PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

OCLALAV and its Environment: A Regional International Organization for the Control of Migrant Pests [and Discussion]

Abdallahi Ould M. Sidia, R. Skaf, J. M. Castel, A. Ndiaye and J. A. Whellan

Phil. Trans. R. Soc. Lond. B 1979 **287**, 269-276
doi: 10.1098/rstb.1979.0060

Phil. Trans. R. Soc. Lond. B **287**, 269–276 (1979)
Printed in Great Britain

OCLALAV and its environment: a regional international organization for the control of migrant pests

By Abdallahi Ould M. Sidia,† R. Skaf,‡ J. M. Castel§ and A. Ndiaye‖

† *Director-General of OCLALAV, B.P.* 1066, *Dakar, Senegal*
‡ *Regional Anti-locust Expert, FAO, B.P.* 1066, *Dakar, Senegal*
§ *Advisor, Bureau d'Études, OCLALAV, B.P.* 1066, *Dakar, Senegal*
‖ *Chargé de Recherches, OCLALAV, B.P.* 1066, *Dakar, Senegal*

[Plate 1]

OCLALAV is an inter-governmental organization with headquarters at Dakar. It is financed by Benin, Cameroon, Chad, Gambia, Ivory Coast, Mali, Mauritania, Niger, Senegal and Upper Volta, and also receives bilateral and international support. The environment of its regional operations against migrant pests is dominated by the natural symbiosis between the Sahel and the Sahara.

1. Introduction

The functions of the Organisation Commune de Lutte Antiacridienne et de Lutte Antiaviaire (OCLALAV) are:

(i) to undertake or to arrange for the control of locusts, in particular the Desert Locust (*Schistocerca gregaria* Forsk.), and grain-eating birds such as the weaver bird, *Quelea quelea*;

(ii) to pursue, support or carry out all studies, surveys, enquiries or other steps which appear to it to be necessary to implement control measures;

(iii) to undertake or to supervise, in whole or in part, the establishment, construction and administration of bases for control or research, according to conventions agreed with the governments or organizations interested.

In recent years (1973–6) OCLALAV has also participated very actively in the control of grasshoppers, to protect the cereal crops of the countries of the Sahel already hard hit by drought. Since 1975 this activity has been included in part among the official functions of the organizations, particularly in time of heavy attacks beyond the resources of the national Plant Protection Services.

The organization covers the Sahel and a large part of the Sahara; a majority of the member countries are among the 25 countries classed by the United Nations as the poorest in the world. The area of operation of OCLALAV covers about 4 000 000 km² from the Atlantic in the west and the frontiers of Algeria and Libya in the north, to the Sudan border in the east, and to the 10th parallel in the south. This is a region inhabited in the main by settled cultivators in the south and by nomads in the north; a region where the overall pattern of economic and biological factors can be understood only in terms of the continued natural symbiosis between the Sahel and the Sahara. Any attempt to solve the human and economic problems in the region, which does not take into account these natural factors, is bound to fail. In fact, life in the Sahel is inseparable from that of the Sahara. This stems from the fact that the Sahara, far from

being an absolute desert, possesses important occasional resources deriving from irregular rains. It is now established that these rains, when they occur, usually involve very large areas, either directly or by run-off. The effects of such occurrences on vegetation, man and animals are enormous, and are reflected in particular in the long-distance migrations of the nomads.

2. The Desert Locust

(*a*) *Strategy of reconnaissance*

In the same way as man, camels or sheep, the Desert Locust (very appropriately named in English) simply exploits the occasional resources of the Sahara. Consequently the concerns of OCLALAV coincide with those of the nomads, namely seeking for grazing: the nomads for the survival of themselves and their herds, OCLALAV for detecting populations of Desert Locusts.

This view, the result of twelve years of field research, is the starting point of our strategy for the control of the Desert Locust. Based on palliative measures up to 1962, it has since changed radically in outlook under the inspiration and valued advice of the late Professor Pasquier till 1972 (Pasquier 1972), and that of other expert specialists in the ecology of the Desert Locust, especially Mr G. Popov, whose studies and observations have been made in the field (Popov 1968*a*, 1968*b*, 1969, 1971). Our strategy depends essentially on the organization of regular surveys in appropriate areas and seasons, sampling the Sahelo–Saharan zone to estimate locust populations, and exterminating gregarious populations as soon as they appear, together with populations of a density reaching a threshold potentially dangerous in relation to the environmental conditions pertaining.

This strategy is based on a hypothesis, now well supported, that gregarization and the formation of swarms can develop from solitary populations in certain regions when conditions occur favourable both to reproduction and to densation. (Densation = increase in population density however caused; Pasquier *et al.* 1979.) Examples for our region are the cases of gregarization in 1967 at Tamesna in Mali described by Roffey & Popov (1968), in 1970 in Mali (OCLALAV 1970), and in 1974 in southwest Mauritania and in Tamesna described by Skaf in a detailed study (Skaf 1978). This last study concludes that the whole process of gregarization took place in a single monsoon season, starting from a very small initial population.

(*b*) *Delimitation of trouble-spots*

The general progress made in the western part of the Desert Locust invasion area has led to the rough delimitation of zones of gregarization in Algeria and in parts of the OCLALAV area (Mauritania, Mali, Niger, Chad). Figure 1 indicates these zones, based on the fact that gregarization, starting with solitary individuals reproducing in large numbers leading to strong densation, manifests itself by the appearance of pigmented nymphs and by their gregarious behaviour. Continued scouting over the region between 1965 and 1974 has located these zones, the subject of a forthcoming special study by Skaf & Castel. This delimits the special regions where concentrations develop and where intervention is possible against the first bands at the start of a period of gregarization. This objective constitutes the reconnaissance tactics of OCLALAV; these zones are the subject of detailed regular survey while neighbouring areas are only covered in more extensive surveys.

Of all our known zones of gregarization, that of the Adrar des Iforas and its surroundings is

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

certainly the most important, being situated right on the boundary of two complementary breeding areas (summer breeding to the south and winter/spring breeding to the north), and also with special conditions particularly favouring retention of water in the soil to the east and the west in Tamesna and Timetrine. Potentialities for reproduction and gregarization are also very high in Niger (Tamesna–Aïr), followed in importance by Mauritania, and then Chad (Tibesti and Ennedi), though for the latter country data are lacking due to the impossibility of scouting there since 1966. Furthermore, following several years of drought leading to degradation of the vegetation, there is an extension to the south of the zones of breeding and gregarization, especially in southwest Mauritania.

It also seems that the mechanism of locust migrations during recessions approaches that prevailing during plague periods, though on a reduced regional scale. It can be suggested that exchanges of individuals and populations between the areas of summer breeding in tropical Africa and of winter/spring breeding in the Sahara do occur, and can alone explain the development of related situations in the two regions in recent years.

One fact is undeniable: the operations of survey and control undertaken by the countries of north Africa and by OCLALAV from 1965 until now, conforming with this plan, have led to the long-term strategy for the control of Desert Locust adopted by the FAO Desert Locust Control Committee (1969), and have benefited these two regions which are so intimately connected by exchange of populations and in the initial mechanism of invasions. Moreover it is this collaboration which explains the maintenance of the present recession in our region, together with similar operations undertaken by other regional and national organizations.

(*c*) *Appreciation of environmental factors*

The execution and development of such a policy must be based on appreciating the various environments of the Desert Locust and their effects on its survival, reproduction, densation, gregarization and displacements. The efforts of OCLALAV and the north African countries since 1965 have considerably contributed to an improved understanding of the subject. Special mention should be made of the joint surveys and special surveys undertaken between 1965 and 1976, in particular under the direction of Professor Pasquier (Abdallahi, unpublished). These surveys have made possible, among other things, a rapid coverage and study of vast areas never previously visited for locust work. These investigations together with the regular work of OCLALAV demonstrate:

(*a*) the importance of winter/spring rains in the Sahara;

(*b*) the importance of unseasonably early rains in the north of the Sahel and especially in highlands such as Adrar des Iforas, Timetrine and Aïr, which permit the establishment and reproduction of the first summer generation in specific, highly favourable habitats which are well known (surveys by Skaf 1973, 1978);

(*c*) the great reproductive potential of the Desert Locust in the Sahel, as shown by the developments in Tamesna in Mali and in southwest Mauritania in 1974;

(*d*) the possible opportunities for breeding in the Sahelo–Saharan zones outside the periods of the monsoon customarily covered by the OCLALAV teams;

(*e*) the importance of late monsoon rains for reproduction and survival of the Desert Locust over extensive areas of the Sahel and Sahara.

We may accordingly conclude that:

(i) The two regions of OCLALAV and northwest Africa are inter-dependent.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

(ii) The Sahelo–Saharan zones play a considerable role in the build-up of Desert Locust populations, and need intensified surveys.

(iii) The hypothesis emerges that the process of gregarization would be best realized when, given an initial locust population, winter/spring rains in the Sahara, permitting an important increase in the population, are followed by early rains (May–June) in the Sahelo–Saharan zone, particularly in the highlands. The conditions favourable for a first generation could thus be followed by one or two further waves of breeding in the same zone during the season of the monsoon. Such a sequence of breeding gives rise to a considerable number of insects and to densation.

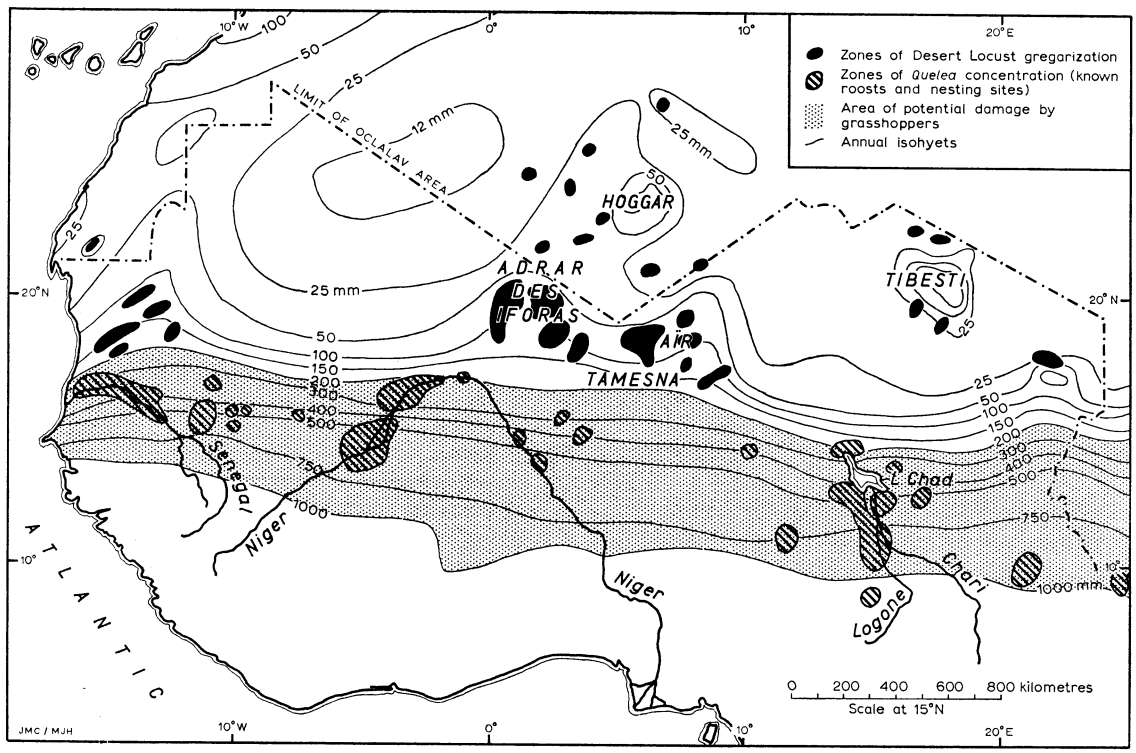

FIGURE 1. Zones of gregarization in Algeria and parts of the OCLALAV area.

To attain its objective of preventive control, OCLALAV takes account of all methods and techniques which could help in detecting areas of vegetation and of soil moisture in the areas of reproduction and gregarization of Desert Locust, and especially the use of satellites. Unfortunately it seems that the most important area of gregarization, that of Adrar des Iforas–Timetrine–Tamesna, cannot be covered by the receiving station of Telespacio Rome, nor by that envisaged at N'Djamena; however we hope that the station under consideration for Ouagadougou may fill this gap one day. Meanwhile the meteorological satellites already provide us in Dakar with valuable current information on the areas receiving moisture in the Sahelo-Saharan region in winter and spring. In this context, the 'monsoon surges', fairly frequent in west Africa in May and June and often causing very early rainfall, particularly attract our attention. Figure 2 (plate 1), a satellite photograph of 6 May 1975, shows a typical case that occasioned heavy rains which were immediately followed by the establishment of locusts at high density in the Adrar des Iforas, previously clear.

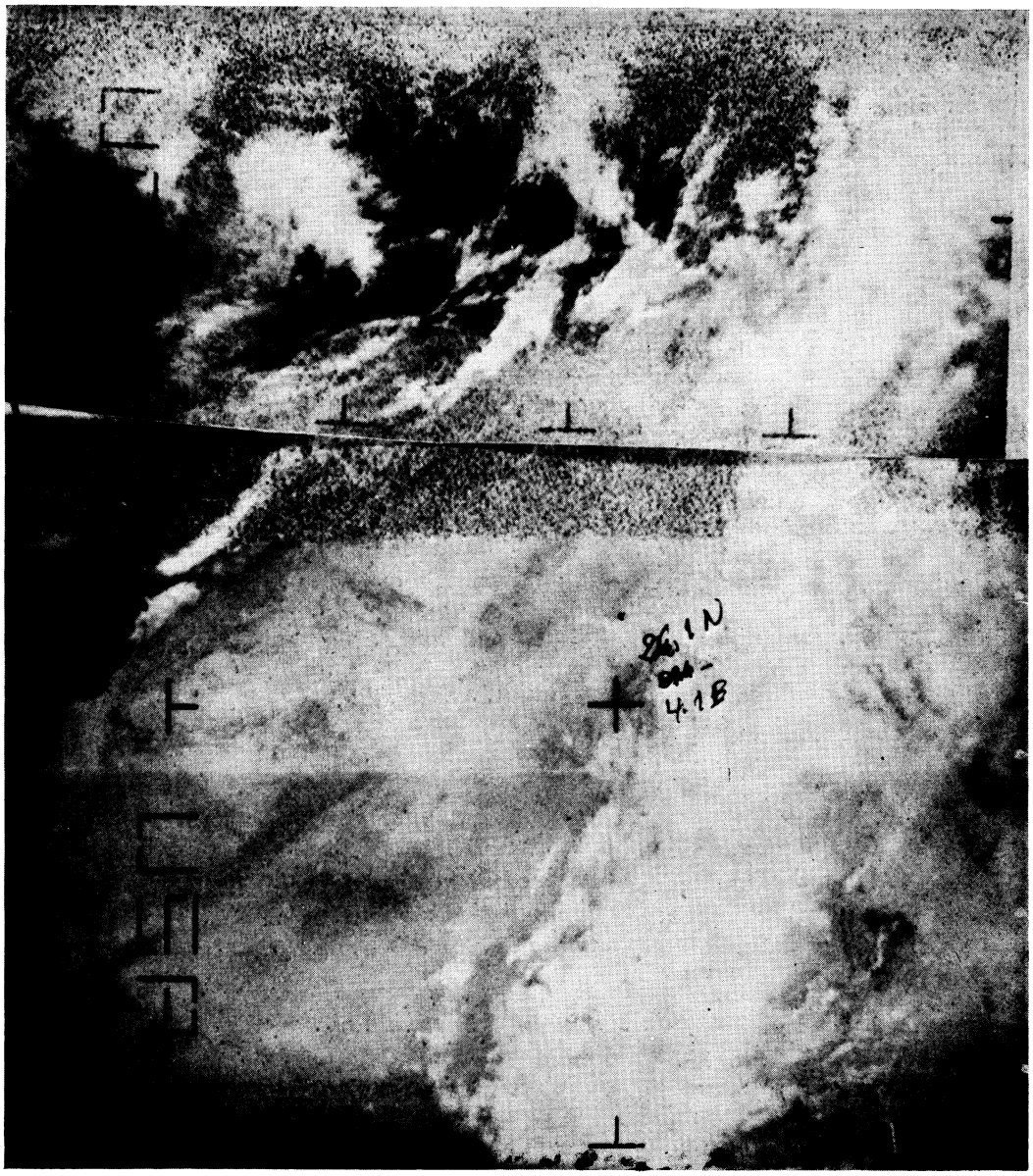

FIGURE 2. Weather satellite photograph of northwest Africa (ESSA 8: 1000 G.M.T., 6 May 1975) as received at Dakar–Yoff (Senegal) and utilized at OCLALAV headquarters to recognize in real time an occurrence of heavy rains in the Adrar des Iforas which was followed by the appearance of Desert Locusts at high densities.

(*Facing p.* 272)

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Finally we recognize the great mobility of the species, and we follow closely the general situation in distant countries outside our region. It must however be emphasized that data from the other regions reach us after considerable delay, thus restricting their value.

(*d*) *Some current difficulties*

Although OCLALAV, as a control organization with a purely technical function, is of indisputable importance for the member countries and for the countries to the north, it must be admitted that the organization in fact faces difficulties of various kinds.

(*a*) First of all, the task in relation to Desert Locust is immense and OCLALAV cannot carry it out alone, especially at a time both of acute financial difficulties of the organization, and of growing responsibilities for problems of grasshoppers and grain-eating birds occurring at the same time as Desert Locust.

It would appear to us necessary if not essential that north Africa should be associated with the survey activities of OCLALAV in the Sahelo–Saharan zone, especially to the north of the 20th parallel, by reason of the immensity of the area to be covered and the difficulty of communications. A grant of bilateral or international financial assistance should also be envisaged as a source of additional income. We emphasize at the same time the need for intensifying surveys in the Saharan zones of winter/spring breeding, particularly in Algeria, and in Libya and Morocco.

(*b*) There is a lack of security in extensive areas of OCLALAV which are of recognized importance for Desert Locust, such as in Tibesti in Chad, and the north of Mauritania, making surveys of all kinds almost impossible for long periods. This obliges us to intensify activities in the central area – in any case the most important part – namely northeast Mali (Adrar des Iforas, Tamesna, Timetrine, Azaouak) and northern Niger (Aïr massif and Tamesna), in the hope and on the hypothesis that even if swarms form in one of the areas not covered because of lack of security, effective survey and control in the surrounding areas and neighbouring countries ought to break the chain leading to the start of a new invasion.

(*c*) We cannot ignore the extension of agriculture and the intensification of grazing which is taking place in the valleys in the interior of Aïr, resulting from the installation of small flood barrages in the wadis and conservation works on the wadi banks; similar works are proposed in the Adrar des Iforas. It will be necessary to follow these activities closely for their eventual effect on the grasshopper situation and perhaps on that of the Desert Locust and grain-eating birds also. We recall that a small-scale densation of the Desert Locust was produced in 1970 in wheat cultivations behind a barrage at Zouerate in Mauritania.

(*d*) Lack of equipment and staff in national plant protection services in member countries has presented OCLALAV with serious new responsibilities. Following the drought years of 1969–73, the organization has played the part of catalyst to draw to the attention of the governments the importance of the problems of plant protection and the need for strengthening the national services. For this purpose OCLALAV annually organizes local training courses on plant protection practice, in the member countries, with the financial and technical assistance of FAO (Office for the Sahelian Relief Operations, now the Office for Special Relief Operations) and at times of the Inter-State Committee for Drought Operations in the Sahel (Comité Inter-États pour la Lutte contre la Sécheresse dans le Sahel, CILSS).

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

3. Grain-eating birds

(*a*) *Migration of* Quelea quelea *in the Lake Chad Basin*

It was P. Ward (1965) who, while working in northern Nigeria, first put forward the idea that *Quelea* was a migrant and did not merely wander hither and thither according to resources of water and food. He distinguishes two movements north–south and south–north associated with the displacements of the monsoon front, the former termed the first-rains migration, and the latter the breeding or prenuptial migration.

Table 1. Probability of colonies of *Quelea quelea* as a function of rainfall

(After UNDP/FAO Quelea project.)

Colonies certainly (++) or possibly (+) present, or absent (0).

	total rainfall/mm							
	end July				end August			
zone	<100	⩾100	⩾200	⩾300	<200	⩾200	⩾400	⩾500
south of Lake Chad	0	+	++	++	0	+	+	++
central	+	++	++	+	+	++	++	+
Waza area (Cameroon)		++	+	0		++	+	0

In the course of recent years the investigators of the UNDP/FAO Research Project on grain-eating birds, particularly Bortoli, Jackson, Manikowski, Eliott and Gaston, have accumulated observations which have enabled them to define the migrations in the Lake Chad basin more closely in time and space (FAO 1975). The chronology of these movements can be summarized thus:

(i) *Late October–late November*. One part of the population, mainly the parents, migrates towards the south, while the young remain in the N'Djamena area, causing heavy damage to rain-grown cereal crops and later to the flood-grown sorghum. The parents show a clear preference for wild grains, while the young preferentially attack the crops. In some years this migration of the parents appears to be relatively unimportant.

(ii) *March*. The birds in the south (in general between the 900 and 1200 mm isohyets) progressively leave this region for the north. The *Quelea* population then remains in the N'Djamena area till the beginning of June.

(iii) *Early June*. Migration of almost all the *Quelea* towards the south, threatening serious damage to rice cultivations in Bongor–Yaguoa area if harvesting is not complete by this time. Advancing harvest dates by the use of earlier strains enables such damage to be avoided.

(iv) *Second half of August*. The *Quelea* return to the north to nest in the N'Djamena area (late August–early October).

These displacements take place along the valleys of the big rivers (Logone and Chari), which are generally orientated north/south and northwest/southwest, and provide the last source of drinking water in the dry season. During the rainy season the plains flooded from lakes and rivers always furnish large quantities of seed, independently of local showers.

The incidence of rainfall (dates and amounts) determines the dates of migration and the nesting sites by affecting the availability of food. The first rains in March cause germination of seeds, driving the birds towards the north where grain is still available on the soil surface and

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

accessible: the stubble trampled or burned. The first rains fall in the north in early June, and the disappearance of the seed by germination leads to the departure of the birds towards the south where at this time they find wild grains already ripening. In the second half of August the physiological requirements of breeding cause the departure of the birds towards the north in search of more favourable areas for nest-building (thorn trees and Graminae already well developed) to ensure the possibility of nest construction and subsequent feeding of the young, especially on *Echinochloa colonna*, *Panicum laetun*, and *P. maximum*. The colonies are established at the end of August between the 200 and 400–450 mm isohyets in favourable areas of woodland and grassland vegetation. Table 1 shows the possibility of the establishment of colonies as a function of rainfall.

In the central zone, there is nearly always some nesting, though at dates and on scales varying with rainfall. In a very dry year, the nesting will be mainly in the south, and totally absent around the lake; in a very wet year, it will be the reverse.

(*b*) *Other regions*

In the Senegal river valley the migrations of *Quelea* have been studied by Morel (1955) and N'Diaye (1974).

On the slopes of the other basins (Niger–Nile) studies are not sufficiently far advanced to establish the pattern of migrations by *Quelea quelea*.

(*c*) *Other species*: Quelea erythrops (*red-headed weaver*)

Systematic studies (Barré *et al.* 1973, N'Diaye 1979) undertaken for the past two years in Benim and Ivory Coast, together with observations made in Upper Volta, Niger and Mali, have provided information establishing north/south seasonal movements of *Q. erythrops*, with dates of arrival and departure, as with other migrants, depending on the rains which control the food supplies from the different ecosystems. It must be noted that the migratory behaviour of tropical birds is not rigorously fixed in time and space; it is highly adapted to the meteorological conditions as they vary from one year to another, and to the resulting changes in the environment. These displacements of tropical birds are not obligatory and genetically programmed as they are in palearctic birds.

4. Conclusion

OCLALAV's approach to problems of migrant pests is not static and one of routine but dynamic and one of development, flexible and adapting to the nature of the pest to be controlled and to changes in the environment.

(*a*) Thus the control of grain-eating birds necessitates following very closely developments in irrigated and out-of-season cultivation in the region and the extension of water conservation schemes, particularly in the light of pest migrations.

(*b*) Control of the Desert Locust, involving an enormous area, must no longer be considered as an independent problem. This insect is only one element of the Saharan environment, and seeks its occasional resources in the same way as man and his animals. Specialists are now united in recognizing the very great value of these resources for stock-raising, and the interdependence of the two zones, the Sahara and the Sahel. It is therefore time to attach the necessary importance to the problems of the Sahara which have been neglected for too long, by tackling them in a manner appropriately integrated and adapted to local conditions.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Nomadism, a way of life outstandingly adequate and well adapted for the best and most economic exploitation of the resources of the Saharan and the Sahelo–Saharan zone, should receive the support of science and technology to improve its productivity and reduce human suffering. An appropriate Nomadism Service, supported by a network of radio and ground communications and even receiving satellite information, would be of incomparable value for the economy and equilibrium of the Sahara and the Sahel. In such an organization the problem of the Desert Locust would have its place along with all the other elements of protection, conservation and production, for the resources are indivisible and communal. Locust control would thereby be greatly facilitated, and inevitably rendered more economic.

References (Abdallahi *et al.*)

Abdallahi, O. M. S. 1971 Rapport sur la prospection spéciale dans le sud-est mauritanien et ses confins maliens. (Awaiting publication.)

Abdallahi, O. M. S. 1972 Rapport sur la prospection spéciale dans le nord-ouest malien et ses confins mauritaniens. (Awaiting publication.)

Barré, N., Bortoli, L., N'Diaye, A. & Park, P. O. 1973 Nidification de *Quelea erythrops* en zone sahélo-soudanaise. *Oiseaux Rev. fr. Ornith.* **46**, 25–28.

FAO 1969 Thirteenth session of the FAO Desert Locust Control Committee. *FAO-DLCC* (13) *PL*: 1969/*M*/5.

FAO 1975 Research into the control of grain-eating birds (*Quelea quelea*). *FAO-UNDP/SF* (*Quelea*).

Morel, G. & Morel, M.-Y. 1955 Quelques données écologiques et éthologiques sur *Quelea quelea quelea* L. dans la vallée du Bas-Sénégal. *CCTA/CSA Afrique* (55) **126**. In *Conseil Scientifique pour l'Afrique, Réunion Internationale pour l'étude du* Quelea, *Dakar, October–November* 1955.

N'Diaye, A. 1974 Diminution des populations de *Quelea quelea* dans la vallée du fleuve Sénégal. Ph.D. thesis, Paris VI; abstract in FAO (1975).

N'Diaye, A. 1979 Les migrations de *Quelea erythrops* dans les pays du Golfe de Guinée. Stratégie pour une lutte à l'échelle régionale. *Oiseaux Rev. fr. Ornith.* (In the press.)

OCLALAV 1970 Rapport sur les prospections conjointes Algérie–Mauritanie (Septembre–Octobre 1970) et Algérie–Mali (Novembre 1970). *FAO-UNDP(SF)DL/SS*/22.

Pasquier, R. 1972 Commentaires sur les résultats des campagnes algériennes de prospection (1966 à 1971) contre la sauterelle pélerine. *FAO-AGP/DL/TS*/11, pp. 100–107.

Pasquier, R., Hassanein, M. S. & Rainey, R. C. 1979 Trilingual glossary of terms used in acridology. *FAO-AGP/DL/TS*. (In the press.)

Popov, G. 1968*a* Rapport de la mission au Niger, 1965. *UNDP(SF)DL/TS*/2.

Popov, G. 1968*b* Rapport de la mission au Niger, 1966. *UNDP(SF)DL/TS*/3.

Popov, G. 1969 Rapport de la mission au Niger et au Mali, 1968. *UNDP(SF)DL/TS*/5.

Popov, G. 1971 Rapport de la mission effectuée en 1969 au Mali. *UNDP(SF)DL/TS*/8.

Roffey, J. & Popov, G. 1968 Environmental and behavioural processes in a Desert Locust outbreak. *Nature, Lond.* **219**, 446–450.

Skaf, R. 1973 Rapport sur la prospection au Sahara espagnol. *FAO-AGP/DL/TS*/13.

Skaf, R. 1978 Étude sur les cas de grégarisation du criquet pélerin en 1974 dans le sud-ouest mauritanien et au Tamesna malien. *FAO-AGP/DL/TS*/17.

Ward, P. 1965 Feeding ecology of the Black-faced Dioch *Quelea quelea* in Nigeria. *Ibis* **107**, 173–214.

Discussion

J. A. Whellan (*C.O.P.R., London*, former Senior Entomologist, Malawi). Which are the most important species of grasshopper in the OCLALAV region?

O. M. S. Abdallahi. In sandy areas in the Sahel the main species is *Oedaleus senegalensis*, in clay and sandy clay in Senegal, *O. johnstonii* and *O. nigeriensis*, and in areas liable to flood, *Cataloipus cymbiferus*; other species are found when the flood recedes. Certain types of vegetation are linked with certain grasshoppers, such as legumes with *Catantops*. In the wetter tropical areas in the southern part of the region, the main grasshopper pest is *Hieroglyphus*.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

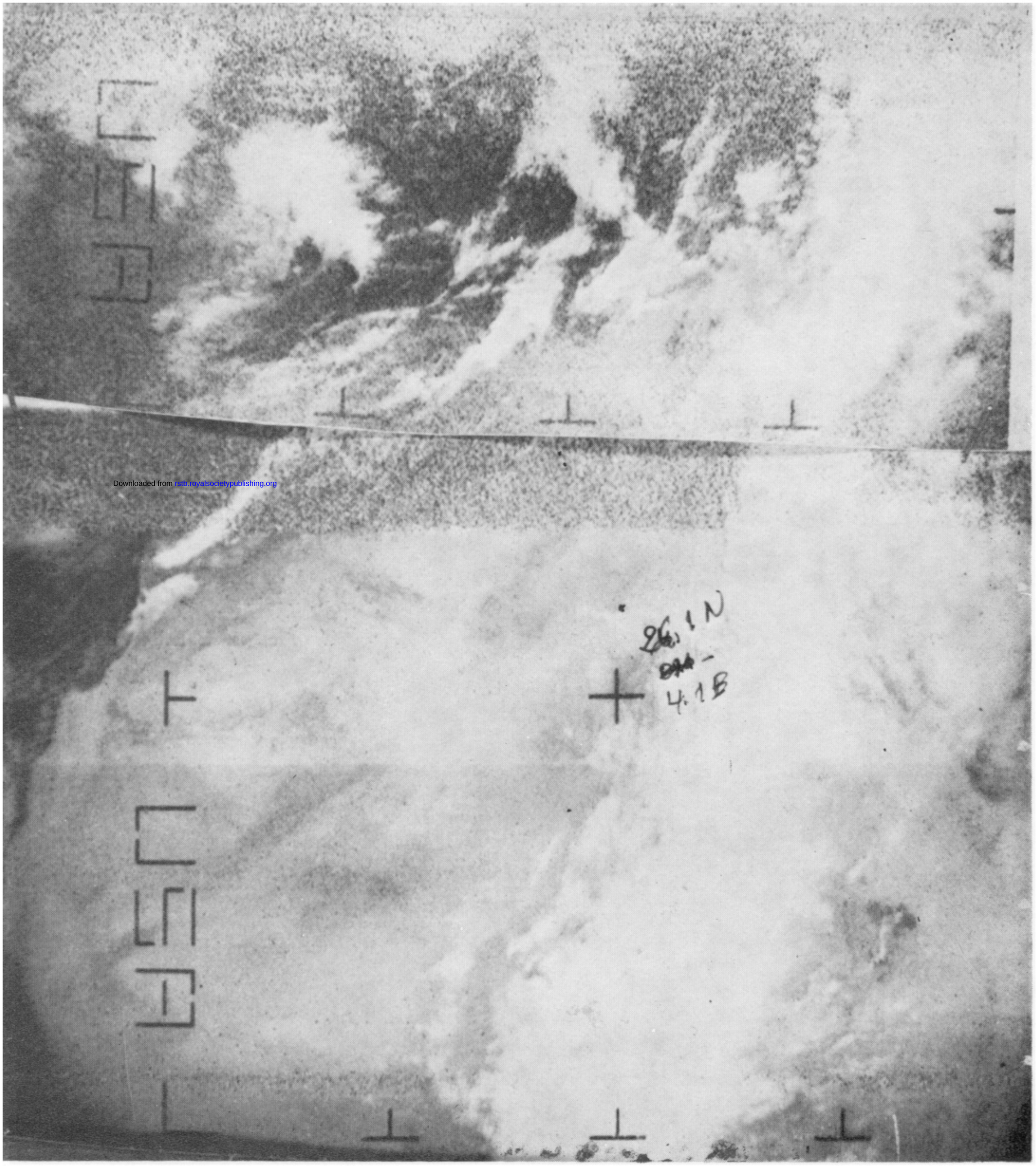

FIGURE 2. Weather satellite photograph of northwest Africa (ESSA 8: 1000 G.M.T., 6 May 1975) as received at Dakar–Yoff (Senegal) and utilized at OCLALAV headquarters to recognize in real time an occurrence of heavy rains in the Adrar des Iforas which was followed by the appearance of Desert Locusts at high densities.