LOCUSTS AND LOCUST CONTROL IN THE MARKHAM RAMU VALLEY

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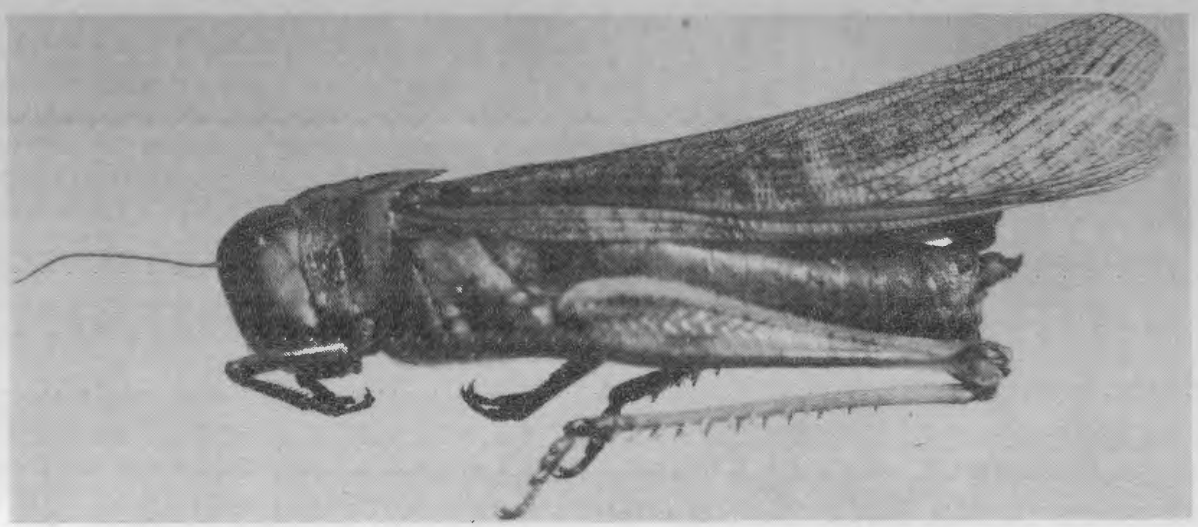
From early 1973 to November 1976, there was an oubreak of the migratory locust, *Locusta migratoria* in the Markham-Ramu Valley.

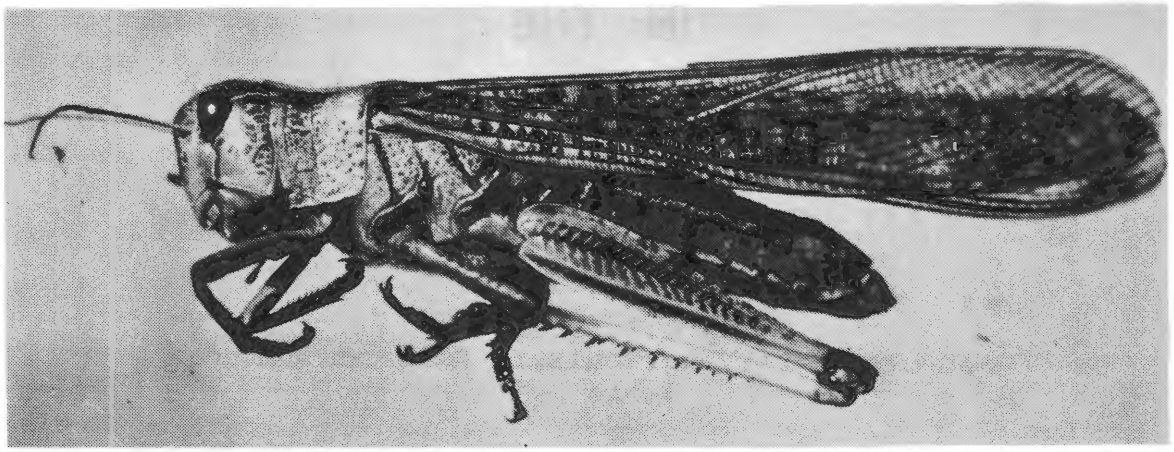
Locusta migratoria L. is a species of grasshopper found from Africa and Europe through central Asia to South East Asia, Australia and the Pacific Islands including Papua New Guinea. This insect feeds on leaves of grasses, e.g. kunai, corn, sorghum and sugarcane, occasionally attacking coconuts and bananas.

In common with some other species of plague locust there are two forms or phases which differ in behaviour, body shape and colour.

Normally *Locusta* is found in the solitary or solitaria phase. Individuals of the solitary phase are green in colour with few markings and are found scattered thinly through the grassland. In the gregarious phase the nymphs or hoppers have a varying combination of black and orange colours and move and feed in large groups called bands. The adults are yellow-brown in colour, fly in large groups called swarms and can migrate over long distances. Because of the large numbers of grasshoppers in the bands and swarms, serious damage can occur.



Phase gregaria. Adult female. Note the dip behind the head.
Photo: G. Baker



Phase solitaria. Adult female. Note the slight hump behind the head. Photo: G. Baker

During times of environmental stress, e.g. drought or flood, the amount of ground available to the insects is reduced and individual grasshoppers are crowded together. When breeding occurs under crowded conditions the locusts can change from the solitary phase to the gregarious phase in one or several generations.

The life cycle of the gregarious phase starts with eggs being laid in suitable soil. Overgrazed pasture and bare ground are the most favoured sites. The eggs take up water from the soil and wingless hoppers hatch in about 2 weeks. The hoppers go through 5 stages or instars, growing bigger at each stage. At the end of the fifth instar the hopper becomes a winged adult. It takes 4½ to 6 weeks from hatching to reach the adult stage. These new winged adults are called fledglings, and, after a week, start to mature and form into dense flying swarms. Three weeks later the adults reach sexual maturity and one week after mating the females begin to lay eggs.

In the Markham-Ramu Valley outbreak it is thought that the solitary locust population was crowded into a few areas of green grass during the 1972 drought, and this gave rise to a generation of gregarious *Locusta*. As far as is known this phase change occurred only once, i.e. at the start of the outbreak and there had not been continuing aggregation of solitary locusts. Up till November 1976, *Locusta migratoria* L. had completed 16 or 17 consecutive generations of the gregarious phase. During this time the grasshoppers ranged from Brahman, Faita and Usino in the Ramu Valley to Nadzab and Gabensis in the Markham Valley. Additionally one swarm migrated along the Wampit Valley into the Mumeng Valley.

PHASE CHANGE

Solitary locusts scattered in grassland —*Drought or flood*→ Solitary locusts are crowded together —*Breeding under crowded conditions*→ Gregarious locusts travelling and feeding in groups

LIFE CYCLE

Eggs laid in soil —*Eggs hatch in 2 weeks*→ Wingless hopper —*Hoppers pass through 5 stages* 4½ - 6 weeks→ New winged adult or fledgling —*3 weeks*→ Sexually mature adults

1 week

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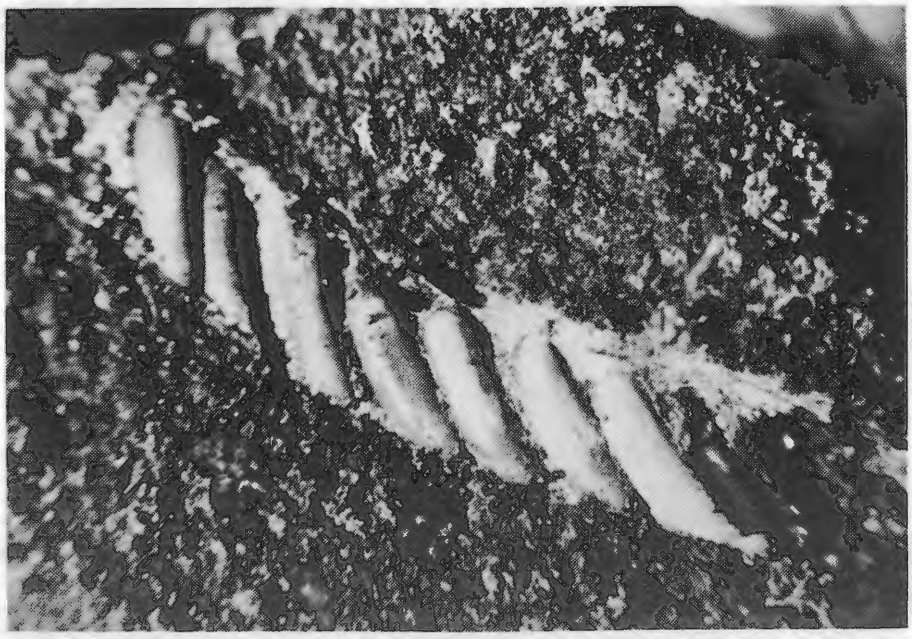
Females start to lay eggs



Eggs in soil. Photo: G. Baker

LOCUST CONTROL

The objective of the control programme was to reduce the numbers of the gregarious phase to such a level that should environmental conditions be favourable the population would change back to solitaria.

A number of factors complicated the control campaigns, these were:

1. Migration. Locusts were continually moving throughout the grasslands of the Markham/Ramu in response to population density and wind movement.

   This had the effect of -

   (a) Extending the area over which control measures had to be undertaken.

   (b) Resulting in invasion of areas where either ground or aerial control was very difficult, e.g. narrow valleys and mountains.

   (c) The locusts being always able to find some part of the Markham/Ramu favourable to the continuance of the gregarious phase.

Hopper band. Photo: G. Baker

Flying swarm. Photo: G. Baker

(d) The natural enemies (predators and parasites) always lagging behind the migration and being unable to reach sufficiently high numbers to make much impression on grasshopper populations.

2. The climatic factor (the 1972 drought) which caused the aggregation of the base population of solitaria was a rare event. Therefore the environmental conditions required to naturally change from the gregarious phase to solitary phase could be equally unusual.

3. Land use in the outbreak area.

While land use is not responsible for starting an outbreak, it is a factor which has an effect once an outbreak is underway, e.g.

(a) The female locust seeks out areas of bare ground in the grassland to lay her eggs. Two practices, one ancient, the other recent, increased suitable egg laying sites for the gregarious phase.

These were:

(i) burning of grassland.

(ii) cattle raising (grazing had shortened the grass and produced bare patches in the pastures).

There was little prospect of either discouraging annual firing of grassland or reducing stocking rates on cattle properties.

(b) As more forest was cleared from the margins of the valley with the consequent change to grassland this increased the potential feeding and breeding area for gregarious *Locusta*.

GROUND CONTROL

From June 1974 ground control was undertaken by Department of Primary Industry spray teams and farmers.

Most ground control was carried out on hoppers although occasionally adult swarms roosting in grassland at night were treated.

Prior to aerial spray campaigns hopper bands were sprayed with water-based Lindane insecticide from motorised knapsack misters. These machines proved to be unreliable and difficult to carry into hilly country. Battery powered ULVA sprayers using 95% liquid Malathion insecticide showed promising results. The ULVA machine produces fine droplets of insecticide which penetrate long grass making it difficult for the insects to avoid the spray. Additionally it is light, powered by torch batteries and about one tenth of the price of a motorised knapsack sprayer.

A vehicle-mounted Terramista was used extensively against hopper bands, from October 1974 to February 1975. This machine also sprayed 95% liquid Malathion.

Motorised knapsack sprayer, noisy, heavy and unreliable.

Photo: G. Young

A Micron Sprayers ULVA

Photo: G. Young

AERIAL CONTROL

Generally speaking, aerial control is very expensive, but highly effective. It provides the best method of quickly reducing locust numbers.

The object was to spray adult *Locusta* in the three week period between when the immature adults hardened, grouping into dense flying swarms, and the start of sexual maturity.

Flying swarms were located by means of a spotter aircraft (fixed wing on the valley floor and helicopter in the mountains) or from the ground. In either case the spray aircraft was contacted by radio when a swarm was sighted.

The single engined spray plane deposited 95% liquid Malathion directly onto the flying swarm.

The insecticide was passed through a small machine which breaks the liquid chemical up into a fine mist as it leaves the aircraft. This mist does not drift far from where it was released as the chemical is relatively heavy. Individual locusts get sufficient of the fine droplets on their bodies to kill them.

Aerial spray campaigns have been carried out at appropriate times since August 1974.

The most recent aerial campaign was carried out from August to October 1976.

CONCLUSIONS

There have been two locust outbreaks in Papua New Guinea in the last ten years. The likelihood of further outbreaks depends on natural occurrences such as drought or flood. As a precaution, in February 1977 personnel from the Centre for Overseas Pest Research, London, were invited to train local agricultural officers in surveying for gregarious migratory locust and methods of controlling outbreaks. These officers are now the Locust Patrol Unit of D.P.I., based at Bubia.

FURTHER READING

Bubia Information Bulletin No. 15
Controlled droplet application and ULV spraying by E.V. Roger, G.A. Meadows, N.G. Morgan. Published by B.P., July 1976.

Damage to corn, Bumbo village, Ramu Valley

Photo: G. Baker