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LOCUSTA MIGRATORIA L. INSECTICIDE CONTROL TRIALS, 1974–75

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SUMMARY

During 1974-75 chlorpyrifos, dimethoate and promecarb were tested against adults and hoppers and phoxim and tetrachlorvinphos against hoppers only of *Locusta migratoria* L. in the Central Highlands of Queensland. Assessments made on locusts treated in cages or in the field and subsequently caged, indicated reasonable activity by each of the chemicals, but field estimates of control showed chlorpyrifos and phoxim to be of greatest potential.

I. INTRODUCTION

The Central Highlands area of Queensland experienced a severe outbreak of the migratory locust (*Locusta migratoria* L.) from 1971 to 1978. The plague dynamics have been described by Elder *et al.* (1979) and Farrow (1979). A variety of insecticides including carbaryl, diazinon, fenitrothion, maldison, monocrotophos and naled were used for control during the period.

World events in 1974 affected insecticide availability and some of these were in short supply or unavailable locally. Concern that continued control with these chemicals might not be possible as well as the need to accumulate toxicity data for alternative chemicals, led to the conduct of the trials reported here.

Dimethoate, although rejected as a candidate for locust control by McCuaig (1966), was included in the tests because of favourable results obtained against other grasshopper species (Jones and Kantack 1973; Blickenstaff and Skoog 1974). The other chemicals were selected on the basis of availability and their considered potential for locust control.

II. MATERIALS

chlorpyrifos	50% w/v emulsifiable concentrate
dimethoate	40% w/v emulsifiable concentrate
phoxim	50% w/v emulsifiable concentrate
promecarb	49% w/v wettable powder
tetrachlorvinphos	50% w/v wettable powder

III. METHODS

Cage trials

Three replicates each of 75 adult *L. migratoria* were treated in wire mesh cages 305 x 305 x 203 mm with 16 mm^{-2} mesh size. Three replicates were left untreated as controls. Treatments were applied on 24 April 1974 via a knapsack spray delivering approximately 170 L ha^{-1}. Although uniform application was attempted, some individuals may have received more or less than the intended dose. The locusts were placed subsequently in shade and were not fed. Mortality counts were made 0·5, 2, 3, 8 and 24 h post-treatment.

Treatments applied were: chlorpyrifos at 140 g ai ha^{-1}, dimethoate at 210 g ai ha^{-1} and promecarb at 550 g ai ha^{-1}.

Twelve replicates each of 75, 3 to 5-instar hoppers were treated similarly with promecarb and chlorpyrifos at the above rates on the same date. Three replicates were left untreated as controls.

Field trials

Chlorpyrifos at 175 g ai ha^{-1}, dimethoate at 210 g ai ha^{-1} and promecarb at 350 g ai ha^{-1} were each tested in the field against swarms of adult *L. migratoria* on 27 April 1974. Treatments were applied at dawn before flight activity commenced. Applications were made from a ground-operated misting machine delivering approximately 80 L ha^{-1}.

Twenty-one tests against entire *L. migratoria* hopper bands were also carried out with the five chemicals at the rates and on the dates indicated in table 1. The majority of hoppers were at instars 3 to 5. The insecticides were applied by either a knapsack spray or a back-pack mister delivering approximately 115 L ha^{-1}. Because of the mobility of hoppers, whole bands were treated in each test with replication being in time.

Estimates of mortality were made in the field by visual assessment of the percentage of dead and moribund hoppers at time intervals of 15 min. Due to movement and scattering among vegetative cover, some variability was inherent in these estimates. All assessments were made by the same observer and were considered reasonable estimates of the chemicals' performance. When practicable, samples of locusts from treated swarms and bands were collected in a sweep net, caged and returned to the laboratory for assessment, as for the cage trials. Collections were also made before treatment to act as controls. Knockdown characteristics of the chemicals were compared on the basis of the time taken for 50% mortality to occur.

IV. RESULTS AND DISCUSSION

The mortality of adults and hoppers of *L. migratoria* after treatment with the various chemicals at the rates indicated is shown in table 1. Also included in the table is the approximate time to 50% mortality.

The five insecticides all showed significant activity against *L. migratoria* at all dosage levels tested. Mortality in all cases was consistently higher when locusts were caged either before or after being treated (70 to 100%) than field estimates indicated (50 to 90%). The differences may have resulted because of better coverage of individuals sprayed in cages or through additional insecticide contact on those collected in the field after spraying, due to contamination of the sweep net passing through treated vegetation. Stress caused

by caging was unlikely to have contributed to the higher mortality rate as mortality in all the controls was zero. Whereas the cage counts were precise, the field assessments may have been underestimates, particularly for the slower-acting chemicals which permitted escape from the assessment area.

Phoxim gave good control at all the rates tested and was rapid in its effect. Chlorpyrifos also gave satisfactory results though the field assessment for the 140 g a.i. ha^{-1} rate suggests it may be marginal. The poor control obtained on 27 April 1974 with 175 g a.i. ha^{-1} against adult *L. migratoria* was most likely due to heavy vegetation cover in the area sprayed. Tetrachlorvinphos, promecarb and dimethoate, while shown to be effective by cage assessments, appeared to be less effective in the field possibly due to their relatively slow action.

TABLE 1

EFFECT OF FIVE INSECTICIDES ON MORTALITY OF *L. migratoria* AFTER 24 HR (CAGE ASSESSMENTS) AND 2 TO 6h (FIELD ASSESSMENTS). (ALL TESTS ON HOPPERS UNLESS OTHERWISE INDICATED)

Date	Insecticide	g a.i. ha^{-1}	Treated in cages	Treated in field		Approx. Time to 50% mortality (hours)
			% mortality measured in cages	% mortality measured in cages	% mortality assessed in field	
27 Apr. 74	promecarb	350		85*	..	1·7
24 Apr. 74		550	75	..	..	2·0
24 Apr. 74		550	100*	..	..	1·8
21 Oct. 74		550		82	50	3·0
23 Oct. 74		1 100		67	60	3·0
24 Oct. 74		1 100		95	80	2·0
2 Dec. 74		1 100		..	50	2·0
27 Apr. 74	chlorpyrifos	140	99	..	..	3·0
24 Apr. 74		140	100*	..	..	3·0
25 Apr. 74		140		100	60	2·0
30 Sep. 74		140		99	60	2·0
1 Oct. 74		140		100	80	2·0
27 Apr. 74		175		32*	..	..
2 Dec. 74		200		..	70	..
3 Dec. 74		280		95	80	1·8
3 Dec. 74		280		98	70	1·8
7 Oct. 74	dimethoate	200		95	50	10·0
27 Apr. 74		210		70*	..	8·0
24 Apr. 74		210	91*	..	..	8·0
8 Oct. 74		400		100	60	7·0
17 Apr. 75	phoxim	280		..	70	..
17 Apr. 75		280		100	90	0·4
17 Apr. 75		280		..	70	0·4
7 Dec. 74		420		100	80	0·3
20 Dec. 74		420		100	90	0·3
6 Dec. 74		550		100	80	0·3
26 Sep. 74	tetrachlorvinphos	550		97	50	7·0
1 Oct. 74		550		89	60	7·0
25 Sep. 74		1 100		100	70	5·0

*adults

Treatment and subsequent assessment in the field were complicated by a number of factors. These were—

(a) vegetative cover (long grass and low shrubs made uniform coverage difficult and hindered assessment);

(b) temperature (temperatures in excess of 30°C often occurred at treatment or during the subsequent assessment period). Under these conditions hoppers were particularly active and scattered when disturbed;

(c) age structure of hopper bands (fourth and fifth instar hoppers moved more rapidly when disturbed than did younger hoppers);

(d) size of hopper bands (entire bands were sprayed in each test so that mixing of treated and untreated individuals was minimized. However, large bands provided greater opportunity for hoppers in the last-treated area of a band to escape treatment by moving away from the perimeter of the band or back amongst hoppers already sprayed); and

(e) speed of knockdown (chemicals with rapid knockdown characteristics were more easily assessed since the band remained in the same area. Slow-acting chemicals allowed movement and loss of identity of bands particularly when older hoppers were treated under hot conditions).

Given the above limitations field estimates, which were likely to be underestimates, of mortality within the range 70 to 100% were considered to provide a good indication of a chemical's potential for commercial use in the control of *L. migratoria*. On this basis phoxim and chlorpyrifos at 280 g a.i. ha^{-1} were the most likely candidates for such use. These two chemicals also demonstrated good knockdown capabilities.

The difficulty in carrying out and assessing insecticide trials on *L. migratoria* swarms and hopper bands is highlighted by the uncertainty and variability attached to the field estimates of mortality and the impossibility of replicating such trials. Cage assessments indicated good control in most cases but when compared with field assessments there was often wide disparity. Cage trials can give an indication of an insecticide's activity towards locusts but the final assessment must be in the field, taking cognizance of the difficulties and limitations described.

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