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PRELIMINARY FINDINGS ON THE EFFICACY OF THREE HOUSEHOLD DISINFECTANTS TO SUPPRESS ANTHURIUM DECLINE

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ABSTRACT

Radopholus similis is the primary cause of anthurium (*Anthurium andraeanum*) "root rot and decline". Phenamiphos is the most effective nematicide to suppress the nematode and forestall decline; ethoprop is a good substitute, while oxamyl and carbofuran are less effective. However, most traditional nematicides are becoming unavailable to growers, for various reasons. Dettol, Jeyes Fluid and bleach are proving very efficacious in disinfesting soil and some plant materials of noxious nematodes. These household disinfectants and cadusafos were compared with phenamiphos for control of *R. similis* and decline in anthurium. The treatments or water were initially applied to 12-week old plants, then every five months. Leaf height, width and number, and *R. similis* populations in roots were measured initially, then at five, 10, and 14 months. After 14 months, leaves of the Dettol-, Jeyes Fluid- and bleach-treated plants were shorter, and somewhat smaller than at the outset. These and the control plants put on approximately 50% more leaves, while the phenamiphos- and cadusafos-treated plants almost doubled and tripled leaf numbers respectively. Leaves of phenamiphos-treated plants were marginally shorter than at the outset, but laminae were somewhat larger, while those of the cadusafos-treated plants were approximately 20% taller, and 30% larger. Only the cadusafos treatment suppressed *R. similis*. There is evidence of injury to plants treated with the household disinfectants.

INTRODUCTION

At every anthurium holding where observations have been made, a disorder called "root rot and decline" has been noticed. *Radopholus similis* has been associated with every instance of decline. Affected plants develop slowly, leaves gradually become off-colour, yellow, then dry, starting with the oldest. Early on, a light brown to chocolate-coloured rot in spots is noticed on roots. In time, as the spots merge, most or all of the root system is rotted, steles are exposed as the rotted cortexes slough off, and the root system becomes sparse and non-functional. High numbers of the nematode might be recovered from growing media, or infested roots before rotting becomes extreme. The plants themselves tend to become prostrate and are easily pulled from the beds. The stunted, unthrifty plants bear few blooms which are mainly of the smaller grades, lack lustre and also tend to be prostrate. Affected beds soon become sparse of plants, as many die, are weedy and need to be remade and replanted earlier than normal. Hutton *et al.* (1980) first recorded the association of *R. similis* with anthurium in Jamaica in 1974. The fungus Pythium *splendens* also causes rotting of anthurium roots in Jamaica (Leather, 1967; Naylor, 1984), and elsewhere.

Investigations have virtually proven *R. similis* to be the cause of anthurium decline. Nematicide treatments before and/or after planting anthurium infested with both *R. similis* and *P. splendens* resulted in more vigourous and bigger plants having abundant root systems with little rotting, and which suckered adequately. However, the greatest continuing economic benefits of the most effective treatments were increased production in quality and quantity of blooms, and that treated beds were long-lived, compared with untreated ones (Hutton, 1989 and 1990). Fungicide treatments alone were not significantly effective, suggesting that *R. similis* was the more important of the two organisms in the disease complex (Hutton *et al.*, 1980; Hutton and Edman, 1993). Both *R. similis* and *P. splendens* are associated with anthurium decline in Hawaii where the nematode is also considered to be the primary pathogen (Higaki *et al.*, 1979).

Many pesticides, including several nematicides, are becoming more unavailable worldwide, because of high toxicity, harm to non-target plants and animals, environmental contamination, and high costs. In Jamaica, the nematicidal effectiveness of several "safe" chemicals, including household disinfectants and certain plant extracts

or residues is being investigated in the search for alternatives to traditional nematicides. Crude pimento oil or the isoeugenol fraction, bleach, Dettol antiseptic, Phisohex and Jeyes Fluid, household disinfectants, were as lethal as oxamyl, a nematicide/insecticide, to several plant and non-parasitic nematode *in vitro* (Hutton, 1996). Bleach, Dettol antiseptic and Jeyes Fluid were as or more effective, compared with as oxamyl, to disinfest soil of *Meloidogyne incognita, Rotylenchulus reniformis* and other plant nematodes, and yam planting material of *Pratylenchus coffeae* (Hutton, 1997*a* and 1997*b*).

This trial was carried out to determine the effectiveness of bleach, Dettol antiseptic or Jeyes Fluid, compared with phenamiphos or cadusafos, a nematicide recently introduced into Jamaica, to suppress *R. similis* and forestall anthurium decline.

MATERIALS AND METHODS

Beds which had been rebuilt and replanted three months earlier were used for the trial. The six treatments, Jeyes Fluid (a blend of high boiling tar acids and washed neutral oil, solubilised in vegetable soap), bleach (NaOCl), Dettol antiseptic (chloroxylenol), phenamiphos (ethyl 3-methyl-4-(methylthio) phenyl(1-methylethyl) phosphoamidate) G, cadusafos (O-ethyl S,S-di-sec-butyl phosphorodithioate) G, and water (the control), were arranged in an Alpha design where the control and phenamiphos replications were doubled. Three beds were over 47.0 m long, and 0.86, 0.91 or 1.30 m wide and accommodated five replications; a 24.0-m long by 0.8-m wide bed accommodated the sixth. Each plot was 3.0 m long by the bed width.

The liquids (Jeyes Fluid, bleach or Dettol) were diluted in water and applied over the plots, while the granular nematicides were sprinkled onto the coir/coconut husk growing medium around the cv. Kaumana plants. The beds were sprinkler-irrigated to about 1 cm after the treatments were applied. The treatments were applied at the outset and every five months. Initially, six plants per plot were tagged. The tallest leaf, width of the two largest leaves and number of leaves on these plants were measured initially, and five, 10 and 14 months after. Root samples were taken from five untagged plants per plot at the outset, and at five, 10 and 14 months. *R. similis* was extracted from these roots by a modified Baermann funnel technique (Hooper, 1985), and counted. All data were subjected to analysis of variance.

Plants were grown under 70% shade saran at roughly 0.3 m^2 spacing. Beds were given about 1.0 cm of water daily, but this could be made up by rainfall, and supplied with 100 gm of a 7-14-7 fertilizer/5m^2 monthly. Beds were hand weeded and repacked as necessary, but there was no plant replacement. Disease and/or pest control was according to a specially developed schedule.

RESULTS AND DISCUSSION

After 14 months, leaves of anthurium plants treated with water (control), Dettol, bleach or Jeyes Fluid were approximately 20 % shorter than at the outset, while those of phenamiphos-treated plants were marginally shorter and cadusafos-treated plants much taller than initially (Table 1).

Leaves of the bleach- and water-treated plants remained unchanged in size, while leaves of Jeyes Fluid- and Dettol-treated plants were somewhat smaller; phenamiphos-treated laminae were slightly bigger and cadusafos-treated plants had much larger leaves than initially (Table 2). Cadusafos-treated plants put on almost three times as many leaves over the 14-month period, phenamiphos-treated plants put on almost twice as many while water-, Dettol-, and Jeyes Fluid-treated plants put on 50% or so more leaves, and bleach-treated plants approximately 40% more (Table 3). Thus, after 14 months, the cadusafos-treated plants were more rigorous, and these plots stood out from the others, while the plants treated with bleach, Dettol or Jeyes Fluid were unthrifty, some appeared moribund, and several had died, such that these plots already had missing plants. In this trial, the plants did not respond to the phenamiphos treatment as in previous trials where this treatment elicited vigorous plant growth and suckering, and high bloom production (Hutton *et al.*, 1980; Hutton, 1989 and 1990).

Table 1. Anthurium leaf height in a trial to determine the efficacy of three household disinfectants, compared with two traditional nematicides, to suppress *Radopholus similis* and decline of the crop.

Treatments*	Leaf height (cm) at			
	start	5 months	10 months	14 months
CONTROL (water)	34.6[a]	32.5[a]	31.7[a]	28.0[b]
BLEACH 25 l a.i./ha	32.2[a]	29.7[a]	27.1[a]	25.0[a]
DETTOL 20 l a.i./ha	31.0[a]	29.8[a]	27.0[a]	22.1[a]
JEYES FLUID 30 l actual/ha	35.2[a]	35.4[a]	33.4[ab]	28.1[b]
PHENAMIPHOS G 20 kg a.i./ha	33.7[a]	35.8[a]	33.5[ab]	31.0[b]
CADUSAFOS G 30 kg a.i./ha	34.2[a]	38.0[ab]	36.8[abc]	41.7[c]

*Treatments were put on at the outset, then every five months.

[abc] In each column, means followed by different letters are significantly different (p = 0.5).

Table 2. Width of anthurium leaves in a trial to determine the efficacy of three household disinfectants, compared with two traditional nematicides, to suppress *Radopholus similis* and decline of the crop.

Treatments*	Leaf width (cm) at			
	start	5 months	10 months	14 months
CONTROL (water)	10.3[a]	11.2[a]	9.3[a]	10.0[a]
BLEACH 25 l a.i./ha	10.4[a]	10.3[a]	9.0[a]	10.7[ab]
DETTOL 20 l a.i./ha	10.3[a]	10.4[a]	8.3[a]	8.5[a]
JEYES FLUID 30 l actual/ha	10.0[a]	11.5[a]	9.3[a]	9.4[a]
PHENAMIPHOS G 20 kg a.i./ha	10.3[a]	12.1[ab]	10.0[ab]	10.9[ab]
CADUSAFOS G 30 kg a.i./ha	10.4[a]	12.6[ab]	11.7[bc]	13.5[bc]

*Treatments were put on at the outset, then every five months.

[abc] In each column, means followed by different letters are significantly different (p = .5).

The cadusafos treatment held *R. similis* in check, moreso than phenamiphos. *R. similis* populations increased substantially in the bleach-, Dettol-, or Jeyes Fluid-treated plots, and more than ten-fold in the water treatment (Table 4). In previous trials, vigourous top and root growth and substantially reduced anthurium root rotting were associated with suppression of *R. similis* (Hutton *et al.*, 1980; Hutton, 1989 and 1990).

Anthurium plants, especially of the hybrid varieties, are sensitive to several factors (Hussey *et al.*, 1969). In previous trials, DBCP, isozafos or diazinon treatments substantially injured anthurium plants (Hutton, 1989 and 1990; Hutton and Edman, 1993). Symptoms of injury were severely stunted growth, yellowing and unthrifty

appearance, poor production, prostration, decline and eventual death of many plants. In this trial, bleach-, Dettol- and Jeyes Fluid-treated plants are showing these symptoms. It therefore seems unlikely that these disinfectants will find a place in nematode control in this crop. Previous work has shown that judicious use of certain nematicides before or at planting, then at intervals during the anthurium crop, will give effective nematode control. Phenamiphos has proven to be the most efficacious nematicide, and ethoprop a good substitute; carbofuran

Table 3. Number of leaves on anthurium plants in a trial to determine the efficacy of three household disinfectants, compared with two traditional nematicides, to suppress *Radopholus similis* and decline of the crop.

Treatments*	No. of leaves/plant at			
	Start	5 months	10 months	14 months
CONTROL (water)	2.1[a]	1.6[a]	3.9[a]	3.2[a]
BLEACH 25 l a.i./ha	1.9[a]	1.5[a]	3.5[a]	2.6[a]
DETTOL 20 l a.i./ha	1.9[a]	1.4[a]	3.2[a]	2.9[a]
JEYES FLUID 30 l actual/ha	2.2[a]	1.8[a]	4.1[ab]	3.0[a]
PHENAMIPHOS G 20 kg a.i./ha	2.0[a]	1.8[a]	4.6[bc]	3.7[ab]
CADUSAFOS G 30 kg a.i./ha	2.1[a]	2.1[ab]	5.9[cd]	5.9[bc]

*Treatments were put on at the outset, then every five months.
** In each column, means followed by different letters are significantly different (p = 0.5).

Table 4. Numbers of *Radopholus similis* infesting anthurium plant roots in a trial to determine the efficacy of three household disinfectants, compared with two traditional nematicides, to suppress the nematode and decline of the crop.

Treatments*	No. *R. similis*/100 gm root at			
	start	5 months	10 months	14 months
CONTROL (water)	410[a]	930[b]	790[b]	4500[c]
BLEACH 25 l a.i./ha	320[a]	1680[b]	650[b]	1355[b]
DETTOL 20 l a.i./ha	495[a]	670[a]	855[b]	1190[b]
JEYES FLUID 30 l actual/ha	520[a]	570[a]	465[a]	1550[b]
PHENAMIPHOS G 20 kg a.i./ha	850[a]	875[b]	725[b]	1150[b]
CADUSAFOS G 30 kg a.i./ha	485[a]	305[a]	330[a]	370[a]

*Treatments were put on at the outset, then every five months
** In each column, means followed by different letters are significantly different (p = 0.5).

or oxamyl were only moderately effective (Hutton, 1993). However, phenamiphos is not now available in Jamaica, having been "delisted". Aldicarb is said to provide exceptional nematode control, although there is no local research supportive of recommending it, but it seems that it too might soon become unavailable.
From the results of this trial, which is ongoing, cadusafos seems to have the potential to replace phenamiphos for effective *R. similis* control in anthurium.

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