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Pesticide control of *Dolichotetranychus floridanus* (Banks) (Acarina: Tenuipalpidae) on pineapples

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Abstract

Methyl bromide fumigation of pineapple (*Ananas comosus*) tops at 32 and 48 g/m^3 gave complete control of *Dolichotetranychus floridanus* (Banks) without plant damage. Methyl bromide at 16 g/m^3 was unsatisfactory. Field spraying and/or dipping treatment of tops with biphenthrin 0.04%, 'Carter's mixture' 1.0%, chlorpyrifos 0.035%, clofentezine 0.005%, dicofol 0.05%, dimethoate 0.03 to 0.15%, fenbutatin oxide 0.025%, fluvalinate 0.0096%, hexythiazox 0.005%, monocrotophos 0.06%, propargite 0.03%, sulphur 0.3% and white oil 1.7% gave no control.

A predatory mite, *Amblyseius benjamini* Schicha, was adversely affected by chlorpyrifos and dimethoate.

INTRODUCTION

The false spider mite *Dolichotetranychus floridanus* (Banks) was first recorded from Australia on pineapples at Kandanga, south east Queensland on 2 March 1983 (D. Smith pers. comm. 1988) after pineapple growers became concerned at necrotic lesions on the leaf bases of their crops. From late 1986 growers throughout Queensland reported further mite damage. It was claimed that the lesions caused uneven plant stands and increased the number of passes required at harvest. The mite was positively identified as *D. floridanus* from Rockhampton on 20 March 1987 from samples collected by the author.

All specimens on which the above records are based were identified by E. Schicka (BCRI. Rydalmere NSW 1987).

D. floridanus is specific to pineapples and has been recorded from Florida, Cuba, Puerto Rico, Panama, Honduras, Mexico, Central America, Hawaii, Philippine Islands, Japan, Okinawa and Java. Feeding injury was reported as insignificant except that it allowed access for bacteria and fungi which cause the bud to rot (Jeppson *et al.* 1975), but Sanches and Zem (1978) indicated leaf attack by mites caused wilting and yield loss.

In Bahia, Brazil, dipping for 3 to 6 minutes in solutions containing 0.11% ethion, 0.03% omethoate or 0.09% vamidothion or for 6 minutes in those containing 0.05% omethoate or 0.03% vamidothion was significantly more effective against *D. floridanus* than dipping in chlorobenzilate, phosalone, fenitrothion or mancozeb (Sanches and Zem 1978). Yield losses of 16% were reported from Brazil by Sampaio and Myazaki (1982), who obtained good control with sprays of 0.08% monocrotophos, 0.15% dimethoate, 0.1% ethion and 0.1% sumithoate (unstated composition).

This paper reports a series of trials aimed at obtaining an effective chemical control for *D. floridanus* in Queensland pineapples.

MATERIALS AND METHODS

Planting material was obtained from three growers near Yeppoon, Queensland, and consisted of tops removed from fruit at harvest and stored on top of plants in the field for at least a month. Treatments and pretreatment counts were made on the same day.

D. floridanus counts were made on two healthy leaves taken from either side of each top approximately 30 mm from the base. Leaves were examined microscopically and rated for the number of mites of all stages, except eggs, on the upper surface: 0 = no mites; 1 = 1 to 10 mites; 2 = 11 to 20 mites; 3 = 21 to 30 mites; 4 = 31 to 50 mites; 5 = 51 to 100 mites; 6 = > 100 mites.

Predatory mite counts were obtained similarly, except that the actual numbers were recorded.

Field trial

The experiment was laid out as a 6 × 4 randomised block design with 50 tops per plot. The six treatments are listed in Table 1.

Treatments were applied by spraying to runoff with a hand-held lance at 5400 L/ha. Treatments were applied twice, at planting (20 March 1987) and 10 days later. Mites were counted on five tops per plot, pre-treatment, and 14 days after the last treatment.

Dipping and fumigation trials

The experimental unit was a single pineapple top. Tops were rated pre-treatment for *D. floridanus* population and stratified to complete replicates on this basis. Treatments were assigned randomly within replicates.

Treatments were applied by dipping tops, held upright, in and out of the appropriate mixture. They were not held in the mixture. A check made five minutes after dipping and draining indicated that there was moisture at the leaf bases. Fumigation treatments were undertaken in a quarantine fumigation chamber where exact volumes were known and precise quantities of fumigant could be delivered.

Four trials were conducted on the control of *D. floridanus* in pineapple-top planting material using dipping and fumigation treatments. These trials were laid out as randomised complete block designs with 13 (Trial 1), 11 (Trials 2 and 3) or 12 (Trial 4) replicates per treatment. Trials 1 to 3 involved dipping treatments only, while Trial 4 evaluated both fumigation and dipping treatments. Tables 2, 4, 5 and 6 list treatments applied in these trials.

To check for phytotoxicity resulting from the chemical treatments, all tops from Trial 4 were planted out under commercial conditions on 4 September after the final mite count. They were dug up on 30 October, eight weeks later, and rated individually for root growth and state of the growing centre as follows:

Roots	Centres
None	Dead
Few (no new white roots)	Brown
Few (new white roots)	Light green
Prolific and healthy	Dark green

Statistical analysis

All results were analysed by blocked ANOVA for differences between treatments taking dates separately as there were no significant differences between treatments pre-treatment.

RESULTS

Field trial

There were no significant differences in *D. floridanus* populations between treatments, either pre or post-treatment (Table 1). In the 23 days between pre and post-treatment counts there was a decline in mite populations from a mean rating of 5.53 to 2.35.

Eighty-three and 72 predatory mites were taken pre-treatment and post-treatment respectively, from a total of 240 leaves on each occasion. Their distribution was such that analysis was unwarranted. They were identified as *Amblyseius benjamini* Schicha (Phytoseiidae) by E. Schicha.

Table 1. Pineapple mite population ratings* pre-treatment and post-treatment in field trial

Treatment (a.c.) per 100 L water	Mean rating per leaf	
	Pre-treatment 20 March 1987	Post-treatment 15 April 1987
Dimethoate (0.03%) 75 mL of 400 g/L	5.30†	3.0 †
Propargite (0.03%) 100 mL of 300 g/L	5.68	2.48
Dicofol (0.05%) 200 mL of 240 g/L	5.48	2.58
Chlorpyrifos (0.035%) 70 mL of 500 g/L	5.75	1.75
Sulphur (0.03%) 375 g of 800 g/kg	5.65	2.00
Control no treatment	5.30	2.25
General mean	5.53	2.35
Standard error	0.21	0.52

* See methods for rating system.

† No significant differences, $P<0.05$.

Dipping and fumigation trials

Trial 1

D. floridanus populations were unaffected by the treatments (Table 2). There was a steady decline in the populations over the 36 day period of the trial from a peak of 4.87 pre-treatment (24 April) to 1.38.

Predatory mite populations were reduced by the chlorpyrifos and dimethoate treatments (Table 3). In the chlorpyrifos treatment they were significantly lower after one week while the reduction for dimethoate took a week longer. Three and four weeks after treatment there were no significant differences between any of the treatments.

Trial 2

D. floridanus populations were unaffected by dimethoate at five concentrations (Table 4). There was a decline in the populations over the 14 day period of the trial from a peak rating of 3.56 pre-treatment (24 June) to 2.36.

There was a total over all treatments of 25 predatory mites present pre-treatment and six and four recorded one week and two weeks respectively post-treatment.

Trial 3

None of the treatments gave any control over the mite population (Table 5).

There was a decline in the populations over the 14 day period of the trial from a peak rating of 3.56 pre-treatment (24 June) to 1.88.

Five predatory mites were present pre-treatment and one recorded one week, and two recorded two weeks after treatment.

Table 2. Mite population ratings* for pineapple dipping Trial 1. General mean for the pre-treatment count 24 April was 4.87

Treatment (a.c.) per 10 L water	Mean post-treatment ratings per leaf			
	8 May	15 May	22 May	29 May
Dimethoate (0.03%) 7.5 mL of 400 g/L	3.85†	1.85†	1.92†	1.21*bc*‡
Propargite (0.03%) 10.0 mL of 300 g/L	4.15	2.88	1.88	0.85*c*
Dicofol (0.05%) 20.0 mL of 240 g/L	4.08	2.62	1.65	1.15*bc*
Chlorpyrifos (0.035%) 7.0 mL of 500 g/L	4.50	2.58	2.08	1.69*ab*
Sulphur (0.03%) 37.5 g of 800 g/kg	4.00	3.08	2.50	2.19*a*
Control no treatment	4.27	2.77	2.38	1.19*bc*
General mean	4.14	2.63	2.07	1.38
Standard error	0.36	0.36	0.34	0.29

* See methods for rating system.

† No significant differences, $P<0.05$.

‡ Treatments with the same letter are not significantly different, $P<0.05$.

Table 3. Predatory mite counts for pineapple dipping Trial 1

Treatment (a.c.) per 10 L water	Mean post-treatment ratings per leaf*			
	8 May	15 May	22 May	29 May
Dimethoate (0.03%) 7.5 mL of 400 g/L	0.41ab†	0.05*e*†	0.11‡	0.03‡
Propargite (0.03%) 10.0 mL of 300 g/L	0.42*ab*	1.14*a*	0.35	0.16
Dicofol (0.05%) 20.0 mL of 240 g/L	0.50*b*	0.69*ab*	0.36	0.11
Chlorpyrifos (0.035%) 7.0 mL of 500 g/L	0.03*a*	0.18*cde*	0.07	0.05
Sulphur (0.03%) 37.5 g of 800 g/kg	0.73*b*	0.53*bc*	0.47	0.17
Control no treatment	0.87*b*	0.52*bcd*	0.37	0.09
Mean	0.49	0.52	0.29	0.10
Standard error (approx)	0.19	0.17	0.14	0.07

* A $\log(x+1)$ transformation was used due to highly skewed data. Data presented are equivalent (back transformed) means.

† Treatments with the same letter are not significantly different, $P<0.05$.

‡ No significant differences, $P<0.05$.

Table 4. Mite population ratings* for pineapple dipping Trial 2. General mean for the pre-treatment count 24 June was 3.89

Treatment (a.c.) per 10 L water	Mean ratings per leaf	
	Post-treatment	
	1 July	8 July
Dimethoate (0.03%) 7.5 mL of 400 g/L	3.14†	2.68†
Dimethoate (0.06%) 15.0 mL of 400 g/L	3.27	2.59
Dimethoate (0.09%) 22.5 mL of 400 g/L	3.00	2.14
Dimethoate (0.12%) 30.0 mL of 400 g/L	2.23	.86
Dimethoate (0.15%) 37.5 mL of 400 g/L	3.45	2.45
Control no treatment	3.32	2.41
General mean	3.07	2.36
Standard error	0.44	0.46

* See methods for rating system.

† No significant differences, $P<0.05$.

Table 5. Mite population ratings* for pineapple dipping Trial 3. General mean for the pre-treatment count 31 July was 3.56

Treatment (a.c.) per 10 L water	Mean ratings per leaf	
	Post-treatment	
	7 August	15 August
Monocrotophos (0.06%) 15.0 mL of 400 g/L	3.23*a*†	2.27‡
Biphenthrin (0.004%) 4.0 mL of 100 g/L	2.18*ab*	2.32
Fluvalinate (0.0096%) 4.0 mL of 240 g/L	2.14*b*	1.64
Hexythiazox (0.005%) 5.0 g of 100 g/k	2.36*ab*	2.18
Clofentezine (0.03%) 6.0 mL of 500 g/L	1.55*b*	1.18
Control no treatment	2.36*ab*	1.68
General mean	2.30	1.88
Standard error	0.33	0.36

* See methods for rating system.

† Treatments with the same letter are not significantly different $P<0.05$.

‡ No significant differences, $P<0.05$.

Trial 4

Methyl bromide fumigation at 32 and 48 g/m^3 gave excellent control of *D. floridanus* (Table 6). Methyl bromide at 16 g/m^3, Carter's mixture, fenbutatin oxide, methyl bromide at 16 g/m^3 and white oil gave no control.

All predatory mites were killed at the two higher rates of methyl bromide. These treatments were therefore excluded from analyses of both the 7 and 14 day post-treatment predator counts. There were no significant differences in the number of predatory mites among the remaining five treatments. Equivalent mean was 0.61 (± 0.24 SE) per leaf base seven days post-treatment and 0.44 (± 0.22 SE) 14 days post-treatment.

Table 6. Mite population ratings* for pineapple dipping/fumigation Trial 4. General mean for the pre-treatment count 20 August was 5.48

Treatment (a.c.)	Mean ratings per leaf	
	Post-treatment	
	28 August	4 September
Methyl bromide (16 g/m^3)	1.46*c*†	1.46‡
Methyl bromide (32 g/m^3)	0.08	0.00§
Methyl bromide (48 g/m^3)	0.00§	0.00§
Carter's mixture (1.0%)¶ 100 mL per 0 L water	2.83*ab*	1.631
White oil (1.67%) 167 mL per 10 L water	3.50*a*	2.29
Fenbutatin oxide (0.025%) 4.5 mL per 10 L water 2.25*bc*	1.29	
Control no treatment	3.17*ab*	2.25
General mean	2.22	1.78
Standard error	0.31	0.33

* See methods for rating system.

† Treatments with the same letter are not significantly different, $P<0.01$

‡ No significant differences, $P<0.05$

§ Not included in analysis because all values zero.

¶ "Carter's mixture" consisted of 1 L of equal parts of diesel fuel and water mixed with 133 g of bentonite.

Most tops from all treatments examined eight weeks after planting out had prolific root growth and healthy dark green growing centres.

DISCUSSION

D. floridanus was not controlled by any of the miticides tested. As these represent all the common miticide groups it is unlikely that a suitable miticide would be obtained by further testing.

Methyl bromide fumigation can control the mite in tops prior to planting out, but there are some problems in the use of this chemical:

- It has high human toxicity and is dangerous to use.
- Fumigation technique is critical. The operator must take into account the ambient temperature and apply the appropriate dose for a specific time. Fumigation time is usually set at two hours. Any variance above the appropriate temperature–dose–time combination could cause damage to the tops.
- Although inconvenient, fumigation of tops is a practical possibility as they are normally gathered into bulk bins prior to planting. Fumigation would need to be carried out in the shade to prevent overheating.

Chlorpyrifos and dimethoate have a deleterious effect on predatory mite populations. Chlorpyrifos has been widely used by the pineapple industry for control of mealy bug (*Dysmicoccus brevipes* (Cockerell)) and, to a lesser extent, white grubs (*Lepidiota* spp. and *Antitrogus* spp.). Integrated pest management is probably the long term answer to mite problems in the industry, but before this can be attempted it would be appropriate to determine the pest status of *D. floridanus*.

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