LOCUSTS IN RELATION TO SUGAR CANE

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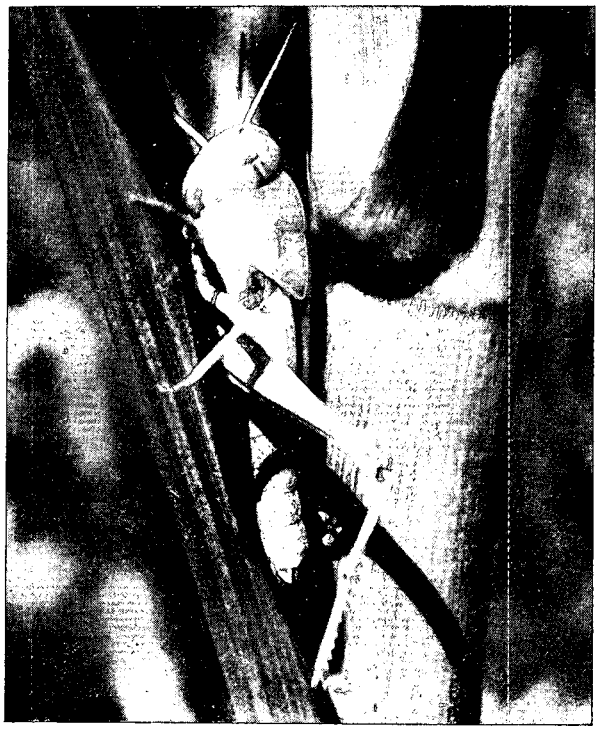
There is perhaps a tendency to regard locusts as things of the past since, in general, they are now very effectively controlled by international organizations specifically established for this purpose. Normally, however, these organizations carry out control operations only in the regions from which plagues are known to originate. It is probably not generally realized that small colonies of locusts in the solitary phase are still scattered all over the areas previously invaded by swarms. The sugar cane growing areas of southern Africa lie in the invasion areas of two locust species; the red locust *Nomadacris septemfasciata* (Serv.) and the African migratory locust, *Locusta migratoria migratorioides* Reich. and Fairm.

Although not closely related taxonomically these two species show many common features in their behaviour. In each case, so far as is known, swarms originate only from one or a few areas where drainage is impeded and where grass growth is luxuriant and extensive. In this respect they differ from the brown locust and other African locusts. In the case of the red locust these areas centre on Lake Rukwa in southern Tanzania while in the migratory locust they are in the flood plains of the Niger in the Republic of Mali. The invasion areas of these locusts cover almost all of Africa south of the Sahara though the red locust, in recent plagues, is confined to the east and south of this area.

At the present time the populations of both species in the outbreak areas are low and pose no immediate threat. It is of interest that at present the biggest known population of the red locust is on the Niger in the outbreak area of the migratory locust. Although outbreaks of the red locust have never been known to originate there, a few years ago its numbers grew so much that it was considered advisable to carry out control measures against it and since then it has been much less numerous. Colonies of migratory locusts are similarly to be found in the outbreak areas of the red locust but they have never become so numerous as to give cause for alarm.

Locusts feed on a great many different plants but, since their staple foods in the outbreak areas are various grasses, it is not surprising that sugar cane receives their attention. Thus, at the time of the last plague, which lasted through the 1930's, petering out in the early 1940's, probably the greatest agricultural damage in South Africa was done to sugar-cane in Natal. Consideration of this fact, together with the knowledge that there have been three prolonged red locust plagues in Natal in the last hundred years, was probably largely instrumental in causing South Africa to give her support to the scheme for setting up an international service for the control of this locust. This service became fully operative with the signing of an international convention which came into operation in February, 1949. All governments to the south of Uganda and the Congo (Kinshasa) contributed to the upkeep of the Service and still do, and it is a measure of the success of the Service that since then there have been no locust plagues nor, indeed, any serious



Late Instar Hopper of Migratory Locust feeding on Sugar Cane.

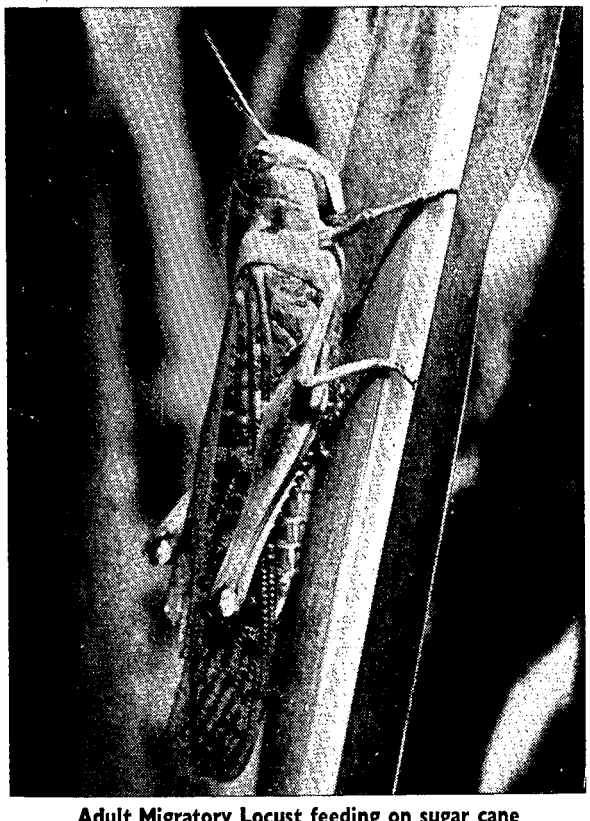
(Photo: Rhodesian Agricultural Journal)

threat of them. A little later a similar organization was set up for the control of the African migratory locust and this also is still functioning.

In the intervening years, as far as is known, the only serious trouble to crops in southern Africa occasioned by locusts took place in 1965, in sugarcane in the Hippo Valley. This is a warm area in the south-east of Rhodesia at an altitude of about 500 m which in recent years has been extensively developed for the growth of various crops under irrigation. At that time the cane plantings were being rapidly expanded. The cane is grown under irrigation and covers a substantial area so that ecologically conditions are not unlike those of an outbreak area of either of these locusts. There is, in effect, a plentiful supply of tall, palatable grass, favourable temperature and moist soil which is an essential for egg-laying. A few red locusts had been seen in the area by Dick and Carnegie in November, 1964, but had not been considered of importance.

It therefore came as a surprise when, in January, 1965, a report was received of extensive damage being caused over an area of some 3,000 acres of young cane which had been planted the previous September. This was on Hippo Valley Estates. affected areas the entire blades of all the leaves of the plants were eaten away, leaving only the midribs. The stems, together with the leaf sheaths, were not in general affected. These areas could be picked out at a glance, especially from the air, by the brown appearance of the cane.

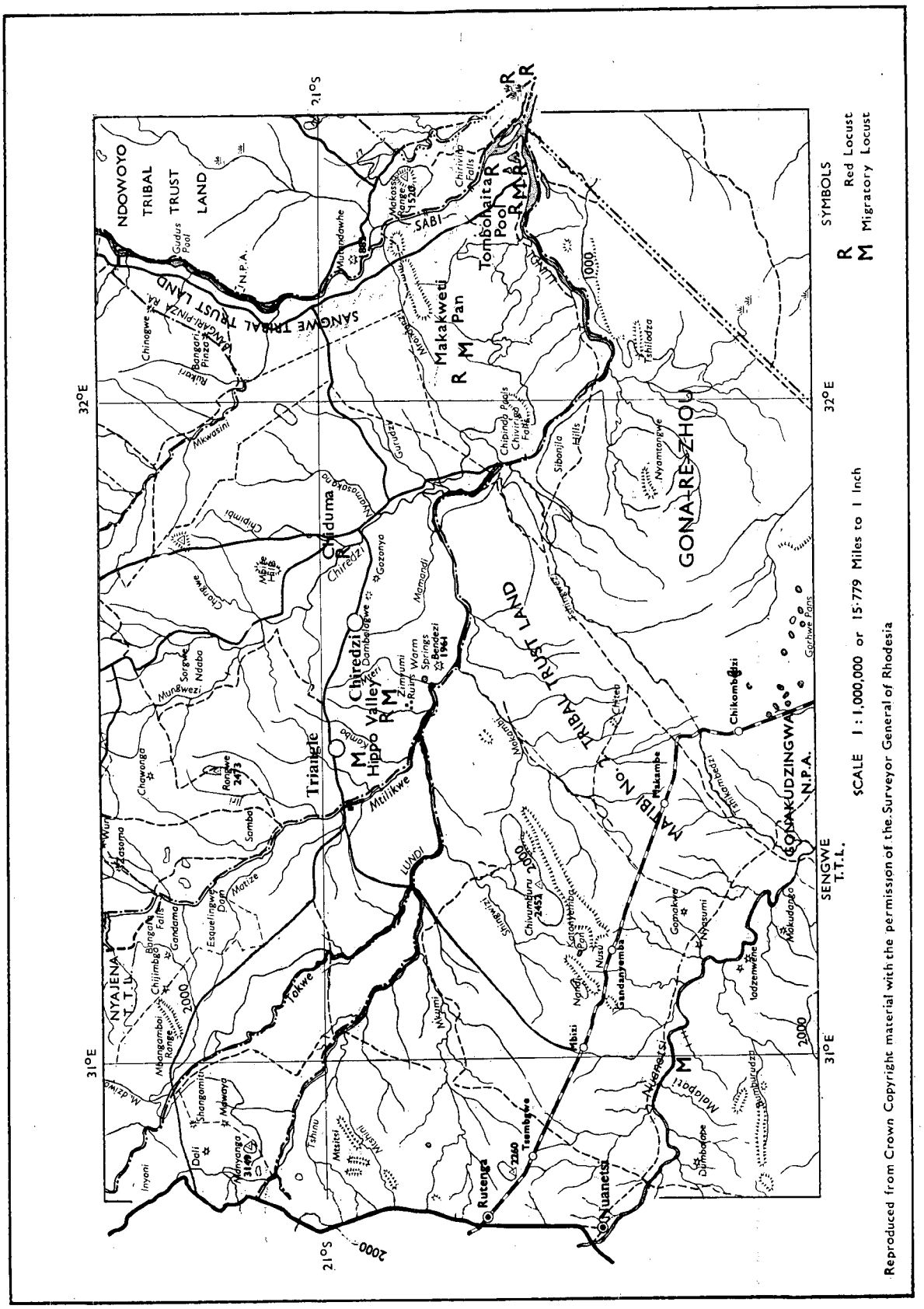
Unlike the red locust, which invariably has only one generation a year, the migratory locust has two generations in its outbreak area and the favourable conditions produced by irrigation in the cane fields could conceivably have led to the development of yet more generations. As under favourable conditions the increase each generation could be of the order of a hundredfold the threat to the cane was clearly a very real one. It was therefore apparent that some control measure was essential. This would consist of the application of an insecticide. The nature of the crop is such that ground spraying equipment is impracticable. Therefore arrangements were made with a crop protection company to spray the affected areas from the air. In Rhodesia few aerial spraying aircraft were available and because of this a helicopter was used. There is, however, no reason to suppose that a fixed-wing aircraft, had one been available, would not have been equally satisfactory.



Adult Migratory Locust feeding on sugar cane
(Photo: Rhodesian Agricultural Journal)

Investigation of the problem revealed the further surprising feature that the locust concerned was not the red locust but the migratory locust. This species had not been known in Rhodesia, other than for a few isolated individuals, since the end of the previous plague (Whellan, 1967).[3] The red locust, on the other hand, was known to exist in small colonies over a wide area of Rhodesia (Whellan, 1964).[2] It is also found under similar conditions in the northern part of South Africa. The damage caused at Hippo Valley was so great as to raise doubts as to the capacity of the cane for recovery. In the badly

Various insecticides were considered but, in the event, two were used, dieldrin 50% wettable powder at one pound per acre and carbaryl 85% wettable powder at two pounds per acre. The dilution was generally in three gallons of water. The results with both of these insecticides were very good, an almost complete kill of the locusts being achieved. The more recently developed insecticide fenitrothion might well be equally effective and would have the advantage of low mammalian toxicity, as compared with dieldrin, and a shorter residual life than both insecticides used.



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Arrangements to spray were perforce made at very short notice and complete coverage of the crop was aimed at. Since locusts move about a good deal this is probably not really necessary and spraying in swaths might be just as effective and would be considerably less expensive. Work on the red locust in the Rukwa Valley (Yule, 1961)[4] has shown that its hoppers can be effectively controlled by lattice spraying with dieldrin whereby less than 10% of the total area is covered. The marching behaviour of hoppers in the outbreak area means, however, that swaths can be spaced further apart than in an area, as in the cane in Rhodesia, where movement is, so far as is known, random. The 250-yard spacing of 20-yard swaths would therefore have to be considerably reduced.

Despite the heavy damage to the cane, after the destruction of the locusts it recovered so well that there was no significant loss in yield. This does not mean that control was unnecessary but rather that it was undertaken in good time. Had the locusts been allowed to carry on unchecked and in the absence of any natural control, the later development of the cane would doubtless have been seriously retarded.

At the end of March, 1965, a thorough survey of the area was carried out. The helicopter belonging to the International Red Locust Control Service was made available for this work. It was found that, as well as the migratory locust, the red locust was present on Hippo Valley Estates but not in sufficient numbers to cause appreciable damage. On the neighbouring Triangle Ranch, where the migratory locust was known to be present but had been thought to be of little significance, some quite heavily infested areas were found, but the red locust was not found. The worst infested areas were subsequently sprayed from the air with good results. It is surprising that locusts had not been found there previously because, unlike Hippo Valley which had been developed only over the preceding few years, the Triangle Ranch had a history of cane-growing extending back for about 30 years.

At first it was thought that the locusts had probably arrived at Hippo Valley from some undetected breeding area in the neighbourhood. To find this was then the primary object of the search by helicopter. The undeveloped areas to the east and south-east of Hippo Valley were thought most likely to harbour such a breeding colony and the search was accordingly concentrated into this area for a distance of some 70 miles. No such focus of infestation was found but two small colonies of the migratory locust were found, the nearer being about 40 miles each of Hippo Valley, while seven small colonies, one of which had a fairly considerable population, of the red locust were found. On a later occasion a further small colony of the migratory locust was found about 40 miles to the south-west of Hippo Valley. All these colonies were in moist pans and have no doubt remained in existence since the last plague, if not even earlier. The largest of them, though extending over a much smaller area, had a red locust density which the pilot thought similar to that at Lake Chilwa, Malawi, which is considered a potential outbreak area (Anon, 1963).[1] None of them, however, seemed a possible focus of infestation by either species for Hippo Valley. The most likely explanation is that in the course of clearing the ground for the planting of cane, one or more areas containing small colonies were cleared and the locusts, finding the cane a more than adequate substitute for the grasses previously present, multiplied exceedingly. That suitable pans were present in the cleared area is known, but there are no observations on the presence of locusts in them.

A sample of the locusts was sent to the Anti-Locust Research Centre in London for statistical analysis. This showed that they were of the phase *transiens*. Swarming from such an area does not seem likely though the possibility cannot be ruled out entirely. The increasing development of the area and the large-scale production of wheat could, however, increase the size of the area suitable for locusts. As, however, control is not difficult, though it is expensive, the numbers should not rise to the levels where swarming could be expected.

What can be expected, however, is that a variable residual population of migratory locusts will remain in the cane, probably from time to time building up to troublesome proportions and necessitating further control measures. The population at the time of writing, February, 1968, though apparently somewhat larger than that in 1967, does not give cause for concern and control measures are not expected to be necessary.

A brief visit to the Chirundu Sugar Estate on the Zambesi in November, 1966, showed that a small population of red locusts was present but no migratory locusts were seen. They were not considered to cause appreciable damage. Sugar cane has been planted in recent years under similar conditions to those at Hippo Valley in the lower Shire River valley in southern Malawi. Examination of the area in November, 1967, and February, 1968, did not reveal the presence of any locusts.

Sugar cane is subject to attack also by a number of solitary grasshoppers. These are not really sufficiently numerous to cause appreciable damage or to necessitate remedial action. One of them, the elegant grasshopper *Zonocerus elegans* Stål, is a well-known pest of many crops. The hoppers are gregarious, occurring in groups of up to 200, and have been known to do considerable damage locally to the cane near Hippo Valley. They are easily recognisable since they are contrastingly striped longitudinally in black and yellow, while the adults, which are most frequently short winged, are very conspicuously coloured, in rose, blue-grey, yellow, black and orange.

Summary

An account is given of the history of locusts as they affect sugarcane in Southern Africa, and the development of international organizations for control of the two species concerned. These are the red locust, *Nomadacris septemfasciata* (Serv.) and the African migratory locust, *Locusta migratoria migratorioides* Reich. and Fairm.

In 1965 an outbreak of the tropical migratory locust

caused serious damage to sugarcane at Hippo Valley in Rhodesia. This was unexpected as the species known to be endemic in the area is the red locust. The infestation was effectively controlled by insecticidal treatment with dieldrin or carbaryl, and timely treatment prevented significant field losses.

A survey was carried out in an attempt at discovering the origin of the locusts responsible for the outbreak, which probably consisted of small groups of insects present in the area before the natural vegetation was cleared and replaced by sugarcane.

References

1. Anon., 1963. International Red Locust Control Service, Record of the Fifteenth Ordinary Session of the Council held on the 18th-19th June, 1963. Salisbury.
2. Whellan, J. A., 1964. The red locust—A Forgotten Menace. Rhod. agric. J. *61*, 67-69, 72.
3. Whellan, J. A., 1967. The Reappearance of the African migratory locust in Rhodesia, Rhod. agric. J. *64*.
4. Yule, W. N., 1961. Dieldrin Lattices applied by Aircraft for controlling Hoppers of the red locust. *Nomadacris septemfasciata* (Serville). Bull. ent. Res. 51, 1961, 441-460.

Discussion

Mr. Carnegie: Why does Mr. Whellan think the locusts, as reported from Mauritius, had a preference for certain varieties. Was it leaf texture or plant content?

Regarding insecticides, we here would hesitate to use persistent insecticides such as dieldrin in a cane field because of a possible upsurge thereafter of aphids or *Numicia* or other pests.

Mr. Whellan: No suggestions were given in the report I read.

The fields in which dieldrin was used are regularly examined and we have not heard of any upsurge. There is mealy-bug in the area which might have been affected.

Mr. Harris: Are there any biological control methods for locusts?

Mr. Whellan: Despite intensive investigation nothing very promising has yet emerged.

Mr. Harris: Why do locust swarms originate from specific areas? Why do they favour certain areas?

Mr. Whellan: Locusts require specific conditions for developing into the swarming phase.

The red locust requires alternating long and short grass areas with moisture present to facilitate egg-laying. The outbreak areas always have impeded drainage or no outlet at all so that they are subject to periodic flooding.

Dr. Dick: Mr. Whellan says that although locusts caused defoliation of cane there was no loss. There is loss and our experiments have shown that this is proportionate to the amount of leaf removed. Although the plant recovers it is seen that the internodes produced by the plant during the period of damage are shortened.

Mr. Whellan: The company concerned reported that there was no loss of sucrose but I do not know how far they went to check on any damaging effect. It could also be that the harvest was delayed which effectively would be a loss.

Mr. Rault: In the locust attacks in the early thirties a new word was coined — 'voetgangers' for the locust hoppers.

In the factory at Mount Edgecombe we certainly experienced a drop in sucrose and in purity the year after the locusts attacked.

Mr. Wilson: At the time of the locust outbreak in Rhodesia were any other crops affected?

Mr. Whellan: Only the sugar cane was subjected to appreciable attack though there were other crops such as maize and wheat in the area.

Dr. Brett: Could not the varieties mentioned in Mauritius have been growing in different areas.

Mr. Whellan: No details were given in the report I read, but I think this unlikely or it would surely have been mentioned.

Mr. Wood: After laying eggs do the adults survive for some time?

Mr. Carnegie: Females of the red locust die shortly after egg-laying, although over a period of several weeks several egg batches may be laid. Males may survive for several months into the next generation.

Mr. Harris: Regarding attraction to various varieties, I think the attraction is frequently due to an olfactory response to the host plant.

Mr. Whellan: Such selectivity would be surprising in locusts which generally feed on an enormous variety of plants, almost all crops except tea being attacked.