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GRASSHOPPERS AND LOCUSTS IN WESTERN AUSTRALIA

By C. F. H. JENKINS, M.A., Chief, Biological Services Division

GRASSHOPPERS and locusts are among the most ancient enemies of the farmer, for they figured prominently in Biblical times, and periodically throughout the ages have devastated crops in all parts of the world.

The term grasshopper covers a wide range of insects differing in size and habits, but characterised by the fact that they are vegetable feeders and have the hind legs especially developed for jumping. There are many different species of grasshoppers and locusts in Western Australia, but the difference between the two groups is not generally understood.

When conditions are suitable, the species usually termed locusts are much more gregarious or social in their habits than grasshoppers, and may undertake long migratory flights of several hundred miles.

In south-western Australia, although several species of true locusts occur, including a form of the world-famous migratory locust, conditions are not favourable to swarm development, and so fortunately only scattered individuals are encountered.

In addition to the distinction between locusts and grasshoppers which is based more upon habits than structure, there is also to be observed the difference between the short-horned grasshoppers (Acri-didae), and the long-horned grasshoppers (Tettigoniidae). The common names are more or less descriptive in that the antennae or feelers of the short-horned varieties are short and moderately broad, whereas in the long-horned group, the antennae may be almost hair-like in thickness and exceed the entire body of the insect in length.

THE SMALL PLAGUE GRASSHOPPER
(Austroicetes cruciata (Sauss.)

The most important grasshopper in Western Australia is the small plague grasshopper of the drier wheatbelt districts. A general description of this pest and its habits may be regarded as typical of the other short-horned species.

Description
The female measures a little over an inch in length, and is mottled brown in general coloration. The male is noticeably smaller than the female, and the forewings are mottled with light and dark brown. The most striking feature about the mature males is the bright yellow tinge on the body and legs. The hind wings in both sexes are clear and transparent.

Life history
The grasshopper lays its eggs in almost any kind of soil providing it is compact and free from dense cover. The female bores into the ground by means of hardened chitinous valves situated at the end of the abdomen, at the same time exuding a frothy substance which acts as a lubricant and a lining to the egg pod.

About 20 eggs are laid in each pod, and it is characteristic of this species that a large group of males usually cluster around the ovipositing female. The eggs are yellowish white in colour and crescent-shaped. Egg laying takes place in the
The small plague hopper spring, and the eggs survive the summer to hatch about July or August, when sufficiently moistened by the winter rains.

When it first issues from the eggs, the young grasshopper moults or sheds a tight-fitting white skin, and is then capable of hopping about like its parent. At this stage however, it is rather smaller than a housefly and dark in colour. It feeds voraciously upon almost any available weeds, and increases in size by a series of moults, until maturity is reached about October.

Egg laying is then performed and the adults die.

The small plague grasshopper is not present in the wetter areas of the South-West, but its place there is filled by a number of other species of local importance.

Influences on outbreaks

A study of the climatic conditions for the plague years shows that the rainfall was light and this appears to have had a favourable influence upon the hatching and development of the insects. Another factor, however, has had a very important bearing upon the incidence of grasshoppers in these areas.

Following the financial depression of 1929, much land which had been normally kept under cultivation was allowed to lie idle. The effect of low prices was accentuated by a succession of drought years and this led to a general decline in agricultural activities in all districts, but more particularly in those areas where the margin of safety was least evident.

In the boom years preceding the depression, agriculture in Western Australia spread at a very rapid rate and extensive clearing took place in all parts of the wheatbelt. Grasshoppers had always been present in these areas in small numbers, but forest and scrub country was not favourable to their multiplication and feed was relatively scarce. The clearing of the country exposed vast areas suitable for egg laying and the grass which this land supported provided an ample food supply for the increasing insect population. As long as high prices and good seasons stimulated farming activities, the menace of these potential breeding grounds was not apparent, and reserves, ring-barked areas, road sides, etc., were the only places where hoppers appeared. When, however, following depression and drought, abandoned farms became numerous, the grasshopper problem became one of paramount importance. The large areas of land left idle in most cases did not revert to bush again and were of such a nature, that the longer they were left untouched, the less herbage they supported, thus yearly increasing the breeding grounds available for the pest.

The problem as it exists in this State is by no means unique. The same species of grasshopper constitutes a comparable
problem in South Australia. Furthermore, the following quotation from the "Journal of Economic Entomology for 1940" shows that the same difficulties are being faced in the United States of America:

"Agricultural conditions of recent years and recently adopted agricultural practices have greatly increased the amount of abandoned and reverted land in certain areas. Thus in North Dakota in 1938 there were more than four million acres of idle crop land listed among farms participating in the agricultural adjustment programme. This amounts to nearly 18 per cent. of the total crop land acreage of the state. This abandonment has occurred along with our extensive outbreaks of grasshoppers of recent years, so it is natural to suspect that the two facts might represent a cause and effect relationship."

Outbreaks
As far back as August, 1922, swarms of grasshoppers were reported from Kununoppin, Nungarin and Merredin in the north-eastern wheatbelt and isolated outbreaks were recorded from these areas almost yearly up to 1934.

In 1935, quite a widespread plague was experienced, and the pest increased annually until in 1937 almost the entire wheat areas were affected.

In order to combat the grasshopper trouble the policy was instituted in 1935 of making free poison bait available to farmers through local Road Boards, and in 1937 Government subsidies were commenced for the ploughing of grasshopper-infested areas. In recent years dieldrin spray was provided instead of bran bait. Since the formation of the Agriculture Protection Board in 1951, grasshopper control has come under the direction of this Board, and the Agriculture Protection Board Act provides that not less than $60,000 be provided each year for grasshopper control.

In recent years grasshopper activity has been rather depressed and this is reflected by the following figures.

Government expenditure
In the ten years 1944 to 1953 the average annual expenditure on grasshopper control was approximately $26,000 applied as follows:

Financing ploughing of egg-laying areas—$20,000 approx.
Providing poison bait—$6,000 approx.
The average annual acreage ploughed was 66,000 acres and the heaviest single annual expenditure was in 1950 when $60,000 was spent in ploughing 140,000 acres and providing 170 tons of bait.

In the past five years the average annual expenditure on grasshopper control was approximately $12,000 applied as follows:

Finance for the ploughing of egg-laying areas—$8,000 approx.
The provision of bait and spray concentrate—$4,000 approx.
The average annual acreage ploughed was 22,000 acres and the heaviest single annual expenditure was in 1954 when $22,000 was spent in ploughing 38,000 acres and providing 160 tons of bait.
This improvement in the grasshopper control position has been greatly helped by the change in agricultural practice in the outer wheatbelt in recent years. Mixed farming methods instead of the earlier dependence on wheat combined with more stable prices for agricultural products has led to the resumption and working of thousands of acres of previously abandoned country and a consequent reduction in grasshopper breeding. The grasshopper population also experienced a severe setback in the summer of 1955-56 when a prolonged and severe heatwave with many days over the century destroyed a high proportion of eggs and resulted in a very light hatching the following season.

The sudden decline in grasshopper numbers on the eastern fringe of the wheatbelt was attributed by many people, despite warnings to the contrary, entirely to artificial control measures, and the effects of climate were largely overlooked. This led to widespread apathy, as far as the grasshopper problem was concerned, and explains some of the surprise and concern expressed by many landholders following grasshopper activity years.

Control measures

Cultural methods

Heavy timber growth and a profusion of ground cover are unfavourable for the breeding of the small plague grasshopper and consequently the needless clearing and ring-barking of land in the grasshopper belt are to be deprecated. Every effort should be made to cultivate hard bare soil so as to destroy eggs already laid and to render the area unattractive to the next swarm of laying adults.

Summer cultivation with fixed tyne cultivators after egg laying is completed is quite effective and is favoured in certain districts where labour and other difficulties may reduce the amount of grasshopper ploughing possible during the seeding and fallowing periods.

Spraying

Recent research on spraying equipment and chemicals has demonstrated that the safest and most effective way to control grasshoppers is by extra low volume applications of technical maldison applied at 4 fl. oz. per acre from specially fitted aircraft or appropriate ground misters.

Technical maldison has a relatively high specific gravity and falls to the ground much faster than the more conventional water based sprays. For this reason very low flying (3 to 6 ft.) is not recommended and the best coverage is often obtained from a height up to 40 ft.

A slight cross wind is desirable to ensure a swathe width of ½ to 2 chains and so preliminary tests to check wind drift should be carried out before the direction of flight and the operating height are finalised. The best results with ground
Aircraft are used extensively in grasshopper control. Equipment are also dependant upon a satisfactory cross wind and the drift should be checked before the swathe width is determined.

Where grasshoppers are invading crops or gardens from adjacent grass paddocks, as wide a barrier of grass as possible should be treated across the line of advance. At least a five-chain strip is recommended where flying insects are active. A portion of the crop face should also be treated.

For small scale use, as in the metropolis home garden, infested areas may be sprayed with the insecticide carbaryl (also called Sevin, Dicarbam and Septene). This is a water dispersible powder which should be used at the rate of 1 lb. 80% powder per acre. The material should be mixed with approximately 5 gallons of water, so that a good deposit remains on the plants being attacked.

Warning

Stock should be excluded for about a week from paddocks where general spraying has been carried out. Scattered treatments should provide little stock hazard.

Baiting

Broadcast amongst the hoppers the following poison bait:—

25 lb. bran.
1 lb. poison dust (10% BHC)**
2½ gallons (approx.) water.

This amount of bait is sufficient for one acre of ground. For home garden use the following quantities are suggested:—

6 lb. bran.
½ lb. poison bait (10% BHC)**
½ gallon (approx.) water.

Mix the BHC dust dry into the bran. Sufficient water should be gradually mixed in to produce a moist crumbly mash which will scatter in fine flakes when tossed into the air.

An alternative bait formula which may be used is as follows:—

4 oz. of 50% maldison thoroughly mixed with ten pounds of dry bran.

For maximum results the bait should be applied early on a bright calm morning.

Bait is most effective against the hoppers when they are about three parts grown.

Warning

Avoid the inhalation of the dust as much as possible when mixing. Also avoid lumpy bait as this may be a danger to stock.

OTHER GRASSHOPPERS AND LOCUSTS OF IMPORTANCE

Although the small plague grasshopper is by far the most important grasshopper pest in Western Australia, quite a number of other species can become troublesome.

** If 10 per cent. BHC (Benzene-hexachloride) is not available, Paris Green or Arsenite of Soda may be used but are slower in action.
The Australian plague locust

Some of the commoner are briefly dealt with, and the control measures already outlined will be found applicable in one form or another to all the local species.

The Australian Plague Locust
(Chortoicetes terminifera (Walk.))

This locust is of primary importance in the Eastern States where it assumes plague proportions. In West Australia it is numerous in the summer months, often attacking vegetables and garden flowers, but very seldom masses into true migratory swarms.

It is larger than the species already described, and may be brownish or green in colour. The extremities of the otherwise clear hind wings are tipped with black.

Its breeding habits are generally similar to those of the previous species, but several generations may occur in one year if weather conditions are suitable.

It is the lack of widespread summer rains which prevents the species from developing plagues in West Australia of comparable importance to those which invade portions of the Eastern States. Occasional swarms have been recorded, however, the most notable of which occurred in the Hyden-Salmon Gums area in the summer of 1966/67.

The Wingless Grasshopper
(Phaulacridium vittatum (Sjöst.))

This is a small grasshopper, uniform grey or brown in colour, and with many individuals almost wingless.

It is common in many districts around Perth and the lower South-West and unlike the grasshopper of the wheatbelt, breeds quite freely in sand. Damage is sometimes done to market gardens, flower gardens and fruit trees, but the plagues are always strictly local, as only a few of the insects ever develop wings, even when fully mature.

The Yellow-winged Locust
(Gastrimargus musicus (Fabr.))

This species is a large thick-set grasshopper, easily recognised by the conspicuous black and yellow colouring of the hind wings.

The favourite haunts of this insect are grassy paddocks supporting a wealth of couch or paspalum. On this account, it is commonly seen during the summer months in the Harvey-Waroona irrigation districts and along river flats.

The yellow winged locust is an important pest in the summer rainfall areas of the north and periodic plagues occur during the summer months which may devastate homestead gardens and other cultivated produce.
The Spur-throated Locust  
* Austracris guttulosa (Walk.)  

The spur-throated locust is a large brown locust about 2\(\frac{1}{2}\) inches in length which is fairly common in many parts of the South-West but never in plague swarms. Like the yellow-winged locust and the migratory locust, however, it swarms in the more northern regions and occasionally has invaded the banana plantations at Carnarvon. The habits of this locust differ greatly from those of the wheatbelt grasshopper as the adult is a much longer-lived insect.

Egg laying, which takes place at night, occurs about December or January and the eggs hatch soon after.

The winged adults feed voraciously on a wide range of plants including eucalypts, bananas and citrus. The winter months are passed in the adult stage, when the insects sometimes cluster in large masses in the tree tops almost like swarms of bees.

Long-horned Grasshoppers

The long-horned grasshoppers differ considerably in habits from the short-horned species and are of much less economic importance.

The ovipositor or egg laying apparatus of the female “long-horned” is usually long and sword-like, although not invariably so. The eggs are usually placed in rows along the edges of leaves, but some species lay them in the ground.

The long-horned grasshoppers, although often numerous enough to cause annoyance, cannot be regarded as serious pests in this State. They may cause damage to ripening fruit and being usually more arboreal in their habits than the “short-horns” are less susceptible than the latter to normal control measures.
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