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3 The Role of the International Red Locust Control Organisation for Central and Southern Africa (IRLCO-CSA) in the Management of Migratory Pests

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ABSTRACT

The International Red Locust Control Organisation for Central and Southern Africa (IRLCO-CSA) has existed since 1949 (when known as the International Red Locust Control Service, IRLCS) after its establishment by an international convention. The formation of IRLCO-CSA was partly a result of nearly 15 years' work to identify sources of Red Locust (*Nomadacris septemfasciata* Serville) plagues and to prevent their re-occurrence. A plague of Red Locusts, which started in 1929 and ended in 1944, had affected most of Africa south of the equator and some areas further north. For the organisation to achieve its objectives, its strategy was first to identify the source of the plague and then to control hopper bands and incipient swarms. For more than 40 years this strategy was effective. Consequently, the organisation expanded its mandate to include the management of other migratory pests, viz. African Armyworm, *Spodoptera exempta*, and quelea birds, *Quelea quelea*.

This paper reviews the historical development of methodologies for the control of Red Locusts and other migratory pests and appraises current techniques. The role of ecological and weather factors in Red Locust upsurges is briefly examined. The quantitative study of such factors may lead to more accurate forecasts of outbreaks, which in turn would lead to more judicious use of pesticides. The search for alternatives to pesticides is advocated in view of the sensitive nature of the environment in the outbreak areas of the Red Locust.

INTRODUCTION

The International Red Locust Control Organisation for Central and Southern Africa (IRLCO-CSA) is an inter-governmental institution and is the successor to the International Red Locust Control Service (IRLCS) which was established by a convention in 1949. The formation of IRLCS was partly the result of concerted research efforts, over nearly 15 years, to identify the sources of a plague of Red Locusts (*Nomadacris septemfasciata* Serville) which started in 1929 and ended in 1944. There had been at least two previous plagues and the 1929–44 plague affected the whole of Africa south of the equator and some areas further north (Figure 1). More importantly, IRLCS was mandated to prevent

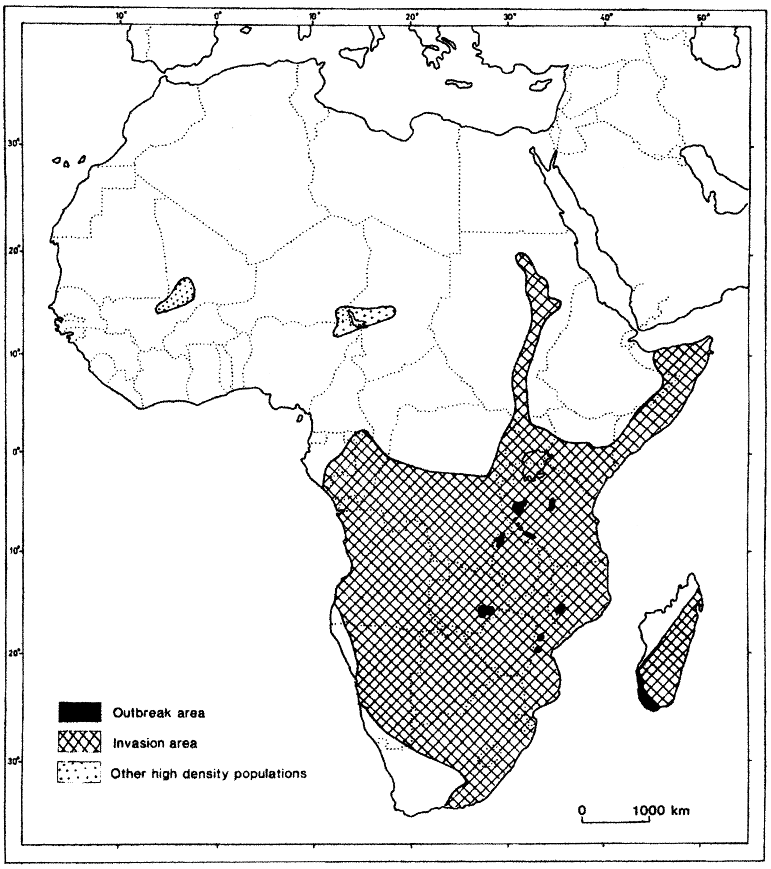

Figure 1 Distribution of the Red Locust.

re-occurrence of such plagues. For IRLCS to achieve its objectives, its strategy was first to identify the source of the plagues, and secondly to control hopper bands and incipient swarms in the source areas.

In 1970, however, IRLCS gave way to the formation of IRLCO-CSA under a new convention but with similar goals. The current member states are Kenya, Malawi, Mozambique, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe. The principal mandate is, as for its predecessor, the prevention of Red Locust plagues, with the additional responsibility of monitoring and forecasting other migratory pests, such as the African Armyworm, *Spodoptera exempta* and Red-billed Quelea birds, *Quelea quelea.*

Plagues of Red Locust are known to have affected large parts of Africa at least three times in recent recorded history, lasting more than 50 years altogether. Following Uvarov's phase theory, the sources of Red Locust plagues or outbreak areas, were initially identified through the work of two pioneer scientists, A. P. G. Michelmore and H. J. Bredo (Gunn, 1957). It was subsequently realised that the ratio of the size of the outbreak areas compared to the whole invasion area was 1:1500. The task of controlling locusts in the outbreak areas was, therefore, much easier than policing the whole invasion area and led to the adoption of the concept of preventive control.

This paper reviews the development of methodologies for the control of Red Locust and other migratory pests and appraises current techniques. The role of ecological and weather factors in the development of Red Locust plagues is briefly examined. The paper also

Table 1 Outbreak areas of the Red Locust

Outbreak Area	Country
Wembere Plains	TANZANIA
Malagarasi Basin	TANZANIA
Iku-Katavi Plains	TANZANIA
Rukwa Valley	TANZANIA
Mweru wa Ntipa	ZAMBIA
Kafue Flats	ZAMBIA
Lake Chilwa/Chiuta Plains	MALAWI/MOZAMBIQUE
Buzi-Gorongosa Plains	MOZAMBIQUE

highlights the fact that close monitoring of such factors is crucial to the accurate forecasting of outbreaks.

ECOLOGY OF RED LOCUST OUTBREAK AREAS

An 'outbreak area' can be defined as a region capable of producing a swarm from an indigenous and, at some time, non-swarming locust population (Symmons, 1964). Earlier, Key (1945) working on *Chortoicetes terminifera* Wlk defined an outbreak area as an aggregate of outbreak centres.

There are eight recognised outbreak areas of the Red Locust in the IRLCO-CSA's region (Table 1). Some of these areas are believed to have been the sources of the last and earlier plagues (Gunn, 1960). However, swarms which originated from Mweru wa Ntipa and the Rukwa Valley initiated the plague of 1929–44 (Michelmore, 1949). At the time, the other outbreak areas were not yet known and, therefore, their contribution to the plague was not documented. Swarms have, however, been recorded in all these areas since (Figure 2).

The characteristics of Red Locust outbreak areas have been reviewed by Materu (1984) and Gunn (1956). Vesey-Fitzgerald (1955) also carried out extensive studies of the vegetation of the outbreak areas, which are generally all flood plains with a number of other common characteristics including:

- impeded or closed drainage systems;
- extensive grasslands mainly of the species of *Echinochloa pyramidalis*, *Cynodon dactylon*, *Hyparrhenia* spp.;
- *Sporobolus* spp., *Cyperus* spp., etc. forming mosaics of short and tall grasses;
- one rainy season: November to April; and
- fairly wide diurnal temperature fluctuations.

Outbreak areas are unstable environments where there are always permanent locust populations. During upsurges, changes in the ecological conditions lead to more successful breeding and gregarisation. From the inception of IRLCS, it was accepted that better knowledge of the ecology of the outbreak areas would greatly contribute to the understanding of the causes of plagues. Unfortunately, there have been no studies undertaken either prior to or during a Red Locust plague to understand the causes of such plagues. Indeed, as there has been no plague since 1944, the causes can only be deduced from circumstantial

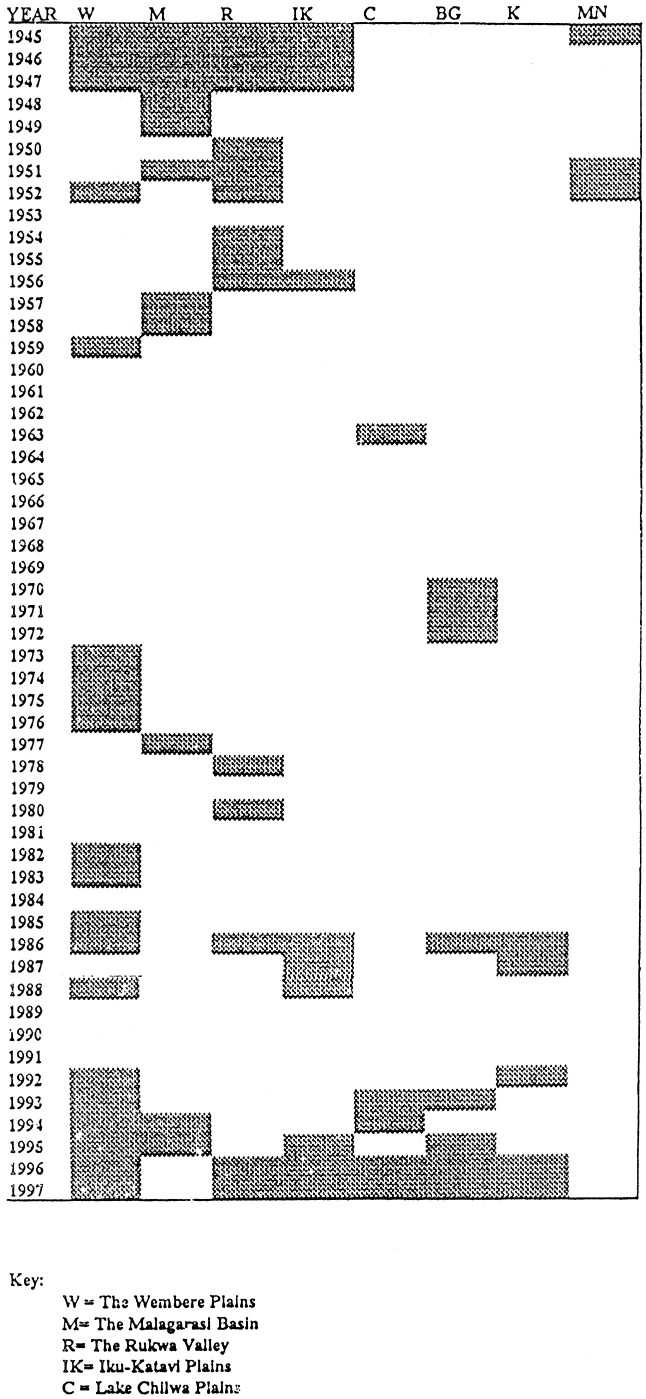

Figure 2 Frequency of swarm formation in Red Locust outbreak areas in 1945–97 (courtesy: A. D. Gadabu).

evidence (Symmons, 1964). Research efforts in outbreak areas have largely been concentrated on control in conformity with the mandate of the organisation. Thus, the need to fully understand the role of ecological changes in outbreak areas as major contributing factors to Red Locust plagues has remained largely unrealised.

PREVENTIVE CONTROL STRATEGIES

Unlike other plague locusts such as the Desert Locust, *Schistocerca gregaria* or Migratory Locust, *Locusta migratoria*, the Red Locust is univoltine. The eggs are laid at the beginning of the rains, around November–December in southern Africa, and hatch after about 30 days. Development to the adult stage takes about 60 days. The adults remain immature until the onset of the next rains. Consequently, the control regime for this locust is closely tied to its life history; first to control the hopper population and secondly to reduce the breeding potential of the adult population. The objective is to prevent swarm formation and population migration out of the breeding areas.

Two concepts evolved from work by IRLCS: (1) insecticidal control and (2) modification of the environment in the outbreak areas. The basis for these concepts is that if control of incipient swarms and hopper bands is carried out in outbreak areas, this would reduce reproductive potential, thus preventing the development of plagues. On the other hand, by transforming the environment of outbreak areas, factors that favour population increase would presumably be eliminated so that locust breeding is inhibited.

Insecticidal Control

The most rudimentary control methods were practised in Red Locust control during the last plague. Thus, hoppers were trapped in ditches and beaten to death or burnt, and adults were whipped with tree branches, but such methods were clearly ineffective (Gunn, 1960). Later, in common with general locust control, there has been a progressive increase in chemical applications against the Red Locust, ranging from extremely poisonous compounds such as arsenic, to more environmentally acceptable formulations. While Red Locust habitats differ from those for other species of locust in Africa, recommendations for the control of the Desert Locust have generally also been accepted for Red Locust. It is only recently that these recommendations are being examined in view of the efficacy on Red Locust of some pesticides that have been found less than optimum for Desert Locust control. In the absence of better control methods, the IRLCO-CSA continues to rely on chemical pesticides.

The outbreak areas are wetlands with a rich flora and fauna. They are, therefore, sensitive to pesticide contamination. Continuous application of pesticides in the same localities could seriously harm the ecological balance of such areas and so there is a need to continue the search for much safer acridicides. A biological control project is presently under consideration, involving the International Institute for Biological Control (IIBC) and IRLCO-CSA, through the LUBILOSA project, in which the feasibility of the use of myco-pesticides for the control of Red Locusts will be determined. The possibilities of using myco-pesticides in the control of Red Locusts are far reaching as an element of preventive control. As naturally occurring pathogens, myco-pesticides offer the opportunity for self-perpetuation and the ability to hold locust populations below swarming levels. Red Locust outbreak areas appear to be better suited for the self-propagation of myco-pesticides than Desert Locust habitats in much more arid areas.

Ecological Control

Flooding levels

Red Locust outbreak areas are periodically flooded. Persistent high water levels in the plains usually coincide with low locust populations. There is evidence that upsurges of Red Locust took place when the lakes in the Rukwa Valley were dry, while recessions occurred when the lake levels were high (Gunn, 1956). Analysis of climate data by Symmons (1959) showed that a high water table in the Rukwa Valley was correlated with poor locust breeding. The results also showed that the amount of rain falling in the catchment area of Rukwa in one season was inversely correlated with locust breeding success of the following generation.

Similarly, studies of lake levels and incidences of swarm formation in Mweru wa Ntipa, one of the sources of the last plague, have also concluded that flooded plains are not favourable to locust population upsurges (Gunn, 1955).

Since the 1960s, the Rukwa Valley has mostly been flooded with high lake water levels. Coincidentally, no serious locust outbreaks have been reported. Similarly, Mweru wa Ntipa, has also been largely flooded. Again, there has been very little recent locust activity in this area. Attempts were made at making some outbreak areas unfavourable for locust breeding through flooding (Gunn, 1957), but they were discontinued because of their costs and the impact such an undertaking would have on the surrounding areas.

Vegetation in locust habitats

Red Locust outbreak areas have common vegetation features (Vesey-Fitzgerald, 1955). The most abundant and common plant species are grasses that colonise different niches depending on soil types, drainage, and water levels. The influence of these grass types on locust population dynamics is yet to be fully understood. However, it is known that the different grass mosaics provide various locust habitats, including food and shelter (Materu, 1984).

The outbreak areas undergo periodic grass burnings that are usually started by pastoralists. Grass burning has the effect of increasing oviposition sites without seriously affecting food and shelter for the locusts. Grass fires have, thus, been found to influence locust populations (Gunn, 1957). In the Rukwa Valley swarms occurred in 10 out of 16 years, a proportion which dropped considerably when controlled burning was introduced (Vesey-Fitzgerald, 1964). The influence of cattle ranching on the grass cover was also tested there but, for various reasons, including mineral content of the drinking water for the animals, tsetse flies (*Glossina* spp.) and marketing, the success of this project was limited (Gunn, 1956; Materu, 1984).

At the height of floods, grass seeds are carried around with flood-waters within the plains. When the flood subsides, the seeds germinate wherever they are deposited, creating a new niche. Thus, over a period, there are noticeable vegetation shifts in the outbreak area but the influence of this shift on locust populations has not been investigated.

Afforestation, as a means of reducing the breeding habitats and therefore influencing locust populations, was also tried in the Rukwa Valley (Robertson, 1958). A number of tree species were planted but did not survive, apparently because the soils were unsuitable for tree survival. Those that grew subsequently died out because of bush fires.

OTHER MIGRATORY PESTS

African Migratory Locust (*Locusta migratoria migratorioides*)

The mandate of IRLCO-CSA has continually been revised to take into account the needs of the member countries and the situation pertaining to locusts in the region. While the organisation was formed to prevent the re-occurrence of Red Locust plagues, in the 1980s, it became apparent that the African Migratory Locust, *Locusta migratoria migratorioides* R & F, was becoming a serious problem to a number of countries. Extensive outbreaks in 1988–90 occurred in Botswana, Malawi, Swaziland, Zambia and Zimbabwe, causing the organisation to include this locust species in its mandate.

No research has been undertaken on this locust by the organisation except for insecticide trials. It was never understood, therefore, why there was a sudden upsurge of the species in the late 1980s. It is possible, however, that the comparatively dry decade of the 1980s may have contributed to the upsurge (Bahana and Byaruhanga, 1988).

African Armyworm (*Spodoptera exempta*) and Quelea birds (*Quelea quelea*)

One of the important changes in the convention governing IRLCO-CSA was for the organisation to assist its member countries to manage other migratory pests, particularly the armyworm, *S. exempta*, and Red-billed Quelea birds, *Q. quelea*. It was recognised that these are trans-boundary pests and that, therefore, a regional intelligence system would be an important ingredient in the management of such pests. In this regard, the organisation would operate a regional database from which long-term forecasts could be made.

The armyworm programme was initially well received by extension departments apparently because it coincided with widespread outbreaks in the region. Training was undertaken and an armyworm pheromone trap system was established in all the member countries. Computers to handle the databases were provided. Unfortunately, the system appears to have ground to a halt for various reasons including:

- the sporadic nature of armyworm outbreaks – the importance of such pests tends to be relegated when there are no outbreaks;
- the cost of back-up service was high, hence computers could not be maintained;
- high staff turnover, common in national extension agencies, so that trained and experienced personnel tended to be lost;
- generally unreliable communication systems in the region.

As for quelea, some of the problems have included: transfers of personnel, reluctance to exchange data by National Plant Protection Units and lack of funds for research into areas of regional relevance, such as migrations of birds.

CONCLUSION

The existence of the IRLCO-CSA is a reminder of the vulnerability of southern Africa to Red Locust plagues. But while the organisation may have succeeded in carrying out its mandate, the paradox is that resources may no longer be made available for this insurance scheme, simply because the threat of locusts is not immediately apparent to planners. Red Locusts are killed in their outbreak areas to avert crop damage. Moreover, outbreak areas are inaccessible except to the organisation's staff and pastoralists, the latter feeling no direct impact of locusts. There is, therefore, a problem of awareness. Because of the economic crises that have beset countries in the region in the 1980s and 1990s, budgetary allocations are continually going to emergencies. Preventive control of locusts is unlikely to be seen, therefore, as a priority.

In view of these economic problems, the need to revisit the strategies for Red Locust plague prevention is more urgent than ever before. Chemical control, which has played an important role hitherto, must be seen in the wider context of environmental concerns, given that Red Locust habitats are sensitive wetlands. The search for biological control and other novel methodologies must be intensified.

The idea of a permanent solution to locust problems is still attractive to many. There are a number of examples of locust species that have been permanently controlled through ecological changes of breeding habitats such as the Mountain Locust in north America (*Melanoplus spretus*), and the Moroccan Locust (*Dociostaurus maroccanus*) in Cyprus (Ashall, 1970).

But the Red Locust may not necessarily lend itself to such control, even if there are indications that flooding could change breeding areas into unsuitable habitats. A number of reasons, both economic and ecological would mitigate against its success.

- As human population increases, outbreak areas are no longer the remote and uninhabitable zones they used to be. Cultivated areas are now slowly encroaching, and human habitation is common in some of these hitherto wild plains.
- Many of the outbreak areas are also game reserves or national parks with many wild animals. Drastic changes of the ecosystem to make them unsuitable as outbreak areas would result in the relocation or death of such animals. This would have serious negative influences on the economies of the countries concerned.
- Outbreak areas are also wetlands with rich flora and fauna. Changes would have serious impacts on the present ecological balance.

It seems, therefore, that research must move faster, to find a permanent solution to the problem of locust plagues before the member governments completely cut financial grants. When the cuts finally come, it will not take long for a Red Locust plague to re-surface. Then to the planner, this will be an emergency worth financing!

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SESSION 2 MIGRANT PESTS AND THEIR IMPACTS