ENTOMOLOGY BULLETIN: No. 53

Locusts and Grasshoppers of the Markham Valley

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WHAT ARE LOCUSTS?

Locusts are species that from time to time occur as dense strongly migrating swarms, whereas grasshoppers either never form swarms (the great majority) or else form only loose swarms that migrate little. Thus, the difference between them is one of behaviour. Both locusts and grasshoppers belong to family Acrididae (order Orthoptera).

When a locust species is present in low density it behaves as a grasshopper. Only when very high population densities are attained can gregarious behaviour develop. Gregariousness has four distinguishing features:-

1. A tendency for the insects to keep close together, so that the resulting "swarm" has clearly defined limits.

2. A tendency for them to move parallel to one another, so that the swarm as such has a direction of movement.

3. A tendency for movement or rest to be synchronized among the members of swarm.

4. A tendency for the swarms to oviposit (lay eggs) close together. The females produce a pheromone or sex attractant which keeps the females in a group.

These features immediately distinguish a swarm from any non-swarming concentrations of locusts brought about by their independent search for favourable living conditions. A remarkable characteristic of locusts is that individuals that have gone through their development as members of a swarm differ in their colour pattern and in certain bodily proportions from those that have lived a relatively solitary existence. The solitarious nymphs of *Locusta* species are green or straw coloured whilst the gregarious nymph are orange. In the adults the sharp colour distinctions between solitarious and gregarious forms is lost. In *Locusta* the solitarious phase can be recognized by a high crest on the pronotum and larger and longer hind femora (see the figure), while in the gregarious phase the pronotum is saddle-shaped. The above differences are so marked that the two types, or "phase", were sometimes regarded as different species until it was shown that they could be produced in one and the same population by regulating the population density.

The locusts and grasshoppers known to occur in the Markham Valley are the following:

Locusts

Locusta migratoria (Meyen) - the migratory locust

Grasshoppers

1. *Xenocatantops humilis* (Serville) - probably a recent introduction to PNG from Irian Jaya.
2. *Nomadacris gohieri* (Le Guillou)
3. *Nomadacris guttulosa* (Walker) (also called Spur-throated locust) - they may form swarms and plague cycles causing extensive crop damage are known to occur in Australia.
4. *Aiolopus thalassinus tamalus* (Fabricus) - formation of small swarms by this insect has been observed in Africa. It is suspected that this grasshopper also migrates but direct observations are lacking.

WHAT ARE GRASSHOPPERS?

The term grasshopper is now generally restricted to the common non-migratory forms while the name "Locust" is reserved for those migratory wanderers which have proved so destructive throughout all time. In Biblical times the Hebrews referred to locusts under nine different names each of which signified destruction. Every large land mass, excepting only the frigid zones, has its particular kind or kinds of migratory locusts and the problems arising from them. Many species of grasshoppers are also quite destructive. It is important to emphasize that while a locust species in low density behaves as a grasshopper, it does not mean that the existing species of grasshopper are derived or can be derived from locust species or vice-versa. The two are quite different in many respects. Several species of grasshoppers are found in Papua New Guinea but none are of economic signifiance as yet.

OUTBREAK AREAS

Locusts usually multiply to pest proportions and concentrate into gregarious swarms outside the agricultural regions. This multiplication can occur

only in a few relatively restricted areas. These - known as "outbreak areas", possess certain well defined characteristics:

1. Moderate rainfall evenly distributed throughout the year.

2. Free from dense timber. As deforestation continues and large areas of PNG open up to crop farming, the activities of locusts are also likely to extend to these areas.

3. Most important of all - they have a patchy distribution of two distinct types of soil - one with a compact surface and one with loose, crumbly surface (when dry), called "selfmulching" soil.

The compact soil carries relatively low, not very tussocky grasses and is liable to wind erosion. The self mulching soil usually carries a pasture consisting of taller-growing markedly tussocky grasses. Each soil type provides a distinct habitat for the locust, and both habitats have to be present if the full capacity of the locust for multiplication is to be realized. The female locust prefers bare compact soil for egg laying and the compact soil becomes the "oviposition habitat". These insects do not lay eggs inside creeks and swamps as is popularly believed. River, lake and creek banks are however their favourate oviposition spots.

The following outbreak areas are known from Papua New Guinea. These are all in the Markham Valley:

Mutzing, Leron Plains, Rumion, Tararan, Chivasing, Wawin, Erap, Nazab, Munum.

The locust outbreaks in Papua New Guinea are recorded as follows:-

1.1966 - 1967 Goodenough Island.

2.1973 - 1976 Markham and Upper Ramu Valleys.

3.1987 - 1988 Markham Valley.

The hopper (young insects without wings) populations of 35 000 000 per hectare and adult populations of up to 25 000 000 per hectare were recorded in the last outbreak. Hopper band sizes raged from 2 to 24km^2 while the adult swarm sizes ranged from 9 to 12km^2. An analysis of reports on locust outbreak in PNG suggests that a number of locations in the Markham valley, mainly around Mutzing, provide ideal oviposition and multiplication sites from which locust swarms originate and migrate. Several hypotheses have been put forwards to explain the locust outbreaks in PNG and these include the belief that a prolonged dry spell precedes an outbreak in the Markham valley. The reports of outbreaks of locusts lasting 1-3 years is very intriguing. It is a rule rather than an exception in other parts of the world for the locust plagues to peter out within a short period. For large populations to persist for extended periods requires successful multiplication. This requires a good supply of vegetation, resulting from moisture in the environment. Such outbreaks are therefore difficult of comprehend on the drought theory. It should however, be mentioned that detailed studies for elucidating locust outbreaks in PNG have seldom been carried out and require urgent attention.

ECONOMIC IMPORTANCE

The migratory locust, *Locusta* feeds mainly on graminaceous plants and crops most generally attacked are grasses, pastures, sugar-cane, pit pit, maize and sorghum. It is therefore not difficult to see why *Locusta* is such a dreaded pest in Markham valley. There are also instances of *Locusta* attacking broad leaved plants and damaging crops such as banana, coconuts, betelnut and ground nuts. In view of the huge numbers of locusts mentioned above extensive damage may be inflicted even if they take very small meals.

CONTROL

A. Chemical

Malathion has been successfully used in the Markham valley for spraying against the locusts both from the air and on the ground. Although a number of other anti-locust chemicals are available, malathion remains the choice chemical in PNG. The best way of controlling locusts is undoubtedly to prevent plagues rather than to suppress them after they have begun. Preventive control based on permanent surveillance aimed at detecting hopper bands and incipient swarms in the outbreak areas and the destruction of such bands and swarms before any escapes to the surrounding areas must form the basis of a sound locust control strategy. Therefore the monitoring of the density, size and movements of locust populations is of vital importance to biological and operational research as well as the forecasting and planning of preventive control operations.

B. Biological

Several pathogens attack locusts and grasshoppers. Among these is the protozoan, *Nosema locustae* which is already in use with great success against sedentary grasshoppers in the Great Plains of the United States. They may be useful at least against hopper bands in Papua New Guinea. Formulations involving the fungal pathogens

Beauveria and *Metarhizium* and application technology are currently in the process of development. In this approach contact biological mycopesticides would replace contact chemicals pesticides which are known to have undesirable environmental effects.

FURTHER INFORMATION

For further information about locusts and grasshoppers contact your nearest DAL entomologist or didiman.

Entomologists are based at:

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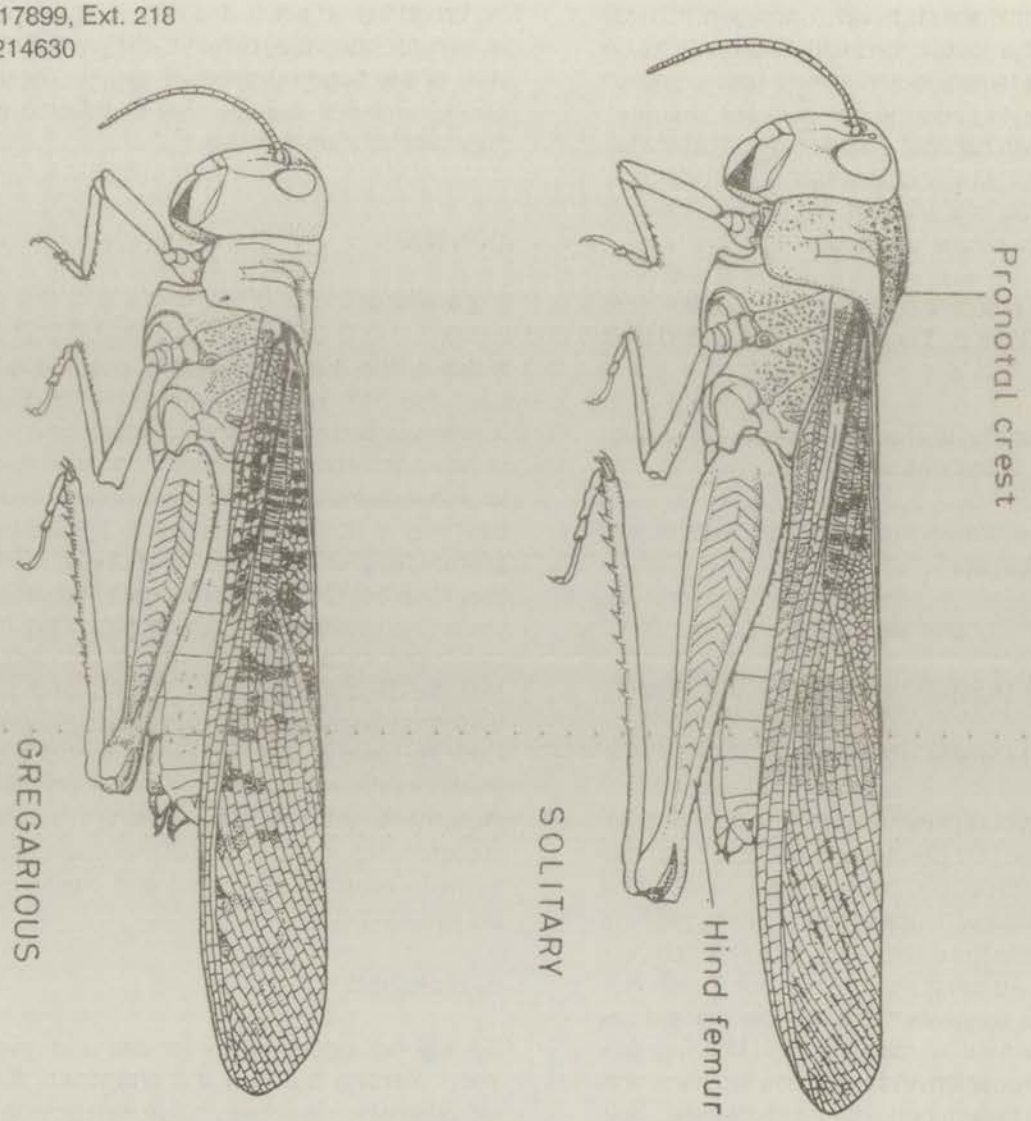

Solitary and gregarious female *Locusta* drawn to the same scale to show differences between solitary and gregarious phases (From Uvarov, B.P. 1966. Grasshoppers and Locusts. A handbook of general Acridology. Cambridge University Press, Cambridge).