Project title:	Control of pear sucker
Project number:	TF 60 [Previously APRC SP 60]
Report:	Year 3 annual report 1995
Project leader:	Jerry Cross, HRI East Malling
Key words:	pear, pear sucker, *cacopsylla pyricola*, Conference

This project report was originally issued by the Apple & Pear Research Council, under project number SP 60.

HORTICULTURE RESEARCH INTERNATIONAL

Report to:

Apple and Pear Research Council
Stable Block
Bradbourne House
East Malling
West Malling
Kent ME19 6DZ
Tel: 01732 844828

HRI Contract Manager

Mr Jerry Cross
Entomology Department
Horticulture Research International
East Malling
West Malling
Kent ME19 6BJ
Tel: 01732 843833

Period of investigation: April to August 1995

Date of issue of report: 23 November 1995

CONTRACT REPORT
HRI IAS No. 30715, APRC ref No. SP60

Control of Pear Sucker 1995

Undertaken for the APRC

Principal Scientists

J.V. Cross, MA MRPPA FRES (Entomologist)

J.L. Moyle, PhD (Entomologist) (Author of report)

Authentication

I declare that this work was done under my supervision according to the procedures described herein and this report represents a true and accurate record of the results obtained.

Signature .....
J.V. Cross

Date ...28/2/96...

CONTENTS

CONTROL OF PEAR SUCKER 1995

SUMMARY

Two replicated orchard experiments, each at two sites, were done in Kent in 1995 to investigate the efficacy of foliar sprays of a range of pesticides for the control of pear sucker, *Cacopsylla pyricola*.

In one experiment treatments consisted of single sprays of a range of 5 or 6 insecticides (Dimilin WP (diflubenzuron), Mitac 20 (amitraz), Masai (tebufenpyrad), Insegar 25 WP (fenoxycarb), AC801757 (tebufenpyrad), Hallmark (lambda-cyhalothrin)) or two sprays at 10 day intervals of the fungicides mancozeb (Karamate Dry Flo) or MTM Sulphur Flowable (sulphur) to small plots of six trees. In the other experiment, treatments were programmes of sprays of the fungicides Captan 80 WG (captan), Karamate Dry Flo or Captan 80 WG+MTM Sulphur Flowable applied (for scab control) by the same grower to large 0.3 ha replicated plots.

Pear sucker nymphs were reduced significantly by 60-90% by the Karamate Dry Flo treatments at all experimental sites. At one site two applications of Karamate Dry Flo were more effective than a single application of the standard Mitac 20. Mitac 20 was an effective treatment at both of the sites at which it was tested, reducing the number of nymphs by over 75% 3-4 days after treatment.

Of the other products tested, Insegar 25 WP was effective but slow acting. Hallmark was an effective treatment at the one site where it was tested. Treatment with AC801757 gave a significant reduction in nymph numbers at one site, but was disappointing compared to other treatments. An ad-mixture of MTM sulphur Flowable to Captan 80 WG gave a modest level of control at only one site. Treatments with Masai and Dimilin WP were both ineffective.

INTRODUCTION

Cacopsylla pyricola is the most important pest of pears in the UK. However, resistance to organophosphate and carbamate insecticides is now ubiquitous (Solomon *et al*; 1978) and the presence of pyrethroid resistant populations are believed to be widespread in other countries (Harries and Burts, 1978; Burts *et al*; 1989). Pyrethroid resistance is also believed to be prevalent in the UK, although there is no published evidence. Although, anthocorids are encouraged as natural predators of pear sucker, their migration into orchards is sometimes too late for the effective natural suppression of pear sucker populations. It is usually necessary to make at least one pesticide application to bring about the satisfactory control of pear sucker. The standard of control achieved with currently available selective pesticides, amitraz and diflubenzuron is often disappointing. Consequently, new effective chemical control methods for pear sucker are needed urgently.

Work, funded by the APRC, to investigate possible new insecticides for pear sucker control was started by Cross in 1993 (Cross; 1993). Two small plot experiments were done to test the efficacy of foliar sprays with six novel products, AC801757 (tebufenpyrad), Insegar 25

WP (fenoxycarb), Consult (hexaflumuron), Nemolt (teflubenzuron), Applaud (buprafenzin) and UK585 (ai coded), in comparison with standard foliar sprays with Mitac 20 or Dimilin WP. Of the novel products tested, three appeared promising as agents for pear sucker control; AC801757, Nemolt and Insegar 25 WP. Consult proved ineffective, apparently because the application rate was too low (Cross, 1993). Control with Mitac 20 was the most effective, but that with Dimilin WP proved to be limited. Further trials, consisting of one small and one large plot experiment each at two sites, were done in 1994, to test further the efficacy of AC801757, Nemolt, Insegar 25 WP, Consult, Dimilin WP and Mitac 20 and investigate the unvalidated claim that mancozeb and captan + sulphur are effective treatments for pear sucker control. Of the novel products tested only Karamate Dry Flo and Insegar 25 WP showed promise. Mitac 20 was the most effective treatment, Dimilin WP was again ineffective. Despite being applied at a higher rate than previously, treatment with Consult remained ineffective (Cross, 1995).

Further replicated orchard experiments were done in 1995 to investigate further the efficacy of Insegar 25 WP, AC801757, Karamate Dry Flo and MTM Sulphur Flowable and confirm the previous results. The results of these trials are reported here.

MATERIALS AND METHODS

Two replicated field experiments, each at two sites, were done in commercial pear orchards in Kent - experiment A, site 1 at Elverton Farm, Teynham and site 2 at Denstead Farm; experiment B, site 1 at Elverton Farm, Teynham and site 2 at Banks Farm, Teynham. The cultivar at all sites was Conference with Comice pollinators. The orchards had a history of serious infestation by pear sucker.

Experiment A

At site 1, treatments consisted of one spray of a range of 6 insecticides or two sprays of the fungicide Karamate Dry Flo in comparison with an untreated control. Treatments were the same at site 2 except that one of the insecticides (Hallmark) was replaced with two sprays of the fungicide MTM Sulphur Flowable (see Tables 1 and 2). The experimental design was a randomised complete block with five replicates. Plots consisted of 6 adjacent trees including a guard at each end, and also had a guard row either side. Sprays were applied at a volume rate of 500 l ha^{-1} with a Solo 436 self-propelled mini, air-assisted tree and bush fruit sprayer especially adapted for small plot experimental work. The sprayer (mean forward speed 3.15 kmh^{-1}) was fitted with Albuz 220 (red) hollow cone nozzles at a pressure of 6 bar and carefully calibrated before treatment application. Applied volume rates were within 10% of those required.

Samples of young expanded leaves (30 from site 1 and 50 from site 2) were taken from extension shoots from each plot at site 1 on 5, 13 and 23 June (3, 11 and 21 days after the final treatment) and at site 2 on 18 and 24 July and 4 August (4, 10 and 21 days after the final treatment). The numbers of pear sucker eggs, each life stage of pear sucker nymphs and total numbers of anthocorids (eggs, nymphs and adults added together) were counted in the laboratory by examination under a binocular microscope. Analysis of variance was done on the data. Due to the low numbers of later instar nymphs the total number of nymphs of each

instar per sample were added together. Log $\bar{x}$+1 transformations of the pear sucker egg and total nymph counts were done to improve the analyses. A one sided Dunnett's test (Dunnett, 1955) was used to indicate which treatment means were significantly less than the control.

Experiment B

At Elverton and Banks Farms a much larger experiment (c 5 ha) was done comparing programmes of sprays of the fungicides Captan 80 WG (3.3 kg product/ ha), Captan 80 WG + MTM Sulphur Flowable (3.3 kg + 4.2 l product/ ha) and Karamate Dry Flo (4.5 kg product/ ha) applied at approximately 14-day intervals from the green bud stage at Elverton Farm and early fruitlet stage at Banks Farm, with commercial application equipment. The experimental design was a randomised complete block with six replicates. Plots consisted of seven rows except two end plots at site 1 and two at site 2 (all Karamate) which were four and five rows wide, respectively. Plots were at least 0.3 ha in area. Only the central row was sampled in each plot.

At Elverton Farm, sprays were applied at a volume of 150 l ha^{-1} on 10 April, 24 April, 9 May, 25 May, 7 June, and 28 June. At Banks Farm, sprays were applied at a volume rate of 135 l ha^{-1} on 30 May, 12 June and 28 June. All plots at Banks Farm also received treatments with Cyperkill (cypermethrin) and Masai (tebufenpyrad) on 10 March and 20 May respectively. Random samples of young expanded leaves from shoots were collected on 16 May and 8 June from Elverton Farm and 24 May and 20 June from Banks Farm. The numbers of pear sucker eggs, each life stage of pear sucker nymphs and total anthocorids (eggs, nymphs and adults added together) were counted in the laboratory as in Experiment A.

Table 1:
Treatments applied in experiment A

Treatment number	Product	Dose product/ ha	Date of application	
			Site 1	Site 2
1	Dimilin WP (+Minax)	600 g (+ 250ml)	23 May	4 July
2	Mitac 20	3.5 litres	2 June	14 July
3	Masai	500 g	2 June	14 July
4	Insegar 25 WP	600 g	23 May	4 July
5	Karamate Dry Flo	4.5 kg	23 May, 2 June	4 July, 14 July
6	AC801757	500 g	2 June	14 July
7	Hallmark (site 1) or MTM Sulphur Flowable (site 2)	9 g 4.2 litres	2 June	4 July, 14 July
8	Untreated control	-	-	-

were not reduced significantly on plots treated with Mitac 20 or Insegar 25 WP (Table 3c).

Table 3:
Mean numbers of (a) pear sucker nymphs, (b) pear sucker eggs and (c) anthocorids 3, 11 and 21 days post treatment at site 1 (Elverton Farm) experiment A.
NB: * next to a value indicates that it is significantly less than the untreated control (P≤ 0.05), using a one sided Dunnett's test (Dunnett, 1955). (1) and (2) next to treatment indicate the times applications were made, 23 May and 2 June respectively.

(a) Pear sucker nymphs

	Time Post Treatment					
	3 days		11 days		21 days	
Treatment	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1
Dimilin WP[1]	122.4	2.04	215.0	2.29	133.6	2.06
Mitac 20[2]	52.8	1.68*	73.0	1.76*	43.2	1.62*
Masai[2]	140.8	2.07	206.0	2.30	146.0	2.13
Insegar 25 WP[1]	28.6	1.40*	14.0	1.03*	19.8	1.27*
Karamate Dry Flo[1,2]	17.2	1.33*	26.0	1.38*	23.4	1.34*
AC801757[2]	86.6	1.87	134.0	2.00	67.0	1.65*
Hallmark[2]	47.2	1.58*	37.0	1.43*	27.0	1.27*
Untreated Control	218.6	2.32	294.0	2.42	142.0	2.12
sed (28 df)		0.197		0.209		0.183
FProb		(P < 0.001)		(P < 0.001)		(P < 0.001)

(b) Pear sucker eggs

	Time post treatment					
	3 days		10 days		21 days	
Treatment	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1
Dimilin WP[1]	424.0	2.60	309.0	2.38	119.2	2.06
Mitac 20[2]	474.0	2.65	340.0	2.48	104.0	1.99
Masai[2]	530.0	2.71	290.0	2.46	92.8	1.92
Insegar 25 WP[1]	627.0	2.76	537.0	2.67	187.2	2.26
Karamate Dry Flo[1,2]	570.0	2.72	265.0	2.40	82.6	1.89
AC801757[2]	356.0	2.51	197.0	2.28	105.0	2.0
Hallmark[2]	523.0	2.70	383.0	2.56	63.2	1.65*
Untreated Control	439.0	2.63	317.0	2.46	135.6	2.07
sed (28 df)		0.082		0.115		0.144
FProb		(P = 0.124)		(P = 0.084)		(P = 0.021)

(c) Anthocorids

	Time post treatment					
	3 days		10 days		21 days	
Treatment	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1
Dimilin WP[1]	2.2	0.432	6.4	0.72	25.0	1.30
Mitac 20[2]	1.8	0.251	1.8	0.37	13.6	1.10
Masai[2]	0.4	0.095	3.0	0.52	29.2	1.41
Insegar 25 WP[1]	1.6	0.311	4.4	0.66	20.4	1.25
Karamate Dry Flo[1,2]	1.4	0.295	2.2	0.35	5.6	0.79*
AC801757[2]	0.4	0.095	4.6	0.66	11.0	0.93*
Hallmark[2]	1.2	0.235	2.6	0.28	8.8	0.91*
Untreated Control	0.6	0.120	6.8	0.73	26.4	1.42
sed (28 df)						0.185
FProb						(P = 0.009)

Site 2 (Denstead Farm)

Four days after treatment, there were statistically significant differences in the number of pear sucker nymphs between three of the treatments and the control. Mitac 20 was the most effective (85% reduction), followed by Karamate Dry Flo (81%) and AC801757 (61%). The statistical significance of the reduction in nymphs by MTM Sulphur Flowable was borderline (47%). Dimilin WP was again ineffective. The numbers of pear sucker nymphs recorded at this site were much lower than those at site 1 and by 10 days after treatment, numbers had fallen dramatically and were too low for statistical analysis (Table 4a). No significant differences between treatments were found for eggs or anthocorids on any of the assessment dates at this site (Table 4b and c).

Table 4:
Mean numbers of (a) pear sucker nymphs, (b) pear sucker eggs and (c) anthocorids 4, 10 and 21 days post treatment at site 2 (Denstead Farm) experiment A.
NB: * next to a value indicates that it is significantly less than the untreated control (P≤ 0.05), using a one sided Dunnett's test (Dunnett, 1955). (1) and (2) next to treatment indicate the times applications were made, 4 and 14 July respectively.

(a) Pear sucker nymphs

	Time post treatment					
	4 days		10 days		21 days	
Treatment	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1
Dimilin WP[1]	46.6	1.63	0.80	0.18	2.6	0.510
Mitac 20[2]	12.0	0.98*	1.40	0.28	1.8	0.40
Masai[2]	37.4	1.57	1.40	0.37	3.8	0.62
Insegar 25 WP[1]	41.8	1.61	0.60	0.16	0.6	0.18
Karamate Dry Flo[1,2]	15.8	1.20*	1.00	0.22	2.6	0.48
AC801757[2]	31.6	1.45*	1.00	0.22	1.2	0.28
MTM Sulphur Flowable[1,2]	43.0	1.55	1.80	0.39	4.0	0.64
Untreated Control	81.6	1.88	1.80	0.34	3.4	0.54
sed (28 df)		0.135		0.134		0.154
FProb		(P<0.001)		(P=0.521)		(P=0.068)

(b) Pear sucker eggs

	Time post treatment					
	4 days		10 days		21 days	
Treatment	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1
Dimilin WP[1]	39.2	1.60	7.0	0.74	15.4	1.16
Mitac 20[2]	55.6	1.75	12.6	0.91	15.0	1.19
Masai[2]	52.2	1.69	11.4	1.08	21.6	1.29
Insegar 25 WP[1]	94.0	1.91	14.0	1.05	27.8	1.45
Karamate Dry Flo[1,2]	43.6	1.52	5.4	0.77	19.8	1.27
AC801757[2]	38.6	1.55	9.8	0.85	18.4	1.17
MTM Sulphur Flowable[1,2]	33.2	1.41	10.2	0.81	19.6	1.15
Untreated Control	55.4	1.75	7.0	0.64	13.8	1.10
sed (28 df)		0.157		0.159		0.158
FProb		(P = 0.087)		(P = 0.133)		(P = 0.550)

(c) Anthocorids

	Time post treatment					
	4 days		10 days		21 days	
Treatment	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1	$\bar{x}$	Log $\bar{x}$+1
Dimilin WP[1]	30.0	1.41	63.2	1.67	48.2	1.69
Mitac 20[2]	17.6	1.21	51.4	1.65	52.4	1.71
Masai[2]	33.6	1.32	65.8	1.76	45.6	1.66
Insegar 25 WP[1]	30.6	1.44	65.8	1.79	62.8	1.80
Karamate Dry Flo[1,2]	22.0	1.20	52.8	1.70	39.0	1.59
AC801757[2]	29.6	1.36	45.0	1.66	53.4	1.71
MTM Sulphur Flowable[1,2]	28.8	1.40	39.0	1.56	57.2	1.72
Untreated Control	37.0	1.47	47.6	1.62	38.2	1.53
sed (28 df)		0.115		0.116		0.097
FProb		(P = 0.192)		(P = 0.579)		(P = 0.226)

Experiment B

Site 1 (Elverton Farm)

On the first assessment date at this site (16 May 1995), there were no significant differences between treatments (Table 5). On the second assessment date (5 June 1995), nymph numbers were, however, significantly less for the Karamate Dry Flo treatment compared to the standard treatment (Captan 80 WG), being reduced by 58 %. Treatment with an ad-mixture of sulphur had no significant effect on nymph numbers. Pear sucker egg numbers did not differ significantly between treatments on either assessment date (Table 5). Anthocorid numbers were recorded, but were too low for analysis.

Site 2 (Banks Farm)

Pear sucker nymph numbers were significantly higher on the first assessment date (16 May 1995) where an ad-mixture of sulphur had been applied with Captan 80 WG than for the standard Captan treatment. Nymph numbers in the Karamate Dry Flo treatment on this date were not significantly different to those for Captan 80 WG. By the second assessment date nymph numbers for the Karamate Dry Flo and the Sulphur ad-mixture treatments were both significantly less than those for Captan 80 WG, being reduced by 86% and 46% respectively. Although egg number followed the same trend as nymphs, there were no significant differences between treatments (Table 6). Again, anthocorid numbers were too low for analysis.

Table 5:
Mean number of pear sucker eggs and nymphs at site 1 (Elverton Farm) experiment B. Nymph means are per 100 leaves and per 50 leaves on 16 May and 5 June respectively. Egg means are per 25 leaves.
NB: * next to a value indicates that it is significantly less than that for Captan 80 WG (P≤ 0.05).

	Pear sucker Nymphs				Pear sucker Eggs			
	16 May 1995		5 June 1995		16 May 1995		5 June 1995	
Treatment	$\bar{x}$	log $\bar{x}$+1	$\bar{x}$	log $\bar{x}$+1	$\bar{x}$	log $\bar{x}$+1	$\bar{x}$	log $\bar{x}$+1
Captan 80 WG	13.5	1.06	168.0	2.12	128.0	1.94	523.0	2.62
MTM Sulphur Flowable + Captan 80 WG	20.2	1.30	252.0	2.34	183.0	2.17	561.0	2.73
Karamate Dry Flo	13.5	1.03	71.0	1.83*	172.0	2.18	470.0	2.66
sed (13 df)		0.180 (P=0.302)		0.116 (P=0.003)		0.178 (P= 0.362)		0.102 (P=0.596)

Table 6:
Mean number of pear sucker eggs and nymphs at site 2 (Banks Farm) experiment B. Nymph means are per 50 and egg means are per 25 leaves.
NB: * next to a value indicates that it is significantly less than that for Captan 80 WG (P≤ 0.05).

	Pear sucker Nymphs				Pear sucker Eggs			
	24 May 1995		20 June 1995		24 May 1995		20 June 1995	
Treatment	$\bar{x}$	log $\bar{x}$+1	$\bar{x}$	log $\bar{x}$+1	$\bar{x}$	log $\bar{x}$+1	$\bar{x}$	log $\bar{x}$+1
Captan 80 WG	1.50	0.33	147.5	2.16	487.5	2.68	856.3	2.91
MTM Sulphur Flowable + Captan 80 WG	6.33	0.85*	80.2	1.90*	542.2	2.70	757.7	2.86
Karamate Dry Flo	0.83	0.23	20.5	1.30*	327.3	2.46	593.0	2.75
sed (13 df)		0.121 (P<0.001)		0.068 (P<0.001)		0.109 (P=0.084)		0.083 (P=0.182)

DISCUSSION

Experiments A and B indicate Karamate Dry Flo to be an effective treatment for the control of pear sucker, in agreement with the experimental results obtained at one of the sites in 1994 (Cross, 1995). The insecticidal and acaricidal properties of the dithiocarbamate fungicides are well known. Work done in Canada and USA show mancozeb to be active against pear sucker, albeit at high doses (McMullen and Jong, 1970; Bode, 1978). The results obtained so far with Karamate Dry Flo substantiate the claim that mancozeb can be used to control pear sucker (see Hutchinson, 1995).

Insegar 25 WP was also highly effective at one of the sites in experiment A, which confirms previous work (Solomon and Fitzgerald, 1987; Solomon and Fitzgerald, 1990; Cross, 1993; Cross, 1995). At the other site where it was tested, its activity was probably masked by a large natural decline in nymph numbers. Hallmark was also effective at the site at which it was tested. AC801757 gave some control of nymphs, but was disappointing compared to other treatments. Treatment with MTM Sulphur Flowable in experiment A was of minimal effectiveness, although in an ad-mixture with Captan 80 WG at one of the sites in experiment B there were modest, but significant, reductions in pear sucker numbers compared to the standard Captan 80 WG treatment. The standard Mitac 20 treatment performed well at both sites in experiment A, but was surprisingly less effective than Karamate Dry Flo, Insegar and Hallmark at site 1 in experiment A. Dimilin WP, as previously found, and Masai performed equally badly at both sites in experiment A.

Treatment effects on pear sucker egg numbers were minimal. The only significant reduction being given by Hallmark in experiment A at site 1 on day 21. The reduction in the number of eggs on the plots treated with Hallmark could be attributable to the repellent qualities of this product often observed with pyrethroids. The lack of reduction in egg numbers by most treatments may indicate that repeated treatments would have to be made for the effective control of pear sucker, depending on the foliar half life of the pesticide applied.

Anthocorid numbers were only reduced significantly at one site in plots treated with Karamate Dry Flo, AC801757 and Hallmark. Although pear sucker nymphs were reduced by Insegar 25 WP and Mitac 20 at the same site anthocorid numbers were no lower than the control. The tolerance of anthocorids to these pesticides make Mitac 20 and possibly Insegar good choices for IPM.

CONCLUSIONS

* Karamate Dry Flo appeared to be very effective at controlling pear sucker nymphs. At one site two applications were more effective than one of Mitac 20. The results obtained substantiate the claims of its insecticidal properties currently being made. The strategy of use against pear sucker requires careful consideration to avoid the development of resistance.

* Insegar 25 WP is also promising, but slow acting. Registration in 1997 will provide a useful new pesticide for pear sucker control.

* Further work with MTM Sulphur Flowable+Captan 80WG is required to establish

whether or not it has potential as an effective treatment.

* Hallmark is effective though harmful to anthocorids. It may provide a useful emergency treatment against severe infestations.

* Masai and AC801757 do not appear to be particularly effective.

* Dimilin WP is confirmed as being ineffective for the control of pear sucker.

RECOMMENDATIONS FOR FURTHER WORK

Further trials need to be done with MTM Sulphur Flowable+Captan 80 WG.

ACKNOWLEDGEMENTS

I am most grateful to Mr. Robert Oliver, Mr Oliver Doubleday and Mr Ken Ellis (Denstead Farm) for providing the experimental orchards and for application of the sprays in experiment B. Thanks also to Miss Jaqui Walters for her help with the experimental work and Ciba Geigy for their support.

REFERENCES

Bode, W.M. (1978). Performance of selected insecticides against pear psylla *Psylla pyricola* (Homoptera: Psyllidae). *Journal of the New York Entomological Society,* **86**, p 279.

Burts, E.C., van de Baan, H.E. and Croft B.A. (1989). Pyrethroid resistance in pear psylla, *Psylla pyricola* Foerster (Homoptera: Psyllidae) and synergism of pyrethroids with piperonyl butoxide. *Canadian Entomologist* **121**, 219-233.

Cross, J.V. (1993). Control of pear sucker 1993. Report to APRC of 10 November 1993, 12pp.

Cross, J.V. (1995). Control of pear sucker 1994. Report to APRC of 19 January 1995, 9 pp.

Dunnett, C.V. (1955). A multiple comparison procedure for comparing several treatments with a control. *Journal of the American Statistical Association* **50**, 1096-1121.

Harries, F.H. and Burts, E.C. (1978). Insecticidal resistance in pear psylla. *Journal of Economic Entomology* **58**, 172-173.

Hutchinson, M. (1995). Pear Sucker. A strategic new weapon. *The Fruit Grower* July 1995, p11.

McMullen, R.D. and Jong, C. (1970). Pear psylla control experiments. *Journal of Economic Entomology,* **64**, 1266-70.

Solomon M.G., Cranham J.E. and Easterbrook J.E., (1978). Pear sucker, *Psylla pyricola*; resistance to azinphos-methyl. Report of East Malling Research Station for 1977, 113.

Solomon, M.G. and Fitzgerald, J.D. (1987). Fenoxycarb for control of pear sucker, *Cacopsylla pyricola*. Tests of Agrochemicals and Cultivars 8 (*Annals of Applied Biology* **110**, supplement) 22-23.

Solomon, M.G. and Fitzgerald, J.D. (1990). Fenoxycarb a selective insecticide for inclusion in integrated pest management systems for pear in the UK. *Journal of Horticultural Science* **65(5)**, 535-539.