AN ALTERNATIVE TO DDT FOR TORTRIX CONTROL : DIPTEREX

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Estate experience during 1962 left no doubt that the effect of DDT in stimulating outbreaks of Red Spider Mite and Scarlet Mite which was reported previously (Cranham, 1962) is not uncommon in occurrence. It may occur in any district, although naturally it is more common on estates which are prone to mite attacks. With the increased use of DDT for the control of Tortrix arising as a side-effect of dieldrin spraying (Cranham, 1961; Cranham, Danthanarayana and Ranaweera, 1962), this unwanted side-effect of DDT has assumed greater economic importance. In the past year, we have carried out trials to find a suitable alternative insecticide for Tortrix control which does not lead to increased mite numbers. This paper is a brief account for planters of the work done and the provisional recommendations developed from it.

Insecticides tested

Insecticides chosen for initial tests were those available in Ceylon which have a low toxic hazard to spray labourers and were not likely to pose serious residue problems in made tea.

The table below lists the materials and dosages initially tested.

Common name of insecticide	*Formulation used*	*Dosage of formulation used per acre in 50 gallons of water*
malathion	Malathion 50% emulsifiable liquid	4 pints
Dipterex	"Dipterex S.P. 80" (80% soluble powder)	2 lb
Sevin	"Sevin 85% Sprayable" (Wettable powder)	2 lb
Rogor, or dimethoate	"Rogor 40" (liquid)	16 fl oz
phosphamidon	"Dimecron 50" (liquid)	10 fl oz
Bacillus thuringiensis	"Thuricide 30B–W.P." (wettable powder)	2 lb

Malathion and Dipterex are well known organo-phosphorous insecticides, non-systemic and of low toxicity. Sevin is a relatively new carbamate insecticide which has replaced DDT for a number of uses in agriculture. Rogor and phosphamidon are systemic organo-phosphorous insecticides of rather low toxic hazard to the spraying labourers and of short persistence in plants. 'Thuricide 30.B

wettable powder' was of special interest since it is one of the first commercial "microbial insecticides", containing 30 billion viable spores of *Bacillus thuringiensis* Berliner per gram of powder. This bacillus has been reported to give control of several moth larvae, and is pathogenic to several insects but harmless to man and warm-blooded animals.

The dosages chosen for test were in line with the manufacturers' recommendations but not to greatly exceed the cost per acre of control with DDT.

Field trial work

Previous experience in field trials on the control of Tea Tortrix had shown that reinfestation of large DDT-sprayed plots, by immigration of the pest from adjacent unsprayed areas, occurred quite rapidly (Cranham, Danthanarayana and Ranaweera, 1962). Depending on the persistence of the insecticide, plots of the size usual in replicated plot trials—say, 100 or 200 bushes—were likely to be reinfested in less than one month. Of the insecticides to be tested, only Sevin was likely to equal DDT in persistence; the others are less persistent.

For these reasons, trial plots were usually one acre in size, and replication was sacrificed. With a pest which disperses as rapidly as Tortrix, the ultimate test is the practical one of spraying whole fields, when the duration of control can be much better than on plots of one acre. However, it was not possible to do initial tests on whole fields.

Trial No. 1

This trial was carried out in December 1961 and January 1962 on a field of an estate in Pundaluoya. Dieldrin spraying of the field six months earlier had resulted in a Tortrix attack causing very severe defoliation.

Table I records the insecticides tested on one acre plots and the counts of Tortrix per 100 bushes 11 and 21 days after spraying. Sevin and Dipterex showed strikingly good results in the 11-day count by comparison with the other insecticides, which showed no appreciable control. After 21 days, reinfestation of the Dipterex plot was marked and only the Sevin plot still showed fair control. It was decided to do further tests with both these insecticides.

Parasitism of the Tortrix by *Macrocentrus* in this field was virtually nil.

Table 1.—*Results of Trial No.* 1

Treatment, dosage per acre	Number of Tortrix larvae per 100 bushes after spraying:	
	11 days	21 days
1. Sevin 85% W.P., 2 lb ...	22	82
2. Dipterex 80 S.P., 2 lb ...	97	370
3. Dimecron 50, 10 fl. oz ...	1072	744
4. Rogor 40, 16 fl. oz	1095	370
5. Melathion 50% E.C. 4 pints ...	1455	428
6. Thuricide 30B, 2 lb	1508	845
7. Unsprayed Control (Avg) ...	1665	537

N.B.—A precount on the whole trial area before spraying estimated 2,250 larvae per 100 bushes.

TRIAL NO. 2 (*Taint Tests*)

In February and March 1962, large plots were sprayed at St Coombs with Sevin (2 lb per acre), Dipterex (2 lb per acre) and Malathion (4 pints per acre). Green leaf was plucked the same day after spraying, and (on other plots) 7, 14 and 21 days after spraying. The Technologist carried out medium-scale manufacture of the leaf from the sprayed plots and from unsprayed control plots. Samples of made tea were sent to four tea tasters.

The results of tasting were as follows:—

	Leaf Plucked	*Dipterex*	*Sevin*	*Malathion*
1.	Same day	Slight taint (2 tasters)	Taint (3 tasters)	Pronounced taint (Technologist)
2.	After 1 week	No taint	Slight taint (1 taster)	Pronounced taint (Technologist)
3.	After 2 weeks	No taint	Slight taint (the same taster)	Taint (one taster)
4.	After 3 weeks	No taint	Slight taint (the same taster)	No taint

Thus, teas manufactured from leaf plucked on the same day after spraying were tainted by all three compounds. With one week between spraying and plucking, Dipterex did not impart a taint. Because of the consistent opinion of the same taster, Sevin is suspect even after three weeks. Malathion tainted the one-week and two-week samples.

Further experimental manufactures are currently being done, to repeat tests on Dipterex and Sevin.

Samples of tea made from leaf sprayed with Dipterex and plucked 0, 7, 14 and 21 days after spraying were sent to the manufacturers Messrs Farbenfabriken Bayer A.G., Leverkusen, W. Germany, for residue analyses. Work is still continuing, but analyses indicate that residues from a 2 lb per acre dosage should be well below 1 p.p.m. by 7 days after spraying provided the teas made from sprayed leaf are bulked with ten times as much tea from unsprayed areas. This position is considered satisfactory.

TRIAL NO. 3

In April 1962, the opportunity was taken with a natural outbreak of Tortrix on an Agrapatna estate, to retest Dipterex and Sevin. The numbers of Tortrix larvae were not so great as in Trial No. 1, but the parasitism by *Macrocentrus* was high at the time of spraying, so that the numbers of Tortrix declined naturally on the unsprayed plots over the period of assessment. With this decline, the differences recorded (Table 2) after 18 days are not so striking, but the trial did give a useful indication of the effect of the insecticides on *Macrocentrus*.

TABLE 2.—*Results of Trial No. 3*

Treatment, dosage per acre	Number of Tortrix larvae per 100 bushes (% parasitism by *Macrocentrus* in brackets)		
	Precount	After spraying	
		18 days	35 days
1. Dipterex 80 S.P. 2 lb	245 (66%)	12 (100%*)	40 (70%)
2. Sevin 85% W.P. 2 lb	315 (88%)	32 (70%)	76 (67%)
3. Unsprayed Control	340 (75%)	102 (55%)	60 (60%)

**Only four mature larvae were available for dissection.*

It has previously been noted that the use of DDT does not interfere with the resumption of natural control by *Macrocentrus* (Cranham, 1962). This trial suggested that the same holds true for Dipterex and Sevin.

TRIAL NO. 4

In July a further trial was carried out on an estate in Galaha in a field where a Tortrix outbreak had followed dieldrin spraying. Parasitism by *Macrocentrus* was very low, yet the numbers of Tortrix again declined on the unsprayed control plot over the period of assessment; this is attributed to the monsoon weather and the effect of fungus diseases of Tortrix. Dipterex again gave good control, both at 2 lb and 1 lb per acre. The impression is, from this trial and later sprayings on whole fields, that control is not quite as complete as with DDT but it is commercially satisfactory. Control from Sevin was not so good in this trial.

Table 3 records the Tortrix counts and percentage of parasitism by *Macrocentrus*, which had increased only a little after 60 days, but again with no evidence of interference by the insecticide.

TABLE 3.—*Results of Trial No. 4*

Treatment, dosage per acre	Number of Tortrix per 100 bushes (% parasitism by *Macrocentrus* in brackets)			
	Precount	After spraying		
		17 days	37 days	60 days
1. DDT 25% E.C., 6 pints	336 (7%)	3 (—)	28 (10%)	18 (20%)
2. Dipterex 80 S.P., 2 lb	392 (10%)	34 (21%)	74 (9%)	57 (22%)
3. Dipterex 80 S.P., 1 lb	424 (4%)	19 (17%)	70 (8%)	48 (11%)
4. Sevin 85% W.P., 2 lb	312 (0%)	74 (4%)	67 (10%)	54 (6%)
5. Unsprayed control	292 (4%)	161 (5%)	203 (6%)	120 (24%)

MITE TRIALS

A replicated plot trial was started in May, on an estate in Haputale, to test the effect of DDT, Dipterex, Sevin and other insecticides on the numbers of Red

Spider Mite and Scarlet Mite. This trial has given results from DDT similar to those reported previously (Cranham, 1962), namely, a marked increase in Red Spider Mite beginning one month after spraying, and a much slower increase of Scarlet Mite. Neither Dipterex or Sevin has caused a similar increase of either mite species. The results will be reported in detail elsewhere.

This result was also demonstrated in Trial No. 3, and no increase of mites has so far occurred in estate experience with Dipterex.

Estate spraying on whole fields

Dipterex has been recommended for trial by individual estates and the results have been entirely satisfactory. Experience with 1 lb, 1½ lb and 2 lb per acre has shown that one spraying round of 1½ lb per acre is normally adequate. This dose has also been applied in 5 to 10 gallons water per acre by mist-blower achieving good control as with DDT (*see* Cranham, 1961).

Discussion

From this work, Dipterex emerges as a useful alternative to DDT for Tortrix control. Control is probably not quite so complete as with DDT, but it has the great advantage of not stimulating mite outbreaks and this effect of DDT was fairly widespread in 1962.

Dipterex is a low-toxicity insecticide; handling precautions are as for DDT. Dipterex did not taint or effect quality in tea made from leaf plucked one week after spraying. At the 1½ lb dosage rate, the costs of chemical is about Rs.9.00 per acre, which compares favourably with DDT. It is clearly a suitable insecticide for use on tea, and could usefully be tried on a number of other pests such as Nettle Grubs, Bagworm larvae, Army worm, *Lygus* bug and *Helopeltis*.

Sevin also merits further attention. It is safe to use and generally considered preferable to DDT from the aspect of residues in food-stuffs. There is so far no evidence that it will stimulate mite outbreaks on tea. Taint tests are being repeated.

Provisional recommendations for Dipterex

Dipterex is provisionally recommended as an alternative to DDT for the control of Tea Tortrix, particularly where there is a history of DDT stimulating mite outbreaks.

Dosage rates

1. *One spraying round:* 1½ lb Dipterex S.P. 80 in 50 gallons of water per acre by Knapsack sprayers, or in 5–10 gallons of water per acre by mist-blower.

   For young tea sprayed to run off, use 2 lb per 100 gallons of water.

2. *Two spraying rounds:* 1 lb Dipterex S.P. 80 in 50 gallons of water per acre by Knapsack sprayers, or in 5–10 gallons of water per acre by mist-blower. Repeat after one week.

Caution

1. Spraying should be done after a plucking round with a one-week interval between spraying and plucking. With this interval, Dipterex has not caused taint. Nevertheless, in order to minimise residues in made tea, you should bulk the tea from the sprayed area with ten or more times as much tea from unsprayed areas, for the first and second pluckings after spraying (this also applies to DDT).

Timing of Spraying

After dieldrin spraying, it has been recommended that DDT should be sprayed routinely just after tipping, whether or not Tortrix is seen to be building up. Because it is less persistent than DDT, this prophylactic use is not recommended for Dipterex. Dipterex should be used when Tortrix is seen to be on the increase, *i.e.* in the early stages of an outbreak.

Agents:—Dipterex S.P. 80 is available from Messrs Hayleys Ltd., P.O. Box 70, Colombo. In packs of 56 lb it costs just over Rs 6/- per lb; in packs of 1 Kg it costs Rs 8/50 per lb.

Acknowledgements

We wish to gratefully acknowledge the co-operation of Superintendents of Estates for facilities for trial work; the Technologist, T.R.I. for his work in the taint trials; Messrs Stauffer Chemical Co., U.S.A. for a supply of "Thuricide 30B-W.P", Messrs A. Baur & Co., Ltd., Colombo, for a sample of "Dimecron 50"; and Messrs Farbenfabriken Bayer A. G., Leverkusen, W. Germany, for work on Dipterex residues in made tea.

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