly eggs were carried out, as a natural infestation of the pest occurred at both sites.

Treatments

1. Untreated

2. suSCon Indigo 10G (slow-release starch based microgranules containing 10% chlorpyrifos) @ 500 g/m^3 compost

3. Intercept 5GR (granules containing 5% imidacloprid) @ 280 g/m^3 compost

These insecticides were mixed into the relevant compost, and then Elle pots or Gro-plugs were formed, at Vapo-Gro (Newhaven, Sussex) or Roffey Ltd. (Bournemouth, Hants), respectively. The co-operation of both those companies is gratefully acknowledged.

Each treatment was replicated 4 times (each tray of plugs was one replicate) and the experiment arranged in a standard Randomised block design on the bench. The trial was repeated during the season at two grower sites.

The plugs were initially wetted up and then poinsettia cuttings inserted and maintained under normal mist settings: No fleece cover was used at any time. The poinsettia variety Sonora was used in all 4 trials. (2 trials each at 2 sites carried out in 1998).

Additional treatments (observation plots only)

At one site, the predatory mite *Hypoaspis miles* was evaluated, compared with routine applications of Entonem (insect parasitic nematodes), using poinsettia cuttings rooted in Jiffy plugs. *Hypoaspis* was evaluated at the following timings:

a) At sticking, and 7 days later
b) 7 and 14 days after sticking

Hypoaspis was applied in a peat/perlite mix over the cuttings, using a shaker bottle, to apply approximately 1,000 mites per m^2. Because the mites were so mobile, plots were not replicated but large plots were surrounded by yellow sticky traps, to prevent emigration of the predators. Plate 1 shows the *Hypoaspis* treated plot on the nursery.

Assessments

All trials were checked for visual differences during rooting, but crop vigour was not scored. In the last 2 trials, numbers of sciarid flies had built up on the nursery and marked visual differences could be seen between untreated plug trays, and those treated suSCon Indigo or Intercept. (See Plate 2 in Appendix).

Sticking dates and assessment dates 1998

SITE	TRIAL	STICKING DATE	ASSESSMENT DATE
1	1	10/7	22/8
2	1	14n	24/8
1	2	28/7	2518
2	2	27/7	25/8

Rooting normally took just over 3 weeks; when well rooted, 12 cuttings per plug tray were taken at random, and placed in polystyrene boxes, covered in fine mesh cloth, with a yellow sticky trap placed horizontally above the cuttings. These were incubated, on the nursery for a further 2 weeks to enable all adult flies to emerge and get caught on the sticky traps. Counts were then made of the number of flies per trap (see plate5). At this date a further 5 plugs per tray (20 per treatment) were taken back to the laboratory for fresh shoot weight and dry root weight assessments.

Fresh shoot weights were determined by cutting the stem at compost level and weighing each cutting separately. The same was done for the roots, after drying the plugs at 50°C for 48 hours. No attempt was made to wash the compost from the roots; this would have removed most of the fine roots, (especially with the glue-plug system) and so the dry root weights quoted are the combined weights of roots and plug.

RESULTS

The results of the fresh foliage weights, and weights of the plant roots and plugs, are shown in Tables 1 to 4 for the 4 trials.

Means followed by the same letter in each of the Tables are not significantly different. (Analysis of variance, followed by Duncans New Multiple Range Test).

The first trial at Site 1 had a low incidence of sciarid fly (see Table 5 for details of fly counts); and there were no significant differences between foliage shoot weights of one type of plug in this trial. However, it is important to point out that because the Elle pot and Gro-plug rooting systems were completely different, comparisons should only be made between different treatment within one plug type; not between plug types - even with the low level of sciarid fly damage, the root weights in Elle pots treated with Intercept were increased significantly.

In general, plants grown in Gro-plugs were larger and had heavier roots than those in Elle pots; but this is not surprising when it is considered that the volume of compost in the Elle pot was only about 55 ml; whereas in the Gro-Plug it was approximately 70 ml.

The level of sciarid fly was higher at Site 2 (Tables 2 and 4) and the response to insecticide treatment was dramatic. Highly significant increases in foliage weight and root weights were seen with both Elle pot and Gro-plug systems. At the time of assessment, visual differences could easily be seen on the bench, with untreated plug trays standing out as of poor vigour, with many plant losses (Plate 2).

The second trial at Site 1 was stuck 3 weeks later than the first, and by this time, numbers of flies had built-up. This resulted in very large increases in foliage weight from both insecticide granules, and slightly less, (but still statistically significant), increases in root weights. Pictures of Elle pots and Gro-plugs are shown in Plates 3 and 4 respectively.

This trend was continued with the second trial at Site 2; although here plants grown in Gro-plugs did not respond to treatment as dramatically as those grown in Elle plugs.

The results of the counts of sciarid flies caught on yellow sticky traps are summarised for each trial in Table 5. These counts were very successful, in that the system used allowed natural emergence of the flies from plugs, and the great majority were caught on the trap. Interestingly, more flies were caught on the upper surface of the trap than the lower (i.e. the side directly above the plugs). This system, which is cheap to assemble and reliable, can be recommended for any trial using plugs or other propagation system. By using one cage per replicate, statistical analysis of the counts was possible; means followed by the same letter are not significantly different (Duncans New Multiple Range Test).

An illustration of the cage system used is shown in Plate 5, in the Appendix.

TABLE 1

HDC SCIARID TRIALS, 1998

Weights of Poinsettia cuttings*
Site 1/Trial I

Stuck 10.7.98
Assessed 22.8.98 (cv Sonora)

TREATMENT		MEAN FOLIAGE WEIGHT (g)	DIFFERENCE FROM UNTREATED	MEAN ROOT WEIGHT (g)	DIFFERENCE FROM UNTREATED
Elle Pots	Untreated	5.49 a	0	4.50 a	-
	suSCon Indigo 10G	4.97 a	-10%	4.71 a	+5%
	Intercept 5GR	5.68 ab	+3%	5.40 b	+20%
Gro-Plugs	Untreated	6.26 b	0	7.60 c	-
	suSCon Indigo 10G	6.07 ab	-3%	7.90 c	+4%
	Intercept 5GR	5.63 ab	-10%	7.30 c	-4%
SE(±)		0.36	-	0.13	-

* Means followed by the same letter are not significantly different ($P<0.05$); Duncans new multiple range test.

TABLE 2

HDC SCIARID TRIALS, 1998

Weights of Poinsettia cuttings*
Site 2/Trial 1

Stuck 14/7/98
Assessed 24/8/98 (variety Sonora)

TREATMENT		MEAN FOLIAGE WEIGHT (g)	DIFFERENCE FROM UNTREATED	MEAN ROOT WEIGHT (g)	DIFFERENCE FROM CONTROLS
Elle Pots	Untreated	2.40 a	0	4.95 a	-
	suSCon Indigo 10G	3.75 b	+56%	5.30 a	+7%
	Intercept 5GR	3.33 a	+38%	5.90 b	+20%
Gro-Plugs	Untreated	2.68 a	0	7.10 c	-
	suSCon Indigo 10G	4.39 b	+63%	8.01 d	+13%
	Intercept 5GR	3.50 a	+31%	7.50 c	-6%
SE(±)		0.43	-	0.15	-

* Means followed by the same letter are not significantly different; ($p<0.05$), Duncans new multiple range test.

TABLE 3

Weights of Poinsettia cuttings*
Site 1/Trial II

Stuck 28/7/98
Assessed 25/8/98

TREATMENT		MEAN FOLIAGE WEIGHT (g)	DIFFERENCE FROM UNTREATED	MEAN ROOT WEIGHT (g)	DIFFERENCE FROM CONTROLS
Elle Pots	Untreated	1.95 a	0	4.84 a	-
	suSCon Indigo 10G	3.35 b	+71%	5.48 b	+10%
	Intercept 5GR	2.84 b	+46%	5.48 b	+13%
Gro-Plugs	Untreated	2.26 a	0	7.22 c	-
	suSCon Indigo 10G	3.27 b	+45%	7.86 d	+9%
	Intercept 5GR	3.05 b	+35%	7.51 c	+4%
SE(±)		0.27	-	0.11	-

* Means followed by the same letter are not significantly different ($P<0.05$). Duncans new multiple range test.

TABLE 4

Weights of Poinsettia cuttings*
Site 2/Trial II

Stuck 27/7/98
Assessed 25/8/98

TREATMENT		MEAN FOLIAGE WEIGHT (g)	DIFFERENCE FROM UNTREATED	MEAN ROOT WEIGHT (g)	DIFFERENCE FROM CONTROLS
Elle Pots	Untreated	1.36 a	0	4.60 a	-
	suSCon Indigo 10G	2.49 b	+83%	5.02 b	+9%
	Intercept 5GR	2.49 b	+83%	5.06 b	+11%
Gro-Plugs	Untreated	2.58 b	0	6.96 c	-
	suSCon Indigo 10G	2.89 b	-12%	7.40 d	+6%
	Intercept 5GR	2.82 b	+10%	7.38 d	+6%
SE(±)		0.29	-	0.19	-

* Means followed by the same letter are not significantly different ($P<0.05$). Duncan's new multiple range test.

TABLE 5

Counts of sciarid flies in the trials*

TREATMENT		Mean number of flies per trap (from 10 plugs)			Overall mean	Overall % reduction
		Site 2 (I)	Site 1 (II)	Site 2 (II)		
Elle Pots	Untreated	16.3 a	26.0 a	63.0 a	35.1	-
	suSCon Indigo 10G	0.8 b	14.8 b	7.8 b	7.8	82
	Intercept 5GR	2.3 b	3.3 c	1.3 b	2.3	94
Gro Plugs	Untreated	7.5 b	14.3 b	13.8 b	11.9	-
	suSCon Indigo 10G	2.0 b	7.3 bc	2.5 b	3.9	75
	Intercept 5GR	0.5 b	3.8 c	1.0 b	1.8	87
SE (±)		2.92	3.56	6.66	-	-

* A count was not made in Trial 1, Site I: so overall means are from 3 trials only.

The results of sciarid fly counts on the sticky traps showed the following:

a) In general, (without insecticide treatment) poinsettia cuttings grown in Elle pots were attacked significantly more than plants grown in Gro-plugs. This may be due to the nature of the growing medium; the compost in Elle pots is loose and friable, whereas in the Gro-plug system, the compost is "glued" together, and this may make it harder for sciarid larvae to penetrate the plug and move around to feed on roots and stem.

b) The number of flies emerging on untreated plugs increased during the trials period; especially with Elle pots. The maximum number caught represented a mean of 6.3 flies per plug; so it is not surprising that this level of pest caused significant plant damage. These results illustrate how severe sciarid fly can be in propagation, and how important good control is to plant quality.

c) The levels of control from both the chlorpyrifos-based granule and the Imidacloprid based granule were excellent at all sites.

An overall summary of the foliage and root/plug weights is shown in Table 6.

TABLE 6

OVERALL SUMMARY OF SCIARID TRIALS

(means from 4 trials)

TREATMENT		MEAN SCIARID FLIES/10 PLUGS	MEAN SHOOT WEIGHT (g)	DIFFERENCE FROM CONTROL	MEAN ROOT WEIGHTS (g)	DIFFERENCE FROM CONTROL
Elle Pots	Untreated	35	2.80	-	4.72	-
	suSCon Indigo 10G	8	3.64	+30	5.09	+8
	Intercept 5GR	2	3.59	+28	5.46	+16
Gro-Plugs	Untreated	12	3.45	-	7.22	-
	suSCon Indigo 10G	4	4.16	+21	7.79	+8
	Intercept 5GR	2	3.75	+9	7.53	+5

These figures confirm the trend shown in the individual trials, and show clearly the large increase in foliage weight in plants grown in Elle pots, with less of a response from plants in Gro-plugs. Levels of response of root growth to insecticide treatment were less than that from the foliage, but still significant. Both these increases clearly relate to effective control of sciarid fly larvae in the plug; the responses show how important control of this pest is at the propagation stage.

Effect of the predatory mite *Hypoaspis* (Observation trials only)

Because of the highly mobile nature of this predator, it was not possible to evaluate it using replicated small plots. At Site 2 only, therefore, *Hypoaspis* was applied to a large unreplicated plot, which was surrounded by sticky traps, to prevent egress of the mites, *Hypoaspis* was applied to poinsettia cuttings in Jiffy plugs at the following timings:

a) 0 and 7 days after sticking
b) 7 and 14 days after sticking.

Counts of sciarid flies emerging from treated plugs were made in the normal way, and compared with jiffy plugs which had received at least 2 applications of nematodes (Entonem) as part of the growers normal control programme. No untreated jiffy's were used in this comparison. The observations are shown in Table 7.

TABLE 7

Control of sciarid flies in jiffy plugs

Treatment	Mean number of flies/10 plugs
Hypoaspis 0 & 7 days after sticking	14.0
Nematodes	3.8
Hypoaspis 7 & 14 days after sticking	9.3
Nematodes	15.3

Overall mean: (*Hypoaspis*) 11.7
Overall mean: (Nematodes) 9.6

Overall counts showed that the *Steinernemia feltiae* nematode treatments used by the grower at Site 2 (Entonem) gave slightly better control than the *Hypoaspis*. However, it should be borne in mind that this was not a fully replicated trial, and no untreated jiffy plugs were used. Nevertheless, dissection of jiffy plugs that had been treated with *Hypoaspis* showed, on several occasions, that the mites could penetrate right inside the plug, and were seen at the base of the cutting, which is exactly where the worst sciarid damage can be caused.

DISCUSSION

Commercial propagators of crops such as poinsettias stick their cuttings in sequential fashion over a long period, in this case from mid June to end of August. Most glasshouses used for this purpose are cleaned and sterilised before the start of the season; so the population of sciarid flies at this time is usually low.

However, the results from the 1998 Season (and the 1997 season) with these trials have shown clearly that the level of sciarid tends to build up over the summer, often to very damaging levels, despite the growers best efforts.

The continuous mist used in propagation tends to leach out any insecticide or nematode applied as a drench, so repeated applications are necessary, which is both time-consuming and expensive.

This was the reason why, in Year 2 trials, insecticide slow-release granules were incorporated in the plug compost. These materials are designed to release small amounts of active ingredient over several months; but it was not known whether, at the rates used, this would be sufficient to control sciarid fly.

Another possible problem was the density, or distribution of granules, in the plug. Experience with other pests has shown that if distribution is uneven, control can be variable.

In the event, it has been shown conclusively that, at the rates used, excellent (but not total) control of sciarid was given by both the chlorpyrifos and imidacloprid based granules.

In conditions of very heavy sciarid attack, it is possible that higher rates of granules could give a higher level of control, but there could be a risk of phytotoxicity.

However, the assessments done for fresh shoot weight and dry root (plug weight) have shown clearly that both insecticide granules gave very significant increases in weight of foliage, and significant increases in root/plug weight. This resulted from prevention of attack by the majority of sciarid larvae.

The mode of action of the granules is assumed to be as a point source of the active ingredient; which diffuses out when the plug is wetted up. The effect of temperature upon the speed of this process is not known; but plug temperatures in this series of trials were consistently above 21°C, and sometimes as high as 30°C for short periods.

It would be interesting to evaluate the effect of the granule treatments on plant growth in the absence of sciarids; but in practice this would be difficult to achieve.

Poinsettias have been used as the test plant for both years in these trials; they are very susceptible to sciarid fly damage; but so are begonias, fuschias, and many other subjects rooted from cuttings.

It is not known whether treatment of the plugs with insecticide granules would result in such high increases in foliage weight in other subjects; before widespread usage this should be tested on important subjects such as begonia.

Nevertheless, these positive trial results have shown that a very small amount (approximately 0.2 gm/plug) of granules can give excellent sciarid control. In terms of cost, this would be minimised, and of course, no labour is needed in time-consuming drenches. Moreover, plugs so treated would be despatched to customers with "in-built" protection against sciarid fly, as presumably the activity would persist for several months.

In environmental terms, this is a highly efficient use of pesticides, with little or no runoff, and a concentration of the active ingredient exactly at the target.

Before widespread use by the industry, however, Imidacloprid (Intercept 5GR) would have to be available separately as a granular product. At present, it is only available ready mixed in Scotts composts. Also, the slow release formulation of Chlorpyrifos (suSCon Ind igo 10G) is not yet Approved; but it is hoped that on-label approval for ornamentals will be gained in mid 1999.

Future work should widen the range of plants treated with granules in the plug. Discussions should also be entered into with Jiffy Limited, to see if it is feasible to mix the granules into their plugs, without loss of efficacy.

In addition, further work would be justified examining the influence of treated plugs on poinsettia growth after potting up. By following the establishment of treated plugs compared with untreated plugs, with or without further sciarid treatment, the most cost effective control regimes could be evaluated. If treated plugs could be potted on into 1 or 2 litre pots, with no need for further treatments, or fewer treatments than normal, this would save growers significant time and money.

CONCLUSIONS

1. Sciarid fly attack tends to increase over the sticking period of poinsettias.

2. Elle pots tend to be more susceptible to Sciarid fly attack than do Gro-plugs.

3. Incorporation of Intercept 5GR, or suSCon Indigo 10G granules prior to plug formation, gave excellent, (but not total) control of Sciarids even in high levels of attack.

4. Control of Sciarid led to very large increases in cutting fresh weights, and moderate increases in root weights.

5. Quality of cuttings (although not scored) was much improved by insecticide treatment.

ACKNOWLEDGEMENTS

Thanks are due to the staff of the two Nurseries involved in this trial who gave freely of their time and resources to help with the trials work.

Thanks also to staff at Vapogro and Roffey Limited, for supply of the plugs and Crop Care Limited and Scotts Company Limited for supply of granular insecticides.

APPENDIX

Colour Plates

Plate 1. View of *Hypoaspis* treated plot

Plate 2. General view of trial: untreated plug tray marked with a red spot

Plate 3. Comparison between untreated and treated Elle pots

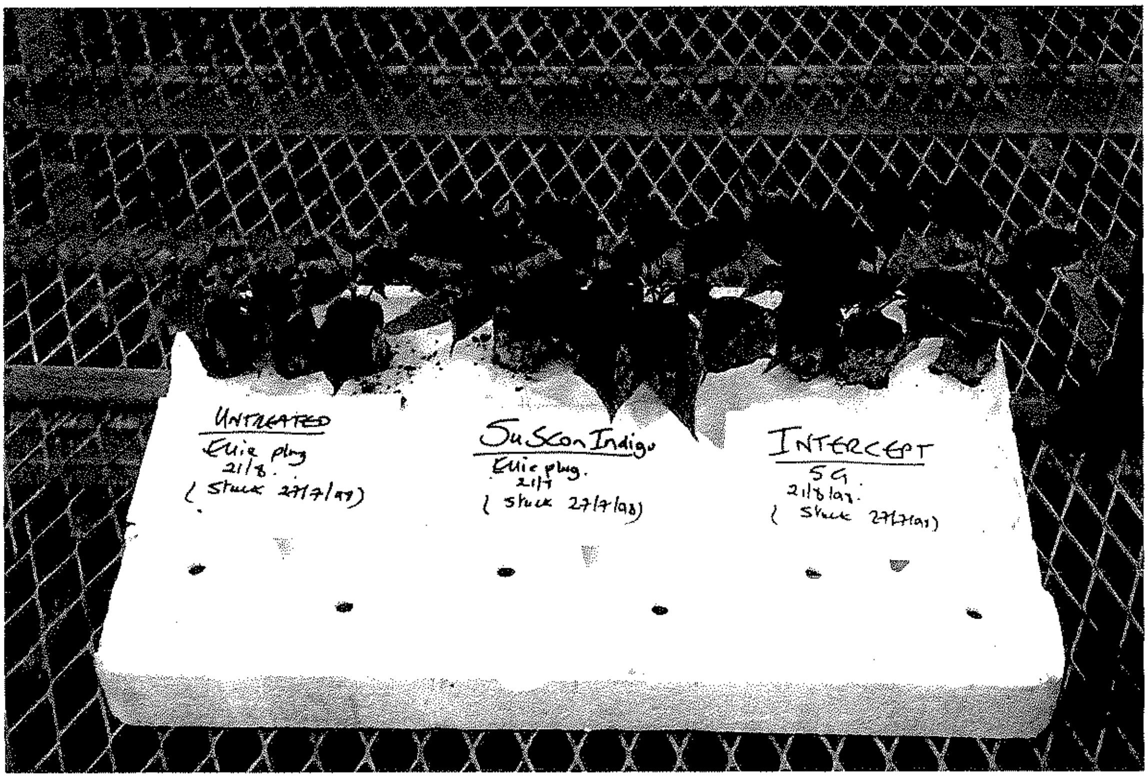

Plate 4. Comparison between untreated and treated Groplugs

Plate 5. General view of Sciarid fly emergence cages and traps