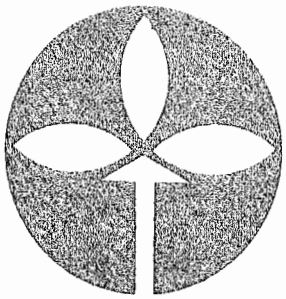

DEPARTMENT OF AGRICULTURE, SOUTH AUSTRALIA

Agronomy Branch Report

BIOLOGY AND CONTROL OF AUSTROICETES CRUCIATA

THE SMALL PLAGUE GRASSHOPPER - 1966 - 68

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Biology and Control of AUSTROICETES CRUCIATA
The Small Plague Grasshopper

1966-68

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GENERAL INTRODUCTION

Introduction

The small plague grasshopper, Austroicetes cruciata first attracted scientific interest in South Australia in October 1935 when Mr. D.C. Swan of the Waite Agricultural Research Institute surveyed grasshopper activity in the Northern Agricultural areas between Peterborough and Hawker. He noted that "the gregariousness of this species is not quite as well developed as in C. terminifera" (Plague locust), "its economic effects in the nymphal stages are however comparable".

During the next five years grasshoppers were very numerous in the Northern Agricultural Areas and were intensively studied by H.G. Andrewartha whose published findings are summarised below.

Distribution

The plague grasshopper occurs over a wide area of South Australia from Murray Bridge to Blinman and from Cowell and Pt. Augusta to Elliston and Nullarbor Station. Swarms are confined to a "grasshopper belt" between Robertstown and Blinman. This "grasshopper belt" was originally opened up for wheat growing, but by 1939, 90% of the area was devoted to sheep production. The effect of clearing, cultivation and grazing resulted in the replacement of native herbaceous perennial vegetation by volunteer grasses and weeds notably Stipa spp., Hordeum, Erodium, and Echium lycopsis providing extensive areas of suitable food-plants for grasshoppers.

General Biology

There is only one generation of plague grasshoppers each year. An obligate diapause in the egg stage ensures that the embryos do not complete their development before the end of winter; an important adaptation to a climatic zone where spring is the only period of the year when there is likely to be an abundance of green feed at a time when temperatures are favourable for the insects.

Diapause development is practically complete by the beginning of June and development thereafter proceeds at a rate depending on temperatures. Hatching occurs between mid-August and the end of the third week in September. A method of estimating the hatching date is described (Andrewartha 1944).

On hatching the embryos shed their embryonic cuticles and emerge as pale yellow hoppers which darken in colour in about an hour. The hoppers tend to congregate on patches of suitable food, notably spear grass, barley grass and trefoil. At first they show no definite tendency to be gregarious, but in the 4th and 5th hopper stages they may mass together in bands and migrate over short distances, and they may then feed on less preferred plants such as Salvation Jane. Where feed is abundant at the hatching site, they may show no gregarious or migratory habits.

The adult stage is reached in late October. Adults are only weakly gregarious and tend to form only loose swarms which may cover many square miles. Even within the swarms there is a large measure of individual action. Under certain conditions of temperature and humidity they may fly strongly and more or less continuously, but there is little organised migration except where prevailing winds or lack of food operate. It is considered unlikely that swarms end up more than 10-15 miles from the breeding ground.

Egglaying normally begins about the first week of November. Females select hard bare ground for ovipositing and never lay in ploughed land or soft sand. The females require a small crack or irregularity to start boring, so that eggs are often clustered around small stones or along the margins of bare areas. Pastures, roadsides, stock routes and headlands provide suitable oviposition sites.

The eggs are laid in pods of about 20 eggs at 1 to 3 inches below the soil surface. Dissected females show a potential to lay about 270 eggs or 14 pods, but in the field this is probably never reached because the food supply dries off and the adults die before reaching this maximum. In about one year in ten or twelve years the feed dries off so early that there is practically no egglaying.

Economic Importance

The "grasshopper belt" between Blinman and Robertstown is used almost exclusively for wool production. Stocking rates are low. Andrewartha (1943) described the area as carrying 1 sheep to 8-10 acres. Many properties on the southern end of the belt carry 1 sheep to 4 or 5 acres. Further, Andrewartha showed that the sheep population of the grasshopper belt was more variable than in the pastoral lease country due to the instability to "natural" annual herbage in an area subject to frequent droughts. In addition to the low gross return per acre (say $0-50 to $1-00 an acre) stock numbers must frequently be reduced, usually at low prices, and subsequently restocked either at higher market prices or by slower natural increase. With such a low productivity, the economics of grasshopper control poses many problems.

Andrewartha urged the re-establishment of perennials, such as Atriplex vesicaria. He stressed the need to prevent continuing erosion in the area, and also suggested that a change to cattle raising or the production of plant products might be considered. Some progress towards the establishment of perennials has been made by some landowners since 1943, using contour furrows and "pitting" techniques. Even to date this has received very little general acceptance in the area so that the problem remains as acute in 1969 as it was in 1943.

During any land utilization changes and subsequently, there would still be need for inexpensive chemical treatment. Ground spraying with ultra low volume (waterless) spraying with inexpensive insecticides such as Maldison offer prospects under these circumstances.

In the Ceduna-Penong area cereal cropping plays a large part in land utilization. Grasshopper control in the area could then have two aims; to prevent damage to crops - an economically more favourable situation, or to prevent damage to pastures, a problem similar to the "grasshopper belt" situation.

DAWSON PROJECT

DAWSON PROJECT

Introduction

Following a number of favourable seasons up to 1965, plague grasshopper populations had built up to quite high levels. With fairly dry conditions during the spring of 1965 there were numerous reports of damage from "the grasshopper belt" and requests for Government action.

Two recent developments in broad-acre pest control offered prospects of application to grasshopper control to considerable advantage. Firstly misting machines had largely replaced boomsprays for pasture pest control because they required only one tenth the volume of water as insecticide carrier, and also they made it possible to travel over and treat much rougher terrain. Secondly the introduction of ultra low volume (U.L.V.) spraying of technical maldison by aircraft offered even greater possibilities for treating relatively large areas of remote country at low costs.

Aims

The initial aim for 1966 was to find out as much as possible about the detailed distribution of plague grasshoppers over a relatively small area and thereby to assess the prospects of carrying out control measures.

Having surveyed the trial area initial trials to evaluate the potential of technical maldison were planned. Application of the spray was to be with a Maruyama motorised knapsack mister designed for U.L.V. application. (Mister loaned by Cyanamid DHA Pty. Ltd., Sydney). Should spraying be effective, more extensive spraying of the surveyed area was planned.

Following the collection of survey information and the limited success with ground spraying, attention was directed to adapting conventional misting machines to U.L.V. application.

Methods

Higher grasshopper populations were present in the climatically milder southern part of the grasshopper belt in 1965. Aerial photographs of this region showed that the Dawson-Ucolta valley, 15 miles NE of Peterborough area was the most discrete area available for study of grasshopper distribution; the ranges of hills bordering the valley being considered likely barriers to grasshopper immigration.

At Ucolta in the south, the ranges are no more than 1½ miles apart. Ten miles to the north at Dawson, the ranges are 4 miles apart, and thereafter to the north, the eastern range breaks down into a series of hills and the valley merges with a network of creeks eventually forming the Nackera Creek. Some surveying was undertaken to the north of Dawson to assist assessment of southerly movement of grasshoppers.

The survey area proper consisted of a total of 25,650 acres. Some 9,600 acres of hillside area was covered with low shrub or limited early maturing grass and supported few plague grasshoppers. The 16,050 acres of the floor of the valley contained just over 2,500 acres of scrub and shrub which in the course of the survey, was excluded as being largely unsuitable for grasshopper breeding. Thus an area of 13,600 acres on the floor of the valley was considered suitable for grasshoppers.

First hatchings were observed on 7th September 1966 and was still in progress a week later. Detailed surveying began on 19th September and was completed on 26th September. The general technique adopted was for a team of two men in a 4-wheeled drive vehicle to select one land title section and to drive along the sides of water courses, scrub lines or other natural boundaries, driving at 5-8 mph and watching for grasshoppers flushed by the front wheels. Having located infestations along these natural boundaries, the extensiveness out from the boundary was determined. Grasshopper densities were assessed on the basis of:-

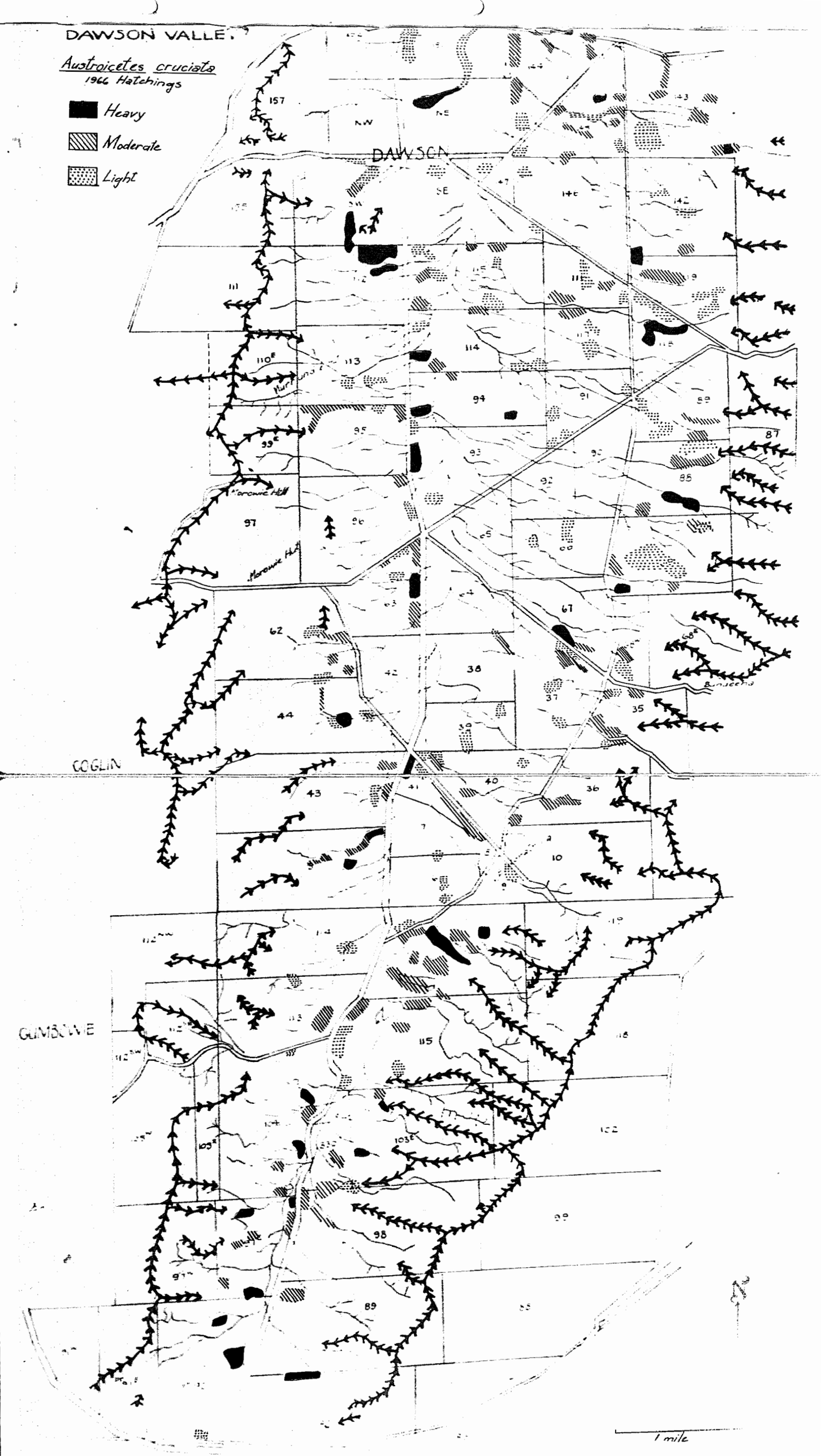
1 or 2 hoppers flushed with every footfall - LIGHT

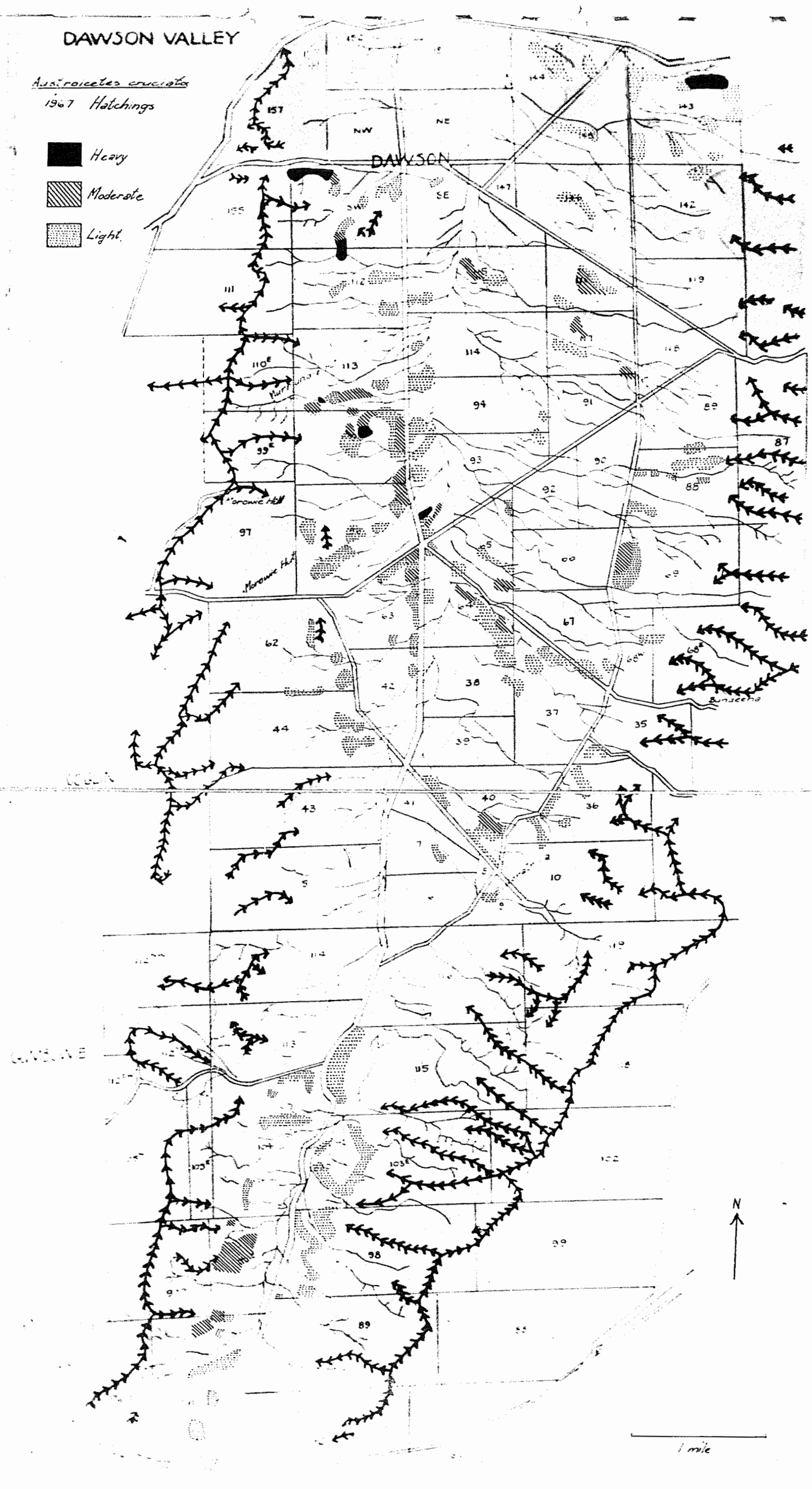
3 to 5 hoppers flushed with every footfall - MODERATE

6 or more hoppers flushed with every footfall - DENSE

With increasing experience, walking checks were frequently dispensed with except where there was difficulty in deciding the rating from the vehicle. Large open areas were covered by one two traverses or until the extent of infestations were satisfac determined.

Survey findings were mapped on one inch to the mile hundred maps with reference to aerial photos of the same scale. During the course of the survey it became apparent that insuffi detail could be plotted on this scale, so the results had to be transcribed as accurately as possible to two inches to the mile scale again in conjunction with aerial photos to the same scale


DAWSON VALLEY
Austroicetes cruciata
1966 Hatchings
Heavy
Moderate
Light
DAWSON
COGLIN
GUMBOWIE
Moronic Hill
1 mile


DAWSON VALLEY
Austroicetes cruciata
1967 Hatchings
Heavy
Moderate
Light
DAWSON
NW
NE
SW
SE
Morrow Hill
Morrow Hill
Burgess
N
1 mile

1966 DAWSON VALLEY SURVEY RESULTS

Grasshopper hatchings were found generally throughout the survey area, but for the most part areas of light, moderate or dense infestation could be defined and mapped.

Heaviest concentrations occurred to the eastern and southern portions of the valley. Individual areas generally bordered areas of trees or bushes. Many were adjacent to the Dawson-Ucolta road. The general pattern suggested that egglaying adults had accumulated along scrub lines, laying in hard bare ground with no more than patchy grass cover. Large areas of light infestation in the N.E. of the valley seemed to indicate widespread laying by scattered adults drifting through between the hills to the N.E.

Although the accuracy of mapping on a 1 inch to the mile scale was less than desired, it was estimated that there was in the survey area:-

	250 acres of dense infestation
	450 acres of moderate infestation
	450 acres of light infestation
Total	1,150 acres

No hoppers were found in bands - a characteristic of the more gregarious plague locust.

Most of the surveying was done by using 2 survey teams. The time required to do the survey was equivalent to one team working for 16 days. Estimated costs were:-

Mileage 800 miles	$ 40-00
Labour 32 man days	$500-00
Maps etc.	$ 50-00
Total	$590-00

Faster progress of surveying was evident with increasing familiarity of the district. Deep creeks and in some cases locked gates impeded progress and involved extra travelling.

One man surveying was effective but slower. The driver-observer had to keep out of the windward side of the vehicle. This restricted the course of the survey vehicle.

Only two areas of grasshoppers were reported by landowners.

1967 DAWSON VALLEY SURVEY RESULTS

Hatchings began on 30th August - relatively early because of warm dry weather. Surveying began on 18th September for one week (equivalent 4 days at Peterborough) and was completed between 2nd and 6th October (equivalent to another 4 days).

Infestations occurred in much the same areas as in 1966, but were generally lighter. Hopper densities fell rapidly during the 2-3 weeks between the two survey periods.

Estimated areas of infestation were as follows:-

			1966
dense infestation:	-	75 acres	250 acres
moderate infestation:	-	270 acres	450
light infestation:	-	1,120 acres	450
Total		1,365 acres	1,150 acres

Actual density ratings were more than usually suspect because of the rapid population changes which were occurring through hopper deaths.

The survey was conducted over approx. 8 full days by one survey team - approximately half the time required in the previous year, and was largely the result of greater familiarity with the area. Relatively little further decrease in survey time in future years is expected. Estimated costs were:-

Mileage	-	500 miles	$ 25-00
Labour	-	16 man-days	250-00
Sundries	-		15-00
			$290-00

No areas of infestation were reported by landowners.

1968 DAWSON VALLEY SURVEY RESULTS

Inspections of main grasshopper patches during September 16-18th and on 12th to 14th October produced so few hoppers that no worthwhile concentration was seen sufficient to mark on a map. In fact A. cruciata was almost a rare insect in the area.

GRASSHOPPER ACTIVITY 1966

Grasshoppers began hatching on 7th September and continued to at least 14th September. The first instar lasted about one week. About 60% had reached the 4th instar by 25th September and about 40% were in the 5th instar on 15th October. Adults began to appear on 13-14th October and about 50% were adult by 26th October.

The extent of hatching was believed to be somewhat less than in previous years because of a fairly short spring in 1965.

The movement of hoppers from the hatching areas was very limited. First stage hoppers rapidly accumulated in grass bordering the eggbeds, very largely they were blown into the grass. On September 25th, a significant movement of 3rd and 4th instar hoppers occurred onto medics and clovers in creek beds adjacent to some eggbeds.

Adults

Although 50% of the population were adult on 26th October very few males had developed the bright yellow pigmentation typical of sexual maturity.

Definite movement of fliers was first seen on 28th October and continued until between 12th and 23rd November. Numbers were very significantly reduced by 23rd November except in a few more favoured situations such as at Ucolta. Salvation Jane was largely dried off by 10th November and only very short green growth was found in spear grass and wallaby grass crowns by November 23rd.

On November 3rd it was apparent that adults had moved several chains to more favourable feed at several places in the valley. A light drifting swarm was located leaving section 48, Hundred Cavenagh, drifting across the road into saffron thistles in the watercourse. Flight was generally downwind. Adults took off at wind speeds of 0-6 mph, but dropped out of flight as soon as wind gusts reached 10 mph (temp. 16°C). Flight activity at Ross Burfords was described on 4th November as the lightest for several years.

Light drifting flights occurred near hatchings in the valley on 10th and 11th November, and a large swarm was encountered on 12th November flying down wind from Section 214 and 215 to Section 172 and 173 (Hundred of Coglin) south along the watercourse, (north of the survey area). No definite information was collected on the extent of movement of adult swarms. Most movement appeared to be very limited.

Egglaying was noticed first on 3rd November and continued until about 23rd November (i.e. max. 20 days). Significant laying was recorded on 9th November (mid E boundary each side of creek 63-Coglin), 10th November, (mid E boundary 90 Gumbowie), (NW corner 98 Gumbowie), ½ way along boundary 98-330 Gumbowie). 11th November, (SW Dawson) (88 Coglin) 23rd November (sth of rail line 90 Gumbowie). All were 1966 hatching sites.

Egglaying Activity

Egglaying activity was noted to occur mainly during mid-mornings. The following pattern was recorded at Ucolta on 25th November.

Time	No. Laying females	Wind	Temp.
8.45 a.m.	21	N 5-8 mph	20.5°C
9.45 a.m.	184	N 7-10 mph	23.0°C
10.45 a.m.	89	N 7-10 mph	24.5°C
11.45 a.m.	14	N 5-6 mph	25.3°C
12.15 p.m.	2	W 5-10 mph	27.0°C

Survival of Eggs Sampling of known eggbeds on 27th June 1967 failed to reveal many eggs. Some collapsed eggs were found indicating that heavy mortality had occurred possibly due to dryness during summer and autumn 1967.

General indications were that egglaying was less than might have occurred due to relatively early deaths of adults. Hence somewhat lighter hatchings were expected for 1967.

Observations in other Areas

Reported hatching 8th September at Moochra - found to be young Collembola.

Hatching at Black Rock and Sc. 94E, Hd. Morgan, Co. Dalhousie had not commenced by 8th September but was occurring on 24th September (Estimated 2 weeks later than at Dawson). The later development of these was still evident on November 5th when some 50% were adult (c.f. 26th October Dawson). A further examination on 24th November showed that at least half had disappeared since the last visit and probably only during the last 2-3 days which had been hot (good speargrass on 5th November).

Adults encountered at Terowie from 2-3 miles south of Terowie to light patches up to Ucolta.

Quite heavy invasion of lucerne at Yongala township on 25th November.

GRASSHOPPER ACTIVITY 1967

Hatchings began on 30th August and were still occurring on 20th September when most hoppers were in 1st and 2nd instars. Even at the time of first hatchings it was quite apparent that a very severe season was in store for grasshoppers. Rainfall in Dawson valley to end of August was only 213 points or Peterborough 447 to end of August. Barley grass and medics and clovers and salvation jane had not germinated. Speargrass and Danthonia crowns had only very short green growth right in crown - comparable with appearance 3rd November 1966 - and which failed to support adult hoppers. Young hoppers on hatching faced almost certain death from starvation.

Egg mortality prior to hatching also appeared high. Samples collected at Ucolta on 27th June showed many pods with shrivelled eggs. On 30th August we estimated 70-90% egg mortality. (Only one pod hatching every 4 feet).

Black ants particularly numerous - thriving in hot dry weather and possibly particularly active because of higher than average temperatures. Ants probably catching 50% of hoppers emerging from egg pods. Ants even running down into emergence holes after young hoppers.

Sampling begun 18th September - areas marked as moderate were checked again on 6th October ($2\frac{1}{2}$ weeks later) and hopper numbers were found to be very much reduced (at least 50% reductions). Even heaviest areas $2\frac{1}{2}$ weeks previously were rated only low density.

Heavy hatchings were reported to "Advertiser" on 6th October from Nackera. This area (when traced) was inspected and moderate hatchings were found in similar spear grass to Dawson. Death of the hoppers in 2 weeks was predicted and subsequently reported (to the "Advertiser") to have occurred almost on schedule.

A small group of hoppers were found between Peterborough and Dawson on 5-6th October on a small patch of barley grass in a damper depression. Bird predation was fairly heavy although probably few of the hoppers would have reached maturity anyway.

Grasshopper numbers were considered to have been reduced to their lowest ebb - comparable with 1940 - possibly even lower.

GRASSHOPPER ACTIVITY 1968

Autumn, winter and early spring of 1968 were cold and rainfall was above average. Hatching was anticipated later than in previous years - about the end of 2nd week in September. Inspections on 16-18th September of major eggbeds of previous years revealed a dozen perhaps first instar hoppers on 17th. No sign of freshly hatched nymphs was seen. At a further inspection 12-14th October, no Austroicetes were found in previous year's major eggbeds.

COUNCIL REPORT

REPORTS TO PETERBOROUGH D.C.

12/9/66	Sect.	218, Lot 5,	Yongala - Light
15/9/66	"	55, 56, 57,	Coglin - Light
19/9/66	"	73	Morgan - Light
26/9/66	"	D.C. Gebhardt,	Gumbowie
27/9/66	"	165	Yongala - west from dam
27/9/66	"	277	Nackera and near house and near Whydown homestead
28/9/66	"	83	Gumbowie near gate B.H. road
29/9/66	"	N.C. Scharkie	Nackera - Light widespread
3/10/66	"	93, 148, 149	Morgan - Light with heavy patches in 98
1967		Nil	
1968		Nil	

REPORTS TO ORRORO D.C.

20/9/66	Section 8 and 9 Erskine Colin Ainsbury
	Township of Black Rock
	Orroroo oval
	T. Trader - few
1967	Nil
1968	Nil

REPORTS TO CARRIETON D.C.

1966	One report, no details
1967	Nil
1968	Nil

REPORTS TO HAWKER D.C.

1966	28/9/66	Section 21, 22, 23, 24, 28, 29. Warcowie - Sparse over 14,100 acres rough terrain.
	29/9/66	Section 51 Yednalue - 10 acres fairly sparse
	30/9/66	Section 27, 18, 32 Warcowie) very scattered 75% of area - rough terrain Section 2, 6 Adams)
	8/10/66	Section 8, 9, 18, 19, 20 Wirreanda - scattered patches light infestation
	11/10/66	Section 112, 113S Arkaba - light over 900-1,000 acres
1967	Nil	
1968	Nil	

CEDUNA - PENONG PROJECT

CEDUNA-PENONG PROJECT

Andrewartha listed most of Eyre Peninsula as country in which plague grasshoppers may occur in sparse swarms. Other than one report for 1910 listing the Far West Coast, there seems to be little history of plague grasshopper outbreaks in the area. In 1965 grasshoppers were numerous in the Ceduna-Penong area and because of damage to cereal crops attracted attention and resulted in a request for assistance from the Murat Bay District Council. Large loose swarms were flying into cereal crops on 22nd October when the area was inspected.

Seasonal conditions, especially in the affected area were particularly dry. Some of the best wheat crops in the area were considered unlikely to yield more than 3 bushels per acre. Egglaying was noted on 22nd October, but no details regarding the beginning or the end of laying were available. In view of the adverse spring conditions only very limited egglaying was anticipated.

On 31st August 1966, hatchings were noticed in the area and reported to be dense and widespread. An inspection on 2nd and 3rd September confirmed these reports, and was quite contrary to expectations. Because of the large numbers of grasshoppers and the potential for damaging cereal crops, steps were taken to control the grasshoppers, and observations were begun with a view to gaining a better understanding of the abundance of grasshoppers in the area, and why they seemed to differ from the Hawker-Peterborough area.

The aims of work at Ceduna were thus:-

-: To control the apparent threatening infestation

-: To determine the factors determining the abundance of plague grasshoppers in this area and to see if and how this differed in the Ceduna-Penong area from in the "traditional" grasshopper belt.

GRASSHOPPER DISTRIBUTION AND CONTROL

Distribution

Landowners of the affected area met at the Charra Hall on 2nd September 1966 and requested the Murat Bay District Council approach the State Government with a view to invoking the Noxious Insects Act, and at the same time they undertook to survey the grasshopper populations on their own properties and to advise the District Council of the location, extensiveness and density of infestation within 7 days. /Densities rated light, moderate or dense as for Dawson project/.

The pattern of infestation apparent from a brief survey showed that hatchings were generally confined to relatively small areas, often only 10-20 acres in extent. They were predominantly on hard uncultivated ground, along fencelines, roadsides and hard bare areas in grazing paddocks. Scrub and roadside trees appeared to have acted as barriers to adult movement so that hatchings were often concentrated alongside such natural barriers. No infestations of significance were found in paddocks which had been cropped within the last 3-4 years.

Consultation, on the spot, with an agricultural pilot confirmed that control could not be carried out economically by aircraft because of the numerous small areas involved.

By September 12th landowners had reported some 66,650 acres of infestation from some 20 miles west of Ceduna to Penong (see map).

Acreage of infestation	inside D.C. area	outside D.C. area	Total
Light	15,700	15,750	31,450
Moderate	3,450	14,460	17,910
Dense	8,640	8,650	17,290
	27,790	38,860	66,650

For initial budgetting it was estimated that all the dense infestations and about half the moderate infestations would be sprayed - a total of 26,250 acres.

The treatment recommended to farmers was the application of 3½ ozs. g.i. B.H.C. per acre (22 fl ozs 16% lindane) and this was supplied on the basis of a 1/3 subsidy on cost of chemical by the State Government.

The results from lindane spraying were inspected on 30th September to 3rd October and found to be very variable and far from satisfactory. An immediate change of recommendation to 2 ozs. active ingredient dieldrin per acre was made and effected as rapidly as possible. Because of late rains very little movement onto crops was noticed, and all spraying had ceased by 6th November, and harvesting was in progress. Because of the limited effectiveness of lindane, landowners requested a 50% subsidy on that material. This request was granted.

Final costs of grasshopper control were:-

Treatment of Crown Lands	Cost	Approx. acreage
lindane 40 galls 16%	$ 132-00	213
dieldrin 30 galls 15%	115-00	360
misting machine for application	430-57	-
Treatment of Private Property		
lindane 1,885 galls 16%	6,221-00	10,053
dieldrin 278 galls 15%	1,072-80	3,336
Total	$7,971-37	13,962

The final acreage sprayed, about 14,000 acres was less than expected largely because of the limited effectiveness of lindane. The final cost - excluding labour costs etc. were

Government expenditure	$4,145-92
Landowners' expenditure	$3,825-45
	$7,971-37

Problems encountered

Undoubtedly the greatest was from the limited effectiveness of lindane. Previous literature published in S.A. on grasshopper control had apparently failed to distinguish between plague grasshopper and plague locust with regard to control measures. This, together with several years' use of small quantities - but probably not at exact application rates, within the District Council of Hawker, were given more credance than W. Aust. literature which showed lindane sprays as significantly inferior to dieldrin.

Considerable variation of results were obtained with dieldrin sprays. Where boom sprays were used results were quite satisfactory. Much of the poor result is attributed to the use of misting machines under excessive wind conditions. Apparently no farmers attempted spraying in the dawn-early morning calmer period, and winds of 10-20 mph were very common on most days during the spraying period.

Trouble was experienced with bursting hoses on both "Marino" and "Mistrite" misting machines. No satisfactory explanation could be found for this.

DISTRIBUTION

1967 Only two reports of infestion were received by the Murat Bay District Council.

Reg Borlace reported some 300 acres 18/9/67

Bill Oates reported some 200 acres 27/9/67

Reports indicated that quite a few were north at Penong-Bookabie road but they were not officially reported. Landowners were generally not anxious to get involved in control programme again following the problems with lindane in 1966. Plentiful feed - spear grass grown from summer rains reduced economic need for control.

1968 No official reports of grasshoppers were received by the Murat Bay District Council. Very dense grass growth following one of the most favourable growing seasons on record made it very difficult to see young hoppers. Low to moderate numbers in A. A. Hoffrichter's - beside Koonibba Reserve.

1966 HATCHINGS

PENONG

CEDUNA

LIGHT

MODERATE

DENSE

0 5 10

miles

GRASSHOPPER ACTIVITY

1965 - Adults flying in loose scattered swarms on 23rd October. Spring growing conditions very adverse, very little paddock feed and cereal crops very poor. Significant damage caused to some crops, (some by the hopper stages). No information on start or finish of egglaying. ?? Cereal crops may provide the necessary feed to enable adults to survive longer and so lay more eggs.

1966 - Hatching reported 31st August - about 1 week earlier than at Dawson.

Bright yellow males were present 26th October (observation by John Dawes). Ken Holden suggests first adults present on 6th October when dieldrin trial put down.

There was very little evidence of adults moving into crops in October-November 1966. This was thought to be at least partly due to late spring rains providing adequate alternative food. Crops were being harvested by November 6th - would appear likely that egglaying had ceased by then, or by 18th November.

1967 - Good summer rains in the area had promoted copious growth of speargrass. First hatchings 23rd August - again about 1 week earlier than at Dawson.

Grasshoppers were reported moving on road to Ceduna (- probably near Bill Oates) on 27th September, 1967. Apparently adults. Conditions at this time quite dry and dusty so that likelihood of causing damage was thought to be high.

First egglaying began on Sunday, 22nd October. Speargrass was still quite green at that stage but finished off very rapidly - by Thursday, 26th October it was very much drier than a week before. By Monday, 30th October numbers of grasshoppers were greatly reduced - Main egglaying must have occurred then over an 8-10 day period. There was also no tendency for adults to move into cereal crops. Western Australia advise that feeding ceases as soon as egglaying begins. - ??

Ceduna max. temperatures

10th Oct.	70°F
11th	67°F
12th	69°F
13th	76°F
14th	66°F
15th	92°F
16th	92°F
17th	97°F
18th	76°F
19th	66°F
20th	68°F
21st	75°F
22nd	94°F
23rd	94°F
24th	77°F
25th	99°F
26th	71°F
27th	80°F
28th	81°F
29th	70°F
30th	90°F
31st	71°F

1st Nov.	68°F
2nd	64°F - Too few to warrant further spraying
3rd	65°F
4th	74°F
5th	79°F
6th	76°F
7th	61°F
8th	69°F
9th	70°F
10th	74°F
11th	91°F
12th	85°F
13th	68°F
14th	67°F
15th	71°F
16th	79°F
17th	86°F
18th	91°F
19th	98°F
20th	100°F

Egglaying period 1967 considered to be short and so not likely to result in very extensive or dense hatchings in 1968.

1968 - Good summer rains again fell during January-February 1968 so promoting good speargrass growth in the area. High winter rainfall has further accentuated a lush season.

Date of first hatching not established.

Inspection of hatching sites Koonibba-Uworra on 7-8th October showed reduced numbers of grasshoppers among very dense plant growth.

A record season for the area. Conditions expected to favour the reduced numbers of grasshoppers.

SPRAYING TRIALS 1966

The pattern of infestation in the Dawson Valley confirmed earlier opinions that ground equipment would be required to cope with the relatively small scattered areas of infestation.

Immediate difficulty was experienced with the Maruyama mister. The use of dyes and marker cards established that the spray was not reaching the ground. Apparently the droplet size was too small. Modifications of the terminal spinning disc, and finally complete removal of the disc gave improved results. Further manipulations of height and angle of the nozzle resulted in moderately successful results. With the nozzle pointing horizontally and directed downwind (max. 10 mph) an effective swathe width of 25 to 50 ft was obtained. At this setting the application of 6½ fl. ozs. of 96% maldison gave up to an estimated 90% kill of 3rd and 4th stage hoppers.

Lack of availability of the Maruyama unit forced a change over to a "Marino Blowamist" knapsack sprayer. Variations in pressure, blockages and unrefined needle valve adjustments provided many problems.

Spraying operations were suspended at the end of October 1966 when adults were appearing and beginning to move. Later reports of successful application of ULV spraying against denser swarms of flying locusts in N.S.W. suggest that further work against adults of plague grasshoppers would be worthwhile.

A fullscale Marino Mister has been made available by Marino Products Pty. Ltd. of Brisbane for adapting to ULV application. A number of problems have been encountered, particularly with regard to calibration, controlling the rate of flow, and with blockages and pump gaskets.

Spraying with lindane from conventional misters at Ceduna gave unsatisfactory results. Results with dieldrin in the same area were also variable and indicated that increased care is needed when using misters compared with boomsprays.

In early December 1966 trial sprayings of wingless grasshopper (Phaulacridium vittatum) were carried out at Meningie with the Maruyama ULV spray. 19 acres was sprayed using a 30 ft. swathe at 8 fl. oz. p.a. and 32 acres was sprayed using a 50 ft. swathe width to apply 4.25 fl. ozs. p.a. The former area gave good control while the latter was uneven indicating that the swathe width was too large. Reinvasion appeared to take place over as much as 140 yards. An aerial spraying trial with technical maldison on 17th December 1966 involved spraying 93 acres with 6.24 fl. ozs/acre and 38 acres with 3.6 fl. ozs/acre. Results were very much inferior to the ground spraying trial - no explanation was found.

SPRAYING TRIALS 1967

Experimental sprayings with the "Marino Mister" encountered many problems. Moderately satisfactory results were being obtained by October 1967 when Terra Trading Company of Perth made available a misting machine they had developed for ULV application. Trial sprayings were undertaken with this machine at Ceduna-Penong against adult plague grasshoppers. Droplet size of a much more uniform nature was obtained with the "Terra" Mister than had been obtained with the "Marino" adaptions. Satisfactory results were obtained in a number of trial swathes. In spite of the manufacturers claims of 3-5 chain swathe widths, the results we obtained indicated that $1\frac{1}{2}$-2 chains was the maximum width giving complete reliability. Some 4 chain swathes were obtained. Spraying was carried out with wind speeds varying from 0-10 mph.

Further spraying with "Terra ULV Mister" against Phaulacridium vittatum during November, December 1967 showed that as wind speeds rose to 14 mph results became patchy. Results with 2 chain swathe, 3-14 mph winds, 0.25 nozzle, 40 p.s.i. pressure with forward land speed of 6 mph were quite successful.

SPRAY ASSESSMENTS

Technical Maldison - 'Terra ULV Mister'

Wednesday 25th October BO_1 sprayed p.m.

Nozzle 0.025

Pressure 40 PSI

Ground speed 6 mph

Wind speed 7 mph

Application rate

10.2 fl oz/min or

6.2 fl oz/ac for 2 chain swathe

Dead thick for 2 chns extending to nearly 5 chns. Deaths - 10 x 10 yard samples

24 Hours	
Male	Female
11	0
35	9
33	6
38	7
55	3
24	2
12	0
8	0
4	0
0	0
220	27

2.2 males per sq. yd.

\+ 0.27 females per sq. yd.

Total 2.5 sq. yd. 9 times as many males as females.

Thursday 26th October, a.m. BO_2

Nozzle 0.031

Pressure 40 PSI

Ground Speed 6 mph

Wind Speed 7 mph

Application rate

14.9 fl oz/min

or 9.3 fl oz/ac (2 chain swathe)

8 hours

Dead extend fairly thickly for 4+ chains. Odd dead to 2 more chains with many alive

24 Hours	
Male	Female
11	2
18	6
17	9
12	3
17	4
15	3
7	1
6	2
2	2
3	3
108	35

1.08 males/sq. yd.

0.35 females/sq. yd.

Total 1.4/sq. yd. 3 times as many males as females

Thursday 26th October, a.m. BO_3

Nozzle 0.039

Pressure 40 PSI

Ground Speed 6 mph

Wind speed 6 mph

Application 26.5 fl oz/min

or 16.5 fl oz/ac
(2 chain swathe)

8 Hours

High death rate for 95 yards = 4+ chains

24 Hours	
Male	Female
2	2
12	5
13	5
5	1
10	1
3	1
5	0
4	0
2	1
2	0
58	16

0.56 males/sq. yd.

0.16 females/sq. yd.

Total 0.75/sq. yd. 3-4 times as many males as females

Thursday, 27th October p.m.

Don Trewartha 1. (N.S.)

Nozzle .046

Pressure 40 PSI

Ground speed 6 mph

Wind speed 4-5mph

Application Rate 33.8 fl oz/min
or 21 fl oz/ac (2 chain swathe)

	24 Hours	
	Male	Female
	0	1
	1	1
	8	2
	13	1
	7	1
	35	9
	29	14
	19	5
	9	3
	11	1
	3	0
	4	0
	3	1
	142	39

1.09 males/sq. yd.

.38 females/sq. yd.

Total 1.4/sq. yd. 3-4 times as many males as females

Friday, 28th October a.m.

Don Trewartha 2 (N.S.$_1$)

Nozzle .020

Pressure 40 PSI

Ground speed 6mph

Wind speed 7-10 mph

120 ft swathes

Application Rate 5.9 fl oz/ac.

24 Hours	
Male	Female
10	2
8	0
2	0
4	1
4	0
4	2
5	2
21	6
31	5
8	1
7	2
5	3
2	0
111	23

.85 males/sq. yd.

.18 females/sq. yd.

Total 1.02/sq yd. 4-5 times as many males as females.

Friday, 28th October p.m.

A.A. Hoffrichter 1. (H)

Nozzle .025

Pressure 40 PSI

Wind 5-6

Ground speed 6 mph

Swathe widths 2 chain

Application Rate

6.2 fl oz/ac.

24 Hours			48 Hours	
Male	Female		Male	Female
54	23	- start beginning 2nd swathe	6	3
65	21		23	13
91	21		9	8
53	23		4	2
		to end of swathe 2nd	12	6
76	36		19	14
103	42		14	13
75	39		33	17
86	28		23	8
93	32	- first 4 yds in 2nd - rest in 3rd swathe	20	6
86	34		32	11
80	22		24	11
85	20		29	12
84	12		248	124
1031	353			

7.93 males per sq. yard 1.90 males per sq. yards.

2.72 females per sq. yard .95 females per sq. yards.

Total 10.65 per sq. yard - This is densest adults yet found.

1967

Friday, 28th October at 4 p.m. (H_1)

A.A. Hoffrichter

Nozzle .025

Pressure 40 PSI

Wind 8.14 mph

Ground Speed 6 mph

Swathe widths 2 chain

Application Rate 6.2 fl oz/acre.

Deaths at 24 hrs.		+ Deaths at 60 hrs.		Death at 72 hrs.		84 hours	
Male	Female	Male	Female	Male	Female	3½ days	
54	23 -*						
65	21						
91	21						
53	23						
	-**						
76	36						
103	42						
75	39						
86	28						
93	32)-***						
86	34	20	2				
80	22	22	0				
85	20	28	3				
84	12	24	3	9	2	17	4
1031	353	94	8	9	2	17	4

7.93 males/sq. yd.		2.35 males/sq. yd.			
2.72 females/sq. yd.		0.20 females/sq. yd.			
10.65/sq. yd	+	2.55/sq. yd.	+	0.3/sq. yd. +	0.5/sq. yd.

Total Deaths 14.0/sq. yd.

-* start begin at 2nd swathe

-** end 2nd swathe

)-*** 4 yards 2nd 6 yds 3rd swathe

This was a particularly heavy infestation - probably as dense as Austroicetes ever reaches as adults. Density 10-14 per sq. yard - (movement in accounts for 14). Technical maldison continued killing