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The Association for
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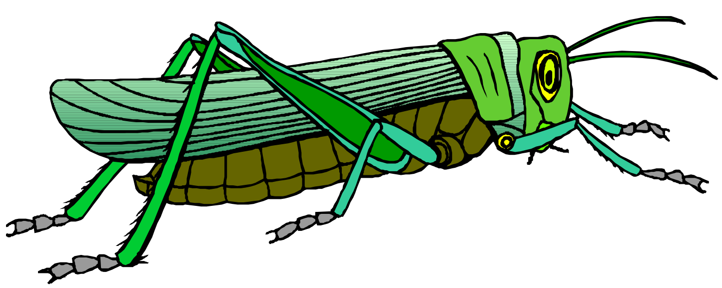


PREFACE

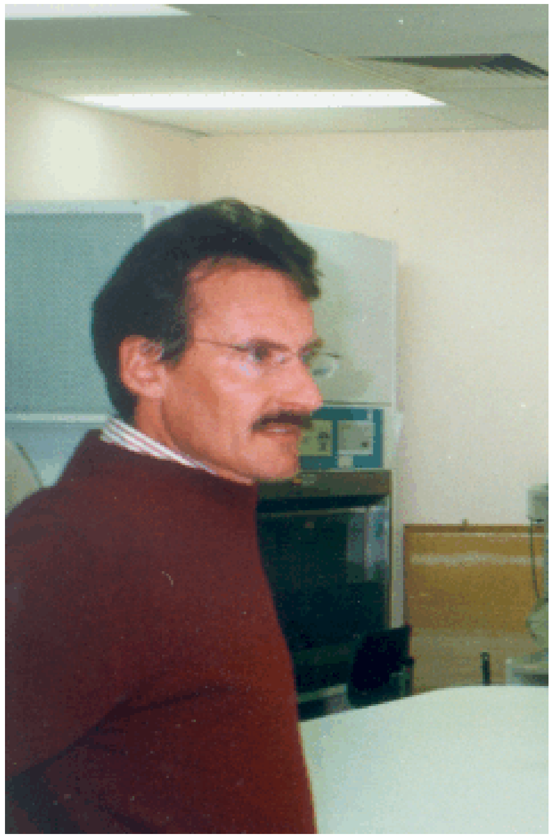
As pest management techniques, perspectives, and products have become increasingly sophisticated in the last 20 years, our capacity to adapt and transfer the methods and knowledge has declined. Formerly effective programs have dramatically diminished their roles in assisting afflicted regions. While the ability for any single nation to sustain a critical mass of expertise in acridid (grasshopper and locust) pest management has diminished, the quality of geographically dispersed experience and knowledge remains extremely high. The *Association for Applied Acridology International* has brought together the world's leading practitioners in this field to develop and provide unbiased analyses along with culturally, technologically, economically, and environmentally appropriate methods for managing locust and grasshopper outbreaks. The *Association* is the first and only humanitarian-based, non-governmental organization (NGO) of entomologists in the world, providing expert advice, training, and applied research to people and nations in need. The *Association* consists of 24 Associates and 11 Affiliates from 24 nations, representing more than 300 years of collective experience and 13 Institutional Partners/Participants comprising the world's best organizations dedicated to the study and management of acridids.

It is my pleasure to have facilitated the production of this third issue of *Advances in Applied Acridology*. The purpose of this report is to clearly and concisely summarize for the scientific and management communities the major developments in applied acridology within the last year. As such, the report is organized into sections that are intended to provide the reader easy access to the information. I would hasten to note that each author was limited to a single page of text in an effort to keep the report as "tight" and information-rich as possible. As such, the reader may find that an article of interest has less detail than desired. This is precisely why we have provided the email address of each author; I invite you to directly contact the authors for further information. This format was very well received by a range of agencies, laboratories, and industries. Because of a rather positive response to the introduction of "Feature Articles" last year, we have continued this practice of including pieces that provide a more in-depth analysis of particularly timely and compelling issues. In addition, we have added a new section, "Associate, Affiliate, and Partner Updates". This department is intended to serve as a less formal quasi-newsletter, in which updates on people, places, and programs are presented. Although a bit lean in this inaugural edition, we hope that this section will expand into vital means of sustaining and building collegiality within our scientific community.

The *Association for Applied Acridology International* would like to thank Ms. Jane Struttmann for her careful and conscientious copyediting of this publication. Her editorial skills were vital to the production of a high quality product. The editing assured consistency in presentation, spelling, grammar, formatting, and organization. In no case was the editing intended to alter the meaning of the text, nor was there any attempt to impose consensus. As such, the reader may find instances in which reports make claims that are not in agreement – and such is the nature of the *Association for Applied Acridology International*. We do not constrain our Associates or Affiliates to a particular "party line". They are the finest scientists and managers in the world of grasshopper and locust bionomics, and they have complete intellectual freedom and professional autonomy to assess situations in the most rigorous and objective manner possible. As such, complex events and technologies may be perceived differently by our various Associates and Affiliates, and the opinions and judgements of this publication are those of the authors.

Finally, if you have any suggestions for how we might make the next issue of *Advances in Applied Acridology* more useful, informative, or relevant, please do not hesitate to contact me by phone (1-307-766-4260), fax (1-307-766-5025), or email (lockwood@uwyo.edu).

Jeffrey A. Lockwood
Director, *Association for Applied Acridology International*
15 May 2002



We dedicate this work to our friend and colleague,
Chris Lomer

We would all do well in life
if we were to advance
applied acridology,
scientific collegiality,
international understanding, and
human compassion
with Chris' enthusiasm and spirit of generosity.

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SURVEY, FORECAST, AND DECISION SUPPORT

Biogeography of Desert Locust in Mauritania: Refinements of Survey and Control

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The LOCDAT database contains data collected regularly as part of desert locust survey and control operations. For the period 1988 to 1999, 18,429 records in 253 fields are available in the database. These data are complemented by vegetation and meteorological data. In order to improve the analysis of these data, a structured relational database has been constructed. This database has been analyzed temporally (in 10-day and monthly intervals) and spatially (in quarter-degree squares). This analysis has led to the delimitation of areas having high frequency occurrences of the desert locust, both by phase (solitary, transient and gregarious) and by stage (larvae or adults). A complementary environmental study has identified, mapped, and described the principal ecological zones within the country. The boundaries of eco-climatic zones have been deduced from the plant taxa present.

The creation of monthly frequency maps has led to a better understanding of the spatial and temporal dynamics of the desert locust in Mauritania. This will lead to an improvement in the timing and location of surveys and preventive control interventions, in turn leading to a reduction in costs.

Notes: This summary is an abstract of an MSc thesis presented in September 2001 at the EPHE, Paris. The work was undertaken in collaboration with CIRAD-Prifas and will be published under the Desert Locust Technical Series (following the DLCC meeting in 2001). The results of this study were implemented during the desert locust surveillance campaign 2001-2002 in Mauritania, and resulted in a reduction of 30% in costs, without affecting efficiency. The LOCDAT program was developed on DbasV by the University of Basel (NLU) under contract with the GTZ bilateral German-Mauritanian locust project in collaboration with the CLAA. The CLAA thanks all the partners involved in this work. For more details on this project, please contact the author: claa@toptechnology.mr

Locusts and Madagascar: The French Project to Re-establish an Early Warning System

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In Madagascar, time is now to draw the lessons from the recent invasion of the migratory locust and to restore a preventive control system. CIRAD was charged by the Service for Cooperation and Cultural Action of the French Embassy in Madagascar to help the new national anti-locust centre (CNA) to organize its monitoring and early warning section. The purpose is to provide CNA with modern tools within the framework of a preventive strategy. The project is led by four CIRAD scientists of the Prifas team, one of whom is permanently in Madagascar within the CNA. This project has been operational since the beginning of 2001.

A geographical information system is in the process of development. The updating of the cartography of the locust biotopes within the outbreak area of the migratory locust (using satellite remote sensing) is being conducted in collaboration with the Malagasy Geographical Institute. The red locust is included in this work, as its economic importance continues to grow (especially in the North), but it is not a well-known species on the island. A field research program on this species has been set up and national staff trained for the field observations. At the end of this three-year project the CNA should have all the elements of a new early warning system to prevent locust invasions in Madagascar.

DURANTON J.-F., 2001. *Appui scientifique et technique au Centre national anti-acridien.* CIRAD (Centre de coopération internationale en recherche agronomique pour le développement) - AMIS - Protection des cultures, n˚33/2001, Montpellier, France. 50 p.

DURANTON J.-F., 2001. *Conception d'un outil d'aide à la décision en matière de lutte antiacridienne à Madagascar*. Centre National Antiacridien. Projet Français de contribution à la lutte antiacridienne. Doc. n˚17. Tuléar, Madagascar. 55 p.

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Ecology of Spatiotemporal Grasshopper Dynamics in Siberia via GIS & Remote Sensing

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Spatiotemporal distribution of grasshopper infestations in the Irkutsk Oblast near Lake Baikal (SE Siberia, Russia) was studied using GIS (ERDAS-IMAGINE®) and remote sensing (Landsat TM satellite imagery). Grasshopper fauna included about 50 species with *Aeropus sibiricus* predominant in the xeric habitats and *Chorthippus albomarginatus* predominant in the mesic habitats. Annual fluctuations of grasshopper infestations appeared to track changes in air temperature and April to September precipitation in the preceding year. As a rule, <u>temporal</u> upsurges of grasshopper populations were preceded by several years with elevated air temperatures and deficient rainfall. However, not a single studied climatic variable (monthly precipitation, mean monthly air temperature, and sum of April to September precipitation) exhibited a statistically significant correlation with the grasshopper infestations during the current or following year. The most reliable descriptor of the trends in grasshopper population dynamics appeared to be a synthetic parameter, the so-called Aridity index (Ar), which combined air temperature and precipitation of the preceding year (Rubtzov, 1935): $Ar=P/(T_{Apr\text{-}Sept}-36)$, where P is the annual precipitation in mm, and $T_{Apr\text{-}Sept}$ is the sum of mean monthly air temperatures from April to September.

Analysis of the <u>spatial</u> distribution of grasshopper infestations demonstrated non-random patterns in different habitats. The highest historic grasshopper densities were found to be strongly associated with transitional (ecotonal) zones between foothills and valleys. Such zones were characterized by: 1) particular elevations (600 to 650 m), 2) soil type (sod-forest, or pararendzina), 3) low amount of April to October precipitation (250 mm), 4) dry-grassland vegetation, and 5) moderate degree of grazing. Among these, the relationship with a particular soil type appears to be most intriguing because the origin of this soil (sod-forest) was connected with coniferous forests, rather than the habitat preferred by grasshoppers, grassland vegetation. The sod-forest soil type occupied only 14% of the study area while it hosted 61% of the highest historic grasshopper densities (>15/m^2). This counterintuitive result reflects the natural-historical past of the study area, where forests were gradually replaced by grasslands under the influence of natural factors (global warming, increased climate aridity and melting of permafrost) and human influence (agricultural deforestation).

This study represents the first application of GIS and remote sensing to acridology in Russia. Its results allow for the optimization of the grasshopper survey, as well as concentration of management efforts and resources, contributing to progress towards more rational, economically sound and environmentally viable methods of grasshopper management.

Operational use of a Decision Support System: Detecting Locust Outbreaks in Australia

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The Australian Plague Locust Commission (APLC) manages locust outbreaks in an area of over 3 million km^2 through a program of preventive control. Control begins early in outbreaks and an essential part of early detection and control has been the integration of the latest locust and weather information into a Decision Support System (DSS). The basis of the DSS is information on locust distribution, habitat preferences and rainfall as analyzed in a Geographic Information System (GIS). Data on current locust distribution are collected by eight survey officers who directly transfer locust survey data by radio link to the GIS. The transferred data are overlaid onto a base map of preferred habitats obtained from 13 years survey data, and are compared with previous distributions. Locusts require green vegetation for maturation/laying and, in the sparse rainfall of the arid interior of Australia, locusts usually encounter green areas by migration. When rainfall is reported by rain stations or by weather radar, locust migrations are modelled using a wind trajectory model. Potential areas of green vegetation are obtained from rainfall distribution as interpolated using a direct link to the Bureau of Meteorology weather data files. Actual green areas are later detected by using a recently improved version of National Oceanic and Atmospheric Administration (NOAA) data obtained 2 to 3 weeks later. The data on locust distribution, migration, rainfall/greenness are integrated within the Decision Support System to forecast areas where locust populations are likely to increase or decrease. Within the 3 million km^2 in which locusts can occur, areas of likely increase are surveyed preferentially so any bands and swarms present can be detected early and controlled.

Monitoring Grasshopper Communities in Argentina: An Unprecedented Database

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During the grasshopper season 2001-2002 a research team from La Plata National University (UNLP) assisted by the authorities of Benito Juárez county managed to continue with the monitoring of grasshopper communities in 27 sites in southwestern Buenos Aires province, a region historically afflicted by grasshopper problems. These activities have been carried on uninterruptedly since 1996, and are yielding valuable data with great usefulness for future management options. The study is unprecedented for Argentina because it is the first time such an effort can be sustained in the long term, and thus far has been able to trace for the first time in the country the building up of an outbreak. Species richness, relative abundance, and density are registered. Density maps, using GIS techniques, are being produced to facilitate decision making by technicians and ranchers.

The Current Locust Situation in México: An Increasingly Serious but Solvable Problem

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The Central American locust (*Schistocerca piceifrons piceifrons*) is geographically distributed from Northeast México to Costa Rica. Major damage to agriculture in México consistently occurs in the southeastern states of Yucatán, Chiapas, Tabasco and Campeche. However, since 1998, locust populations have become a major problem in the northeast region, particularly in the south in the state of Tamaulipas (Cd. Mante, Nuevo Morelos, Ocampo, Aldama, Gómez Farías, González, Xicoténcatl) and the state of San Luis Potosí, where locust swarms are being controlled at present. *S. piceifrons piceifrons* causes severe damage to subsistence and industrial crops (maize, sorghum, cotton, soybean, citrus, *Agave*, and sugarcane) along its distribution area.

In 2000, control operations against the Central American locust were carried out in the state of Tamaulipas in 7,000 ha, using methyl parathion 720 at a dose rate of 1 l/ha. Costs of campaigns and organization are the responsibility of the State Plant Protection Committees and producers. As a result of control operations, locust populations decreased in 2001, with control operations required in only 3,350 ha of Johnson grass and sugarcane.

In an attempt to reduce methyl parathion applications and in order to search for safer locust control alternatives, *Metarhizium anisopliae* was introduced in 2000 and fipronil in 2001.

CONTROL: CHEMICAL

Experiments with Teflubenzuron Against the Italian Locusts and Grasshoppers in Russia

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In 2001, new experiments with a suspension formulation of teflubenzuron (Nomolt ®) were conducted in the Kulunda steppe (Novosibirsk Region, the southern part of West Siberia). This is a new insecticide for locust control in Russia.

The steppe rangeland was divided into several experimental and control plots (about 3 ha each). The targets consisted of nymphs (mostly 1st and 2nd instars) of grasshoppers (*Omocestus haemorrhoidalis*, *Euchorthippus pulvinatus*, *Dociostaurus brevicollis*, and *Oedaleus decorus*) and the Italian locust (*Calliptamus italicus*; about 25% of overall density). Four experimental treatments were conducted: 1) blanket, 2) barrier (alternating swaths of 15 m wide), 3) alternating treated (15 m) and untreated (30 m) swaths, and 4) alternating treated (15 m) and untreated (45 m) swaths. The dose rate in the “barriers” was 30 g.a.i./ha, while the rate in the “blanket” area was 22.5 g.a.i./ha. The main results are summarized in the following table.

Treatment/Day	**D-1**	**D1**	**D6**	**D10**	**D17**	**D20**	**D29**	**D39**
Treated (15 m) / Untreated (15 m); average mortality, %	-	34.8	49.8	84.7	72.0	71.1	64.8	61.9
Treated (15 m) / Untreated (30 m); average mortality, %	-	35.6	44.8	78.7	64.4	13.6	53.0	47.5
Treated (15 m) / Untreated (45 m); average mortality, %	-	14.3	19.2	72.5	56.5	-	38.3	38.6
Blanket; average mortality	-	50.2	68.2	100	96.9	90.7	96.3	87.9
Untreated; density (No./m^2)	19.2	17.3	8.3	15.0	16.0	14.2	17.8	16.4

These experiments showed that teflubenzuron (like other IGRs) could be very suitable for locust and grasshopper population management in the Siberian steppes. However, the efficacy of the barrier treatments with relatively wide untreated swaths was low. Hence, blanket application and barrier treatments with narrow equal alternating swaths may be optimal.

Control of Australian Plague Locust Nymphs using "Barrier" Treatments with Fipronil

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Successful field-testing of "barrier" treatments with fipronil has resulted in the APLC including this technique as one of the options for future control operations against infestations of nymphs in rangeland areas. As stated previously this technique combined with the use of spray aircraft fitted with DGPS equipment offers significant operational cost savings (reductions in aircraft flying time and quantities of insecticide used) and possible advantages to non-target species.

During trials this season, targets up to 45 km^2 with populations of *Chortoicetes terminifera* nymphs in high density bands (3,000 to 5,000 nymphs/m^2) were treated with fipronil (Adonis 3UL®) using spray runs spaced 500 m apart across blocks. The aim was to treat a 200 m strip of vegetation downwind of each spray run with a dose of ca. 0.5 to 1.0 g.a.i./ha, while leaving the strip between 300 and 500 m downwind relatively free of insecticide.

In the 45 km^2 block (which contained *ca.* 60 bands varying in size from 50 to 400 m), intensive aerial and ground monitoring showed a 70% decline in the number of bands within 4 days of spraying, increasing to 90% by 7 days. Within the treated barriers, nymphs became disoriented during the 24 h following spraying causing the bands to break up rapidly as the nymphs died. Bands in the untreated or lightly dosed areas remained cohesive and continued to march up to 200 m/day, with most reaching higher-dosed areas within 2 to 4 days. On reaching higher-dosed areas, these bands slowed (30 to 50 m/day) and also disappeared as the nymphs accumulated a lethal dose.

A further refinement of the technique may include an increase in the distance between spray runs.

Locust Management in Australia: Matching Solutions to Problems

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The success with *Metarhizium* (see report in CONTROL: BIOLOGICAL) as part of control operations and with fipronil in barrier treatments means that these two products will form part of integrated pest management of locusts by the Australian Plague Locust Commission. *Metarhizium* will allow treatment of locusts close to waterways, in environmentally sensitive areas, and on the significant number of organic beef properties in the interior. Fipronil applied in barriers applied every 500 m will allow the rapid control of large areas and minimal economic and environmental cost. Assessments of the effects of fipronil on non-target organisms is underway to determine any long- term effects of barrier treatments.

Fipronil vs. Central American Locust: Improving Economics and Safety

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Fipronil (Regent 200 S.C.) was introduced in November 2001 to control late instar nymphs and young adults of *S. piceifrons piceifrons*, population density of 10 to 15/m^2. Several treatments were tested in the field:

1) 5 g.a.i. + 2 litres soy oil/ha as ULV aerial. Both blanket and 30 m width barrier spraying provided excellent results, with more than 95% mortality 4 to 5 days after the application and 21 days persistence in the field.
2) 5 g.a.i. + 30 litres water/ha as aerial conventional spraying. Mortality and persistence were similar to the soy oil formulation.
3) 5 g.a.i. fipronil + 30 litres water + 1% molasses/ha, aerial spraying, provided >95% mortality 48 h after the application.

At present, fipronil is being used successfully as a barrier spray to control overwintering adult populations of the Central American locust in México. The dose has been reduced to 2 g.a.i./ha, applied using barrier (65 m wide) spraying. The cost /ha is US$ 3.50 including aircraft costs. After the introduction of fipronil, the use of methyl parathion has been practically discontinued.

Adverse effects of fipronil have been observed on Tettigoniidae, Coleoptera, Lepidoptera, Hymenoptera, Hemiptera, Homoptera and on non-target grasshoppers. Up to 70 to 80% of these populations are killed in treated areas with the 5 g.a.i./ha dose. Lower doses (2 to 3 g.a.i./ha) and barrier spraying may reduce substantially mortality of non-target species and environmental impact.

Reduced Agent-Area Treatments Becoming the "Norm" in the Western United States

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Reduced Agent-Area Treatments (RAATS: application of low rates of insecticide in incomplete coverages) are becoming the standard approach to grasshopper management across the western United States. This method has been adopted in nine states (Idaho, Kansas, Montana, Nebraska, Oregon, South Dakota, Utah, Washington, and Wyoming), with others likely to follow suit. Representative programs in the last 2 years include: treatment of 21,000 ha in Oregon (2001), an 11,000 ha program in Idaho, and protection of 16,000 ha in Wyoming. Estimates place the cost savings at nearly $1 million and insecticide reductions at >50%, compared to traditional, blanket treatments.

CONTROL: BIOLOGICAL

The LUBILOSA Project: Green Muscling Biological Control into Locust Management

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The LUBILOSA project has started its last year of activities. An external review committee concluded that lobbying for microbial control of grasshoppers and locusts needs to continue beyond the end of the project to get this novel technology going in Africa. In comparison to large chemical companies, the small producers of microbial control products have limited capacities for marketing. But this is, according to the reviewers, what is needed to make microbial locust and grasshopper control a success. However, LUBILOSA made substantial progress towards a wider use of Green Muscle®. Last year's activities covered mainly training, together with increasing the use of Green Muscle®:

- Most African countries are lacking registration frameworks for microbial pesticides. An Africa- wide seminar on the harmonization of microbial pesticides was organized in collaboration with the Virginia Polytechnic Institute, in early 2001.
- Production facilities of BCP have been upgraded. BCP delivered the first large Green Muscle® order to the Niger plant protection agency with support from the Luxembourg technical cooperation.
- Calliope, a French company, received a temporary sales permission for Green Muscle®, issued by the Comitée de Pesticides du Sahel, the pesticide registration body of nine Sahelian countries.
- Green Muscle® has been applied during the 2001 grasshopper control operation on 2000 ha in Niger.
- Farmers in Mali with the support of non-governmental organizations are increasingly purchasing Green Muscle®.
- Plant protection officers from West Africa were trained in locust and grasshopper biological control at the International Institute of Tropical Agriculture in Cotonou, in close collaboration with USAID.
- LUBILOSA technical bulletins covering laboratory and field techniques used for the development of Green Muscle® have been updated and placed on the internet (www.lubilosa.org).
- FAO Desert Locust Control Committee recommended the large-scale operational trials using *Metarhizium* against desert locust be carried out with support of FAO, EMPRES and the Commissions as soon as targets are identified.
- FAO commissioned an expert consultation and risk assessment on the importation and large-scale use of mycopesticides against locusts.

Use of *Metarhizium anisopliae* on Acridids in Australia: A "Well-Oiled" Approach Works

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During the 2000-2001 locust season, more than 23,000 ha of nymphal bands of *Chortoicetes terminifera* were aerially treated with Green Guard™, a commercially produced ULV oil formulation of the FI-985 isolate of *Metarhizium anisopliae* var. *acridum*. These treatments were at 17 to 25 g conidia in 500 ml oil/ha (0.7 to 1.0 x 10^{12} conidia/ha). During late 2001, lower doses were tested and doses of 10 to 25 g conidia in 460 to 500 ml of oil resulted in an 80 to 99% decline in locust numbers in 10 to14 days. However, when applied in a volume of 300 to 330 ml of oil, doses ranging from 6.5 to 16 g/ha proved ineffective; oil has been shown to be important in improving efficacy in the laboratory and field, and it would appear that 300 to 330 ml of oil/ha is insufficient. At the effective doses of 10 to 25 g conidia in 500 ml of oil, Green Guard™ costs about US $2.30 to 5.70 per ha.

The Australian Plague Locust Commission, in collaboration with several farmers in Western Australia and South Australia, applied an EC formulation of Green Guard™ at 75 g conidia in 125 l water/ha to grasshoppers (*Phaulacridium vittatum*) near their vineyards. The weather was cool and cloudy which inhibited the speed of development of both the grasshoppers and the *Metarhizium* with 80 to 90% mortality not reached until 3 to 5 weeks after treatment. In these initial trials, the small areas requiring treatment and the high value of the crop being protected meant a high dose was used to help ensure high mortality. Further trials with lower doses are planned.

Monitoring *Nosema locustae* in Argentine Grasshoppers: Approaching a Quarter-Century

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Thanks to a generous, anonymous donation made through the Orthopterists Society, it was possible to continue during the grasshopper season 2001-2002 with the monitoring of the introduced microsporidian pathogen *Nosema locustae*. Samples of grasshoppers were obtained in or around the 1978-1982 original application sites and similar sites in other areas for purposes of comparison. These activities have been conducted since 1994, and they are designed to obtain information on the presence, prevalence, host range, and geographical distribution of the pathogen. Other pathogens (*Perezia dichroplusae*, *Entomophaga grylli*, *Malameba locustae*, *Gregarina ronderosi*, *Entomopoxvirus*) are monitored as well.

Natural Enemies of *Brachystola magna* in Durango, México

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In some years, the plains lubber grasshopper *Brachystola magna* is a serious pest in northern México, causing severe damage in beans, *Phaseolus vulgaris*. Since 1996 there have been outbreaks causing crop losses in the cultivated areas of Durango state. The plains lubber grasshoppers range widely on the western plains of the United States and México, and are considered an occasional pest of cotton in Texas (Pfadt, R.E. 1994. Plains lubber grasshopper, *Brachystola magna* (Girard). Wyoming Agricultural Experiment Station Bulletin 912). Insecticides, such as fenitrothion, can control the grasshopper but are environmentally undesirable.

In Durango, México, the natural enemies of *B. magna* were surveyed between 1996-2001. The mean rates of parasitism by Sarcophagidae, Nemestrinidae and Tachinidae were consistently at moderate levels (18 to 30%). In a tentative effort to find pathogens, grasshopper-infested areas were surveyed. Isolates of *Metarhizium anisopliae* and *Beauveria bassiana* were found infecting *B. magna*. These isolates are deposited at the Collection of Entomopathogenic Fungi (Centro Nacional de Referencia de Control Biológico SAGARPA-SENASICA-DGSV).

Field Trials with *Metarhizium anisopliae* var *acridum* in México: Cause for Optimism

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Spores of two Mexican isolates of *Metarhizium anisopliae* var *acridum*, MaPL32 and MaPL40, were formulated in mineral citrolina oil to control second to third instar bands of *S. piceifrons piceifrons*. The oil formulation, at a dose rate of 50g spores/litre citrolina/ha (2.5 x 10^{12} conidia/ha) was sprayed using ULV knapsack sprayers. Population dynamics in one untreated and two treated blocks were followed to determine the efficacy of the isolates. By day 13 after the application, populations declined more than 95% in the area treated with MaPL32, while populations sprayed with MaPL40 declined 85%. *Metarhizium* will be used operationally in México in May and June 2002.

APPLICATION TECHNOLOGY

FEATURE ARTICLE
Improving Pesticide Application Techniques for Desert Locust Control

Mohamed Abdallahi Ould Babah, Chief CLAA, Mauritania and *Robert Aston,* CTA, Mauritania.

This research and development project, funded by Norway and executed by FAO, has been active in Mauritania since 1996, although a major revision in 1999 enabled an expansion of project activities. The project has an international scope, although most of the work has been undertaken with the full cooperation of the Locust Control Centre (CLAA) in Mauritania. The objective of the project can be summarized as developing systems of pesticide use that result in lower quantities of pesticide used for desert locust control. Within this overall objective, five research themes have been identified.

Analysis of current practices has been used as a tool to identify where current practice in pesticide use falls below the "accepted best practice", and more importantly to determine what prevents the adoption of optimum pesticide use strategies. This activity is undertaken using a number of different methods, including risk analysis workshops with control staff, operator perception workshops with spray operators, observation of spraying practices, and targeted training. During the project this activity has been key in orienting project research activities to address real problems faced by control team staff. Constraints to the adoption of best practice can be classified within a number of general themes. For example, technological constraints include factors such as equipment which is not suitable for ULV spraying (*e.g.*, sprayers designed for orchard spraying used as airblast sprayers with poor droplet spectrum), poor design of machinery, and so on. Other areas of constraints include financial, training, and working conditions.

One of the principal outcomes from this analysis has been the need for a standard operating manual which can be used in field operations. This manual is being developed by the CLAA and FAO EMPRES, and will contain not only operational information but also minimum specifications of equipment and protective clothing that will allow standardized purchasing and use. It should be noted that the operations manual will form the basis of a training manual so that staff who are recruited at short notice during an emergency can be trained quickly and effectively. In order to define specifications for spraying equipment, the project is in the process of developing methods of testing machinery for suitability. These tests are based on the 1998 FAO Guidelines on Agricultural Sprayers, modified for ULV equipment, and relate to factors such as spillage during loading, operator contamination, residue in sprayers, optimum cleaning regimes, and other factors.

The second area of research is field trials related to reduced dosage applications. Due to the relatively low level of desert locust populations since 1999, only limited opportunities for small-scale trials have been possible. Despite this limitation, there are sufficient data from the field trials undertaken to indicate that there is the potential for a considerable reduction in dosages if correct application procedures are followed. In the absence of desert locust field populations, the project has been using a two-model approach to defining minimum dosages. This is based on a laboratory model, in which application parameters are varied (drop size, drop number, concentration and formulation) and insects exposed to the deposits. This permits (under laboratory conditions) a calculation of the optimal deposit. The physical model is a large series of field trials where application parameters are varied (drop size, volume application rate, sprayer configuration, *etc.*) under different meteorological conditions and terrain to assess the optimum application parameters for achieving the deposits defined from the biological model.

A third area of research is in the collection and management of control data. During a desert locust outbreak, the need for timely information for appropriate decision making is, of course, of utmost importance. The project, with the CLAA, FAO HQ and FAO EMPRES has developed a system of electronic data transmission which permits data to be sent from the field via HF radio equipped with a modem directly into the operations center GIS. The system is based on a similar system used by APLC, although technical details vary. This system is now ready for operational use for survey data, using a custom database for collecting data ("elocust" developed by FAO HQ). It is also ready for use with control data.

The fourth area of work has been on monitoring of operators and domestic animals for exposure to pesticides during desert locust control operations. Working in collaboration with CERES/Locustox, the project and the CLAA now routinely undertake monitoring of staff during locust control operations. Although little control has been undertaken during the project, monitoring has been done in order to validate the system under the harsh conditions in which locust control staff operate in the field (three, full locust seasons). Issues that remain now are those of management in terms of replacing staff who are detected as being exposed. The CLAA has already implemented a preventive system by rotating staff within control teams to reduce exposure time.

The project has also undertaken a large amount of work on monitoring domestic animals for exposure to pesticides. The project has focused on camels, which share much of the desert locust habitat and are potentially liable to exposure. The project has used a simple blood test kit which measures depression of acetylcholinesterase. As it would not be realistic to monitor an individual animal before and after exposure, a large amount of data on camels has been collected which serves as baseline data. Data from animals suspected of being exposed to pesticides can be compared to this baseline data to confirm exposure. In Mauritania, there was only one opportunity to monitor an actual treatment, and although no difference could be detected (indicating no significant exposure), no replication could be done. This is largely a result of a strong aversion of the camel owners (nomads) to having their animals unnecessarily handled.

The final area of project activities is in training. Most of the training that has been done has been with control teams on a very targeted basis. This has meant that different training methods could be tested in the field, and appropriate systems developed. Other training has included the use of workshops with control team staff to develop standard operating procedures. These are very hands-on exercises which serve both to train staff, and as importantly, permit them to develop confidence in training others. An international workshop was held in November 2001 with invitees from five locust-affected countries seeing and discussing project results.

In addition to the work outlined above, the project has been very active in the development and testing of systems that address some of the constraints identified by the analysis of current practices. For example, it is clear that in order to apply reduced dosage recommendations, application parameters have to be correct. The project undertook trials in Sudan in 1998 with DGPS for aircraft. The improvement in the accuracy of track spacing was highly significant. As a result of this work, the data were presented to the DLCC Technical Group in 2000, and subsequently to the DLCC itself. They recommended that DGPS equipment should be mandatory on aircraft contracted in for desert locust operations.

The project has also tested DGPS equipment for ground spraying. Without any form of track guidance, the tendency to overdose is apparent even in experienced drivers. The use of DGPS has shown that this can be eliminated. However, the cost of DGPS, plus the correction signal, may preclude its adoption on a large scale. Since the removal of selective availability in 2000, the accuracy of GPS has increased. Tests by the project have shown that accuracy can be as good as 5 m under optimum conditions with a good handheld receiver. In reality, a vehicle cannot maintain a highly precise track due to the terrain. Based on this, the project has been working with a company to develop a simple track guidance system based on a low cost GPS unit which can be fitted to all spray vehicles. This is close to completion. The system automatically records the track and speed of the vehicle. These data can be sent back electronically to the operations center (as, of course, can aircraft data from DGPS units).

In order to reach areas that may harbor potentially important desert locust populations, the project has been working with the Technical University in Oslo in testing a simple, low-cost all-terrain vehicle. This vehicle, known as the GT, was initially designed as a simple-to-construct vehicle that could be used where roads were absent. Initial testing in Mauritania yielded interesting results, and further development is ongoing.

For more information about this project, please contact Mohamed Abdallahi Ould Babah (claa@toptechnology.mr) or Robert Aston (faonorim@toptechnology.mr). A website, which will contain project reports and results, will be available shortly.

Delta Planes for Locust Control Operations: Super-Lights Appear to be Ultra-Effective

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At present there is a great interest in Uzbekistan with regard to the use of delta-fliers or super-light flying devices (SLFDs) for the application of pesticides to protect field crops. Use of SLFDs in agriculture decreases fuel input, increases labor productivity, and reduces the volume of water needed for chemical treatments. Use of SLFDs in pest control increases every year. From 1993 to 1996, the area of aerial pesticide application by SLFDs in Uzbekistan totaled 327,000 ha.

The possibility of application of insecticides against locusts by dispersing the chemical from an SLFD is a new way of protecting crops in Uzbekistan. This approach to treatment has been practiced in farms of Karakalpakistan and Surchandarya region, where the water supply is quite limited. Tests were held by using SLFD types M8-20 and M8-50 of the independent company “KAZAVIA” (Kazakhstan).

In the Surchandarya region, tests were conducted in 1999 to evaluate the efficacy of using delta-fliers to apply insecticides for control of the Moroccan locust, *Dociostaurus maroccanus*, and in Republic of Karakalpakistan during 2000 for control of the Italian locust, *Calliptamus italicus*. The SLFDs were equipped with a sprayer (АО-СЛА-7.0 m) having four Micronair nozzles (spinning pulverizers). During spraying operations, the plant canopy height was about 1.5 to 2 m; ambient temperature was 17 to 19 ºC; relative humidity was 78 to 83%; wind speed 2 to 3 m/s. The vegetation consisted of 140 units/m^2 at a height of 30 to 40 cm. The application method was ULV, requiring a total volume of only 1 to 3 l/ha.

The analyses of results of the tests from two regions against different kinds of locusts suggested the following conclusions. Use of delta-fliers for applying chemical treatments to pastures by ULV enabled us to achieve very high levels of locust control. Adonis® (0.12 l/ha) provided up to 96% control within 20 d. Dimilin OF-6 ® (1.0 l/ha) provided up to 91% control, and Nomolt 5% (0.5 l/ha) yielded 96% mortality. Thus, there was no clear difference among the efficacies of the various treatments. There is no specific information about the difference between the results of morning and evening ULV applications. However, during the evening treatments when the ambient temperature was 30 to 34 ºC and there were increasing winds, it was necessary to increase the volume to 3 l/ha.

Wind Tunnel Studies to Simulate Aerial Application

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Using the new wind tunnel facility at the University of Queensland's Centre for Pesticide Application and Safety (C-PAS), ULV formulations of fipronil (Adonis 3UL®), Green Guard ™ (oil with *Metarhizium anisopliae var. acridum* spores) and diflubenzuron (Dimilin OF60®) were run through a Micronair AU5000 rotary atomizer at a speed of 200 km/h to simulate aerial spraying. By varying flow rates and using a range of blade angles, data on the droplet spectra produced with each material were collected.

Using the AgDRIFT™ and GDM™ (Craig *et al*., Crop Protection Vol. 17, 6, pp. 475-482) deposition models, these data will be used by the APLC to determine theoretical deposition patterns in sprayed areas (eg. within "Barriers"), the extent of off-target drift and the effect of release height/wind speed on deposition. Actual residue sampling in the field will also be used to validate the results from these models.

In addition, calibration of AU5000 atomizers on aircraft used by the APLC is now based on actual cage RPM rather than blade angle so that irrespective of the speed of the aircraft used (piston or turbine), the spray droplets generated during application will be within the same desired range.

All-Terrain Vehicles Reduce Grasshopper Control Costs to $1 per Hectare

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Reduced Agent-Area Treatments (RAATs) originated in Wyoming and are being further developed and adopted throughout the western United States. RAATs are a form of integrated pest management for rangeland grasshoppers in which the rate of insecticide is reduced from traditional levels and untreated swaths (refuges) are alternated with treated swaths. RAATs work via *Chemical Control* (grasshoppers are killed in treated swaths and as they move out of untreated swaths) and *Conservation Biological Control* (predators and parasites preserved in untreated swaths suppress grasshoppers). This approach has reduced the cost of control and the amount of insecticide by >50%, and 75% reductions are feasible. Even greater reductions in economic and environmental costs may be possible with ground-based application. Diflubenzuron (Dimilin 2L®, 1 oz/ac), carbaryl (Sevin XLR®, 16 oz/ac), and fipronil (Adonis 6UL®, 16 oz/ac) were applied by ground using an all-terrain vehicle equipped with a BoomBuster® 125 or 140 nozzle to provide a 13 to 16 ft. swath (see figure). With a RAATs approach using 20% coverage (treat 13 to 16 feet, skip 52 to 64 ft), at 21 d after application these treatments yielded 87% (Dimilin®), 73% (Sevin®), and 89% (Adonis®) mortality. The programmatic cost of such treatments (including labor, chemical, fuel, and equipment) was $0.38 per protected acre, making this the most substantial economic savings in insecticide-based control for rangeland grasshoppers since the development of RAATs nearly 10 years ago. With these treatment parameters, it is possible to protect 400 to 640 ac per day. Follow-up studies to validate and optimize these preliminary results would appear to be a matter of the highest priority.

ENVIRONMENTAL AND HEALTH IMPACTS

Public Health and Locust Control in Madagascar: A Toxic Mix

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Introduction: During the locust plague of *Locusta migratoria capito* and *Nomadacris septemfasciata* that occurred in Madagascar from 1997 to 2001, more than 3 million ha were protected and nearly 1,398,000 ha received a blanket treatment (ground and aerial spray). Assuming that only 1 to 3% of the applied dose was actually contributing to biological effect on the target species (Graham Bryce, 1977; Hall, 1985), one must wonder about the effect of the remaining amount on the public health. The main chemicals that had been used were fipronil, deltamethrin, fenithrothion, and propoxur. This report is related to the survey of public health in a few regions during the first period of the outbreak (July 1998 to June 1999).

Methods of Data Collection: With regard to the effect of the different active ingredients (cholinesterase inhibition*, GABA blocking, nervous system attack, *etc.*) and to their route of intoxication (inhalation, contact, ingestion), the following methodology was adopted to assess the overall effect:

- Surveys in five control sites and in five impacted areas. Data collection was based on cholinesterase (AChE) measurements and on the survey of the health state of the sample populations at different times in the study period. Use of control sites minimized the influence of possible interactions with population samples' habits: tobacco, alcoholism, *etc.*
- Site replication
- Targets consisted of pesticide handlers and populations near areas where pesticide application had been conducted. To ensure representative samples, data collection was designed to reflect, as close as possible, the population structure.

The following clinical signs were used to assess the health state of the samples:

General signs	**Orthoringolaryngite signs**	**Neurological signs**	**Respiratory signs**
Anorexia Asthenia Muscular cramps Fever Reduced blood pressure Insomnia Sweating Bradycardia	Buzzing in the ear(s) Ocular burns Conjunctiva Sneezing Watering Myosin Pharyngitis Rhinitis	Headache Coma Convulsion Hemiplegia Obnubilation Paresthesia Dizziness Neuropsychological troubles	Thoracic burns Dyspnea Bronchitic hypersecretion Difficulty breathing Cough

Results and Discussion:

Neighboring populations: The survey of clinical signs showed much higher proportions of impacted individuals around treated sites compared to those of control sites, mainly for respiratory and neurological signs. ANOVA tests with SPSS indicated that these differences are significant. AChE inhibition decreases with time.

Pesticide handlers: In general, cholinesterase inhibition rises progressively with time, certainly as a consequence of exposure duration.

Possible origins of intoxication: Daily intake by means of contaminated food chains (pesticide residues had been detected in some sorts of foodstuff) and indirect/direct contact (dermal, inhalation) should be the main causes of the above mentioned intoxications.

Application of insecticides for locust control in Madagascar

Conclusions: Without intensive measures (trained personnel, adequate infrastructure equipment and financial resources, strong pesticide legislation, *etc.*), chemical control of locusts does affect human health, although it depends on the nature of the active ingredient. Because of poor safety in the use of pesticides in Madagascar and similar countries, not only can handlers be affected but also a significant part of the neighboring population.

**Cholinesterase is an enzyme (a form of biological catalyst) which acts in body tissues to keep muscle, gland, and nerve cells working in a harmonious and organized way. If tissue cholinesterase activity is reduced to low levels, the effects would include fine and coarse twitching of muscle fibers in the body and excessive secretion of tears and saliva. Breathing then becomes weak and the heart beats more slowly and feebly. The main toxic effects of exposure to organophosphorous insecticides are due to depression of the nerve acetylcholinesterase (ACheE) level. Carbamates produce the same effect but reactivation of inhibited enzymes is relatively rapid. Butylcholinesterase (ChE) could also be measured but it is not as important as AChE.*

A Lull in Locusts: Environmental Impact Studies Put "On Hold"

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In 2001, both the desert locust and the Malagasy migratory locust situation remained relatively calm throughout the year. Thus, NLU-Biogeography did not conduct new environmental impact studies.

Effects of Grasshopper Suppression on Flea Beetles: Weed Biocontrol Agents Sustained

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Established populations of *Aphthona* flea beetles – *Aphthona lacertosa* and *A. nigriscutis* – (Coleoptera: Chrysomelidae) on leafy spurge, *Euphorbia esula* L., could be in jeopardy on western United States rangelands where damaging populations of grasshoppers require insecticide treatments. Laboratory bioassays and field evaluations were conducted to determine the impacts of grasshopper control treatments. In laboratory bioassays, diflubenzuron spray produced no significant mortality. Malathion spray produced moderate mortality, while carbaryl spray produced high mortality. In the season of treatment, field evaluations in western North Dakota showed that diflubenzuron formulated spray resulted in minor if any mortality at 1 and 2 weeks post treatment. Carbaryl bait resulted in low mortality, malathion spray resulted in moderate mortality and carbaryl spray resulted in high mortality. *Aphthona* populations exceeded the first year pretreatment levels in 23 of 24 plots one year after treatment. Except for malathion 8 fl oz/ac and diflubenzuron 1 fl oz/ac, all treatments resulted in population increases greater than seen in untreated check plots. RAATs treatments of diflubenzuron and malathion resulted in greater population growth at 1 year after treatment compared to their parental traditional treatments. Populations increased the most in bran bait plots, followed by carbaryl 16 fl oz/ac plots, malathion 4 fl oz/ac plots, carbaryl 8 fl oz/ac plots, diflubenzuron 0.75 fl oz/ac plots, untreated check plots, diflubenzuron 1 fl oz/ac plots and malathion 8 fl oz/ac plots. The timing of grasshopper treatments (third grasshopper instar and peak adult *Aphthona*) allowed a sufficient number of eggs to be deposited before treatments could affect them, therefore ensuring the survival of *Aphthona* 1 year after treatment.

Grasshoppers as Vectors and Reservoirs of Vesicular Stomatitis

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Vesicular stomatitis (VS) is an economically devastating, viral disease of livestock, wildlife, and humans in the Americas, with periodic epizootics spreading from México to Canada. These outbreaks trigger quarantines to slow the spread and allow time to distinguish VS from foot-and-mouth disease (FMD; early clinical signs are identical to VS). Field observations suggest that VS is spread by arthropods. However, a 35-year search for a hematophagous vector responsible for the rapid, large-scale outbreaks has been unsuccessful. Prompted by a spatiotemporal correlation between grasshoppers and VS outbreaks, we designed a series of laboratory studies to reflect ecological conditions and found that grasshoppers can: 1) become infected by cell culture virus, 2) readily transmit the virus to one another by cannibalism, 3) transmit the virus to cattle, and 4) become infected via saliva from infected cattle. The ecological conditions and biological processes necessary for these transmissions to occur are present throughout much of the Americas. The discovery that an herbivorous insect may be a vector and reservoir of a viral disease of domesticated animals represents a new biological paradigm. In light of the global concern for FMD, the potential use of animal diseases for biological warfare, and the economic and health effects of VS in its own right, pathogen detection and disease control systems may need to be radically revised.

SOCIOPOLITICAL AND POLICY ISSUES

FEATURE ARTICLE

Research on Desert Locusts: Room for Improvement

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In contrast to many other pests that are considered to be economically important, there is a relative paucity of recent research (in the past 15 years) on desert locusts of sufficient quality for publication in peer-reviewed scientific journals. Aside from some solid but relatively scarce publications on desert locust pheromones, insect growth regulators, and mycopesticides, research appears to have stalled. This seems ironic in view of the common perception of the desert locust as an ancient source of pestilence that can still reach "Biblical proportions" and is most often associated with the adjectives "scourge," "plague," and "devastating."

There are a variety of reasons for the low research output that, in combination, result in layers of physical, political, and bureaucratic obstacles. It is well known that gregarization among desert locusts is a sporadic phenomenon, and that swarms and hopper bands can at times cause total loss of crops at the local (farm or community) scale. However, the true economic importance of desert locusts and control campaigns remains a contentious issue. Bilateral aid agencies are the financial foundation for most desert locust research efforts, but many bilateral aid agencies are not convinced that desert locusts should receive a high priority in their development portfolios. Attempts to economically rationalize desert locust prevention and control programs with studies and assessments have been occurring since the end of the 1986-1989 plague, usually without making appreciable impacts on the various perspectives of stakeholders. In terms of constraints to research, most or all fall within one of two broad categories: priorities and accessibility.

Priorities

The desert locust breeds in some of the poorest countries on Earth. In the so-called developing countries, research on almost anything takes a back seat to much more imminent exigencies including remedial health, infrastructure improvement, and national security. When research on pest management is conducted in developing countries, it generally addresses pest problems that occur widely and chronically on crops of staple importance for subsistence or export in lieu of focusing on a temporally and spatially sporadic insect that is of arguable economic significance. Much of the funds available to developing countries are donated by bilateral agencies or through multilateral organizations. Application of those funds is channeled or restricted by bilateral (and multilateral) entities that, during desert locust recessions, tend to focus on economically important pests that cause widespread agricultural losses every year.

Desert locusts also occur in relatively affluent countries like Saudi Arabia and Oman. For example, the desert locust center in Jeddah is skilled in monitoring desert locusts, and although it has conducted tests on new insecticide application and surveillance technologies, none of these tests have been reported in peer-reviewed scientific journals because publishing is not required and comparatively few researchers have received rigorous training in pest research. The government of Oman built and accoutered an unused regional desert locust monitoring and research center on the outskirts of Muscat (it has labs, sleeping quarters, a conference room, a kitchen), not far from a specialized training center.

The core donor countries for desert locust research during the current recession have been limited to Europe and North America, countries that are not themselves at serious risk of desert locust swarms. In many donor agencies, it is axiomatic that funding for development activities is “disaster driven.” When the immediate potential threat of a desert locust plague-induced crop loss, and scenarios of starvation pass, other programs, some of them for addressing more recent or ongoing disasters, become greater priorities.

In most of the desert locust recession countries, there is a paucity of personnel skilled enough in research to attract grant funds and report results in peer-reviewed journals. In cases, students stay in the country where they attended graduate school, and others are given administrative positions in desert locust-affected countries. A few work for international research centers, one of which has a research station located in Port Sudan which provides good access to the prolific desert locust breeding area on the Red Sea coast of Sudan. International research centers are substantially supported by donors, which, as mentioned previously, do not always view locust research as being a high priority.

Several years ago, I reviewed, with others on an international panel, some 27 pre-proposals submitted by developing country researchers for grants to support studies on various aspects of the desert locust and its control. All but two or three were completely unacceptable to the panel because they failed to address the topics and/or advanced wildly inappropriate budgets in response to the request for the pre-proposals which plainly delineated technical parameters and the grant ceiling. Those few pre-proposals that were not flatly rejected were finally deemed to be of marginal quality and grants were not provided. In most cases, the apparent priorities of the authors were considered to be inappropriate (they focused on the money instead of the research), and the technical quality of many of the pre-proposals reflected relatively low national priorities on training and maintaining skilled researchers.

Accessibility

Field research on desert locusts, especially on transitional and fully gregarious stages, presents daunting geographic and temporal challenges. A decade or more can pass between gregarious interludes, a condition that is not in harmony with annual funding and spending cycles common to many research institutions and programs. There are no monetary caches for desert locust research that has to be conducted during the geographically limited and temporally sporadic windows of opportunity (especially for investigating gregarious field populations).

Insecurity in desert locust breeding areas because of war between nations, armed rebellions and civil wars, clan rivalries, banditry, and land mines from past conflicts has also narrowed the geographic and temporal windows of opportunities for studying gregarizing or fully gregarious desert locust populations. The 1986-1989 and 1992-1994 desert locust campaigns each began on the Red Sea coastal plains of Sudan and Eritrea, both of which were undergoing civil wars that involved critically important breeding areas and stymied early intervention, but this is relatively uncommon.

Some countries implicated in terrorism, rampant corruption and/or human rights violations receive comparatively little assistance, including research programs, from the "traditional" Western donor countries (including through multilateral organizations). Nevertheless, some research in such countries has been conducted during the last decade, particularly on mycopesticides.

In most cases, the key desert locust breeding areas are geographically remote by most standards. Probably one of the most accessible desert locust breeding areas today is Shel-Shela, near the village of She'eb on the Eritrean Red Sea coastal plain's interior. When I first began visiting Eritrea in 1992, it took 4 to 5 hours in a 4 x 4 vehicle to get from Asmara to She'eb, but since the late 1990s, thanks to road construction, it takes an hour-and-a-half. Other key breeding areas, such as the Adrar des Iforas in Mali, the Aïr Mountains and Tamesna of Niger, and the interiors of Mauritania and Sudan are both vast and remote.

Accessibility to areas of interest to desert locust researchers is also hindered by cultural and linguistic differences. Many European and North American acridologists are unfamiliar with the regions inhabited by the desert locust, the cultures and languages, and the processes and procedures (informal and formal) of developing working partnerships and associations with governments and organizations that are critical to the success of research programs. While I was the Coordinator for the FAO's EMPRES-Central Region (desert locust component) program based in Asmara, I found that almost all researchers and trainers from donor countries were greatly benefited by having a strong liaison, whether through multilateral organization personnel based in the host country, or directly with the host country government.

Doubtless, there are other causes relating to the recent paucity of solid research on desert locusts, but I believe that the above are a fair representation. Some of these are intractable until other, larger forces bring about changes that are favorable to enhancing research opportunities. Some examples would include infrastructural improvement (e.g., the previously described road to She'eb, Eritrea), and concluding armed conflicts (though in specific instances with which I was involved as a facilitator, locust monitoring and control operations – not research – have been conducted in rebel-held territories).

Although many of the obstacles to research are difficult (or functionally impossible) to surmount from within the locust research community, others can be overcome to a great extent by acceptance of and participation in what I had termed "Cooperative Research Teams" (CRTs) designed to strengthen research capacities for locust-affected country and donor country researchers alike. The idea is simple: researchers with established experience in generating and reporting scientifically defensible results partner with researchers in the desert locust-affected countries. The researchers in the locust-affected countries can provide invaluable and intimate knowledge of the conditions and locust population dynamics in the field, and access to research sites. They can benefit when scientific training by their partners is made integral (e.g., required by the donors) to the research programs. Multiple partnerships can be established within the rubric of a single CRT in order to make more possible field research sites available and add necessary expertise. CRTs, *per se*, do not necessarily mean that one or the other partner(s), regardless of nationality, will join the team well funded (see the previous section on priorities). Some key international aid agencies, ironically, will not fund CRTs precisely *because* they are technology transfer and research partnerships between developing countries and donor countries -- even if the same donor agencies will fund costly training events for which trainers from the donor countries themselves are contracted, and most or all of the training materials are provided by donors. Also, in some cases, there are noted desert locust researchers native to desert locust-affected countries but, alas, they reside in and work for research entities in donor countries. Some common sense flexibility in donor policies as regards research partnerships designed to combine individual strengths and overcome individual weaknesses will go far in answering age-old questions about desert locusts and in establishing stronger research capacities indigenous to desert locust-affected countries. Although substantial donor funds have been made available for desert locust research during the last five years, it does not appear to have increased the numbers of peer-reviewed scientific journal articles.

As another measure for promoting viable research on desert locusts, any desert locust-affected country government should stipulate that corporations conducting field tests for getting their products registered for use in a desert locust-affected country (often those countries have lax or no regulatory conditions in place) must conduct the research as a serious (and well-endowed) partner, and the results must be published in peer-reviewed scientific journals (page charges supported by the corporations). It could conceivably be stipulated that corporations fund CRTs or CRT-like research partnerships that would be designed for ensuring scientific rigor and for reducing the possibility of bias. The host country should responsibly ensure that their researchers get the most out of corporate research activities, and not just corporate logo pens, baseball caps, and coffee mugs, *etc*.

While some mountains obstructing solid desert locust field research cannot be moved at present, research output would surely increase with higher prioritization of rational partnerships by stakeholders. Although there is evidence that some aspects of desert locust control have improved during the last decade, these can be attributed mostly to more organized visual surveillance and proactive interventions, not to new tactics generated by research.

Mauritania's National Locust Control Centre: A Model for Organizational Development

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The Operations Performance Review (OPR) – in French "Journée annuelle de réflexion" (a literal translation is "Annual Day of Reflection") has been held in Mauritania since the creation of the CLAA in 1995. It is inspired by the ZOPP (Object Orientated Project Planning) approach developed in Germany. The aim of the review is to identify, without restriction as to organizational hierarchy, all of the problems encountered by all staff involved in the operation of the CLAA (survey teams, control operations, coordination and management) in the previous campaign. All staff of the CLAA -- managers, technicians, and administrative staff -- participate, as well as other institutions who may wish to attend (donors, FAO, *etc*.). The reviews are moderated by an external moderator; problems identified, together with possible solutions are displayed on a pin board. The problems and potential solutions are discussed freely between participants in a constructive manner. The aim is to improve human resources and other inputs as well as field practices. Topics covered generally concern personnel, logistics, and resources, survey and control methods, and monitoring and coordination. A lot of time has been spent on harmonizing data collection methods (*e.g*., estimating locust densities) and defining targets and thresholds for treatment. Other topics regularly discussed include the control products used, research, and minimizing environmental impact.

A total of five OPRs have been held between 1996 and 2001; each has been released as a report. The reports constitute a framework for the development of the CLAA. The reports show that many of the earlier weaknesses in terms of organization and coordination have been addressed. However, some solutions to problems identified rely on the availability of finance (or the timely availability of finance), and these problems persist through a number of successive reports. The CLAA would like to thank the various bilateral and multilateral partners who have supported its activities over a number of years.

US Government Changes its Grasshopper Funding and Policy

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The severe infestations of grasshoppers, and particularly Mormon crickets, in the western United States in the summer of 2001 led to Congressional hearings. Led by Utah, the state most severely affected by these outbreaks, the testimony led to a reinstitution of federal funds for grasshopper and Mormon cricket management. The majority of funds have been directed by the US Department of Agriculture (USDA) to support an intensive survey program in 2002.

In addition, the USDA has completed its draft Environmental Impact Statement (EIS), the policy document that will define the parameters of grasshopper and Mormon cricket suppression on all federal lands and involving any federal funds. The finalized EIS is expected before the need for treatments in 2002. The current draft, which is likely to be substantively the same as the final version, identifies Reduced Agent-Area Treatments as the only authorized strategy for grasshopper and Mormon cricket control. As such, blanket applications of traditional rates of insecticides will be prohibited in all programs involving federal lands or funds.

OPERATIONS AND LOGISTICS

IITA + Danish Government = Environmentally Sound Grasshopper Control in the Sahel

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The International Institute of Tropical Agriculture in collaboration with CILSS/AGRHYMET (Niamey, Niger), Ornis Consult (Copenhagen), and the Danish National Environmental Research Institute (Silkeborg) will cooperate with different institutions in Cape Verde, Burkina Faso, Niger, and Senegal for the development of integrated grasshopper control strategies. In the Sahel grasshoppers are still controlled using purely curative control strategies based on large-scale insecticide treatments. This program will particularly improve knowledge on Senegalese grasshopper population dynamics. It will make GIS-based tools available which allow the application of a range of control methods, with a focus on microbial and classical biological control. The environmental impact of different IPM components will be studied carefully, including food chain effects on bird populations. Additionally the program contains training components for stakeholders in grasshopper control at all levels in the four Sahelian partner countries. Many similar IPM components have already been developed in regions outside of West Africa, for different acridid pests. Therefore, the program is seeking collaboration with similar initiatives worldwide.

Asian Development Bank Launches a Project on Locust Management in Kazakhstan

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Due to the immense scope of the locust problem (>8.1 million ha treated against acridids in 2000), Kazakhstan became the focus of international attention of the organizations involved in locust control in the end of the 20th and beginning of the 21st century. In 2000-2001, the FAO Technical Assistance project was implemented, and starting in the fall of 2001, the Asian Development Bank (ADB) started a project entitled Technology and Institutional Development for Sustainable Locust Management (TA No 3647-KAZ). The 18-month project with a budget of over US$ 0.7 million is financed through a grant from the Japan Special Fund and implemented by a consultancy company IPP Consultants. Dr. Mark Ritchie, formerly from the Natural Resources Institute (UK), is a Team Leader for the project. The executing agency is the Ministry of Agriculture of Kazakhstan. The project includes three main components: 1) dissemination of information on improved technologies of locust management, 2) development of a GIS-based locust monitoring and forecasting system, and 3) environmental monitoring of locust control operations. In fact, the components of the project represent the continuation of the main activities of the FAO Technical Assistance of 2000 (see pp. 15-16 in the 2001 issue of *Advances*), although the two projects are not linked formally.

One of the main objectives of the current ADB project is the development of mid-term strategy for locust management in Kazakhstan. Other objectives include the introduction of myco-insecticides, creation of the geo-referenced locust database system, and development of a public information program on locust control.

Locust Outbreaks and Control Programs in Central Asia: Problems Persisted in 2001

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Reproduction of the Moroccan locust, *Dociostaurus maroccanus*, was recorded on 20 March (Turkmenistan), 25 March (Uzbekistan), and 27 March (Tajikistan). Mortality was recorded from 1 to 20 June. Reproduction of the Italian locust, *Calliptamus italicus* L., was recorded 10 May to 10 June (Uzbekistan), and mortality was recorded from August to the end of September. Reproduction of the migratory locust, *Locusta migratoria* L., was recorded 8 May until death in August.

Country	Area of damage (1000 ha)	Locust species	Area treated (1000 ha)	Product	Amount (tons)	Application (1000 ha)	
						Ground	Air
Uzbekistan	420	Moroccan	215	Fury	22	90	200
		Italian	45	Fastac	45		
		Migratory	30	Adonis	3.5		
Turkmenistan	60	Moroccan	30	Hastation	20	30	0
				Decis	10		
Tajikistan	40	Moroccan	10	Fury	1.5	10	0

The Locust Invasion in Peru: FAO Resources and French Expertise Provide Solutions

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During the last years, Peru has had to face significant outbreaks/invasions of two locust species: *Schistocerca piceifrons peruviana* in the south and the center of the country, and *Schistocerca interrita* in the northwest. In 2000, the locusts caused US$23 million losses in Peru. In order to help the Government in the organization of an anti-locust campaign, FAO set up a technical project (FAO TCP/PER/0065). Within this framework, two expert missions were provided by CIRAD-Prifas. These missions were dedicated to: elaboration of a locust control strategy in the medium and long term, assistance in the execution of the locust control operations, organization of field and aerial surveys, choice of the most suitable methods, evaluation of operations with particular attention to environmental aspects, and locust information management. Training with regard to ULV techniques was also provided. At the beginning of 2002, the invasion appeared to be finished in certain areas (Chota, Lambayeque), but it continued in the western zone of Cajamarca.

DURANTON J.-F., 2001. Appuis techniques et scientifiques auprès du SENASA pour la lutte contre les fléaux acridiens. Rapport de mission au Pérou (5 Février - 19 Mars 2001). Projet FAO TCP/PER/0065 Programme d'assistance à la lutte antiacridienne au Pérou. Organisation des Nations Unies pour l'alimentation et l'agriculture, Rome. 50 p.

DURANTON J.-F., 2001. Appuis techniques et scientifiques auprès du SENASA pour la lutte contre le fléau acridien. Rapport de mission au Pérou (24 Septembre – 26 Octobre 2001). Projet FAO TCP/PER/0065 Programme d'assistance à la lutte antiacridienne au Pérou. Organisation des Nations Unies pour l'alimentation et l'agriculture, Rome. 73 p.

COMMUNICATIONS: TRAINING, WORKSHOPS AND MEETINGS

LOCDAT Training: The Mauritanian-Swiss Connection

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A co-worker of the *Centre de Lutte Antiacridienne* (CLAA) in Mauritania was trained in the management and utilization of the LOCDAT desert locust databank (c.f., AAAI Annual Report 1999). The 6-week training took place in Lausanne and Basel (NLU-Biogeography). Important subjects were data entry and validation, data analysis, use of LOCDAT with other computer programs (Excel, MapInfo, *etc.*), and compatibility of LOCDAT – which now contains more than 18,000 datasets – with RAMSES, the NRI (Natural Resources Institute, UK) desert locust databank.

Acknowledgements. The training was funded by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ; German Development Cooperation).

Desert Locust-Affected Countries in Collaboration: Sharing Operational Experience

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Since the restructuring of OCLALAV in 1989, Mauritania has progressively developed an indigenous desert locust control capacity, which resulted in the creation of the Desert Locust Control Centre (CLAA) in 1995. The CLAA was initially helped in its activities by support and technical input from FAO and a number of other partners. Technical support usually took the form of training of CLAA personnel, but assistance was also provided through the local knowledge inherited from the time of OCLALAV. The capacity of CLAA staff was further increased through joint operations during outbreaks and plagues. At the same time an enormous quantity of data, related to both ecology and locusts, was collected during successive campaigns and regular survey operations. The importance of such data is now recognized by numerous specialized institutions.

Mauritania has always been happy to share data and experience with other locust-affected countries in order to achieve the common objective – the prevention of invasions and plagues. Actions taken by Mauritania over the period 1989-2001 to improve communications and sharing of experience include:

1. Dozens of technicians and survey officers from the Maghrebian countries have undertaken joint operations with Mauritanian counterparts. This has been under the Force Meghrebian program, under the auspices of CLCPANO supported by FAO. More than 90 man-months have been spent by staff from other countries in field surveys over the last 13 years. This has resulted in improved knowledge of survey and control techniques, as well as developing a better understanding of the biology of the desert locust and its habitat.
2. Half a dozen survey officers from Senegal participated in the 1994-1995 campaign. They spent 4 months in the north of Mauritania undertaking joint survey and control operations. This was supported with the cooperation of OCLALAV and Canadian Aid.
3. Two senior locust control staff from Niger spent 3 days at the CLAA in June 2001, with the support of Luxdevelopment.
4. A group of three senior locust control staff, from Sudan, Yemen and EMPRES Central region, together with colleagues from India and Pakistan, visited Mauritania in November and December 2001 to participate in a workshop and work with the CLAA. This work was a jointly funded activity, with contributions from GTZ, FAO,and the SW Asian Committee of FAO. The workshop was jointly organized by the CLAA and the Norwegian-funded locust project in Mauritania. The workshop looked at the practicalities of an ultralight aircraft for aerial survey for locust bands, a novel all-terrain vehicle developed by the University of Agriculture, Oslo, and participated in demonstrations of the use of the fungus *Metarhizium*. Participants also looked at the use of DGPS track guidance systems for ground sprayers. The ultralight aircraft was provided by the national guard of Mauritania, which is a partner organization to the CLAA. The group was also involved in operational surveys with CLAA staff in order to discuss differences between countries and suggest improvements. A brief report of this workshop is available on the FAO Migrant Pests home page under the training section.

Based on the experience of Mauritania, which has profited tremendously from such collaborations, a more formal system of setting up such exchanges would be a valuable tool in improving desert locust control.

Locust Problems in Central Asia: FAO Round Table Publishes Results

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In August 2000, the international Round Table meeting on Locust Problems in Central Asia was held in Almaty (Kazakhstan). More than 80 specialists from 10 countries attended the forum. It was organized in the framework of the FAO Technical Assistance project implemented in 2000-2001. The materials of the Round Table are published in Russian in the first issue of 2001 of the new journal, *Plant Protection and Quarantine in Kazakhstan*. In particular, the following articles are available:

S. Khasenov, *Locust problem in Kazakhstan*
V. Kambulin, *Principal elements of the strategy and tactics of locust control*
M. Childebaev, *Effect of several insecticides on non-target grassland arthropod fauna*
G. Yusupova, *Acridicides: efficacy and environmental safety*
A. Zhasanov, *Italian locust in Aktyubinsk Oblast*
A. Smolyaninov, *Anti-locust control in Novosibirsk Oblast*
A. Anarbaev, *Locust control in Kyrgyzstan*
F. Gapparov, *Locust situation in Uzbekistan*
V. Bovsunovsky, *Locust control in N.-Kazakhstan Oblast*
M. Dubliazhova, *Locust control in Pavlodar Oblast*

Management of the Migratory Locust in Indonesia: Moving Toward Self-Reliance

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Indonesia has been confronted with serious infestations of the migratory locust, *Locusta migratoria manilensis*, since 1998. There have been significant outbreaks in many provinces and especially Sumatra, Kalimantan, and East Nusa Tangara. These outbreaks are likely to become chronic and to further develop with each dry episode related to the phenomenon of El Niño. The intensification of the deforestation and the development of new crops is also expected to exacerbate the situation. In 2001, CIRAD-Prifas continued its assistance with the support of the French Embassy in Indonesia. The actions lay within the scope of the general program of migratory locust control in this country. They came in support of concrete measures implemented by Indonesian authorities to improve locust control through application of recommendations made during the preceding missions. Four training courses were organized (in South Lampung and in Sumba Island) for pest observers and field extension workers (monitoring locust populations in the field and ULV techniques). Efforts were conducted at the national level for a standardized system of locust monitoring and survey within the framework of the Pest Forecasting Center (linked to the Directorate of Crop Protection) on Jatisari (Java Island). In addition, the outline of a guideline for pest observers was elaborated and discussed largely in the field with users. To amplify its efforts in locust control, the Indonesian government recently addressed (at the beginning of 2002) a request to FAO to profit from a technical cooperation project in locust control. The purpose is to strengthen the locust management program for food security improvement in some Indonesian provinces where locusts are endemic.

LECOQ M., M.-H. LUONG-SKOVMAND & T. RACHADI, 2001. *Improving survey and application methods for control of the Oriental Migratory Locust in Indonesia. Basis for a guideline for pest observers and field extension workers.* CIRAD-amis-PC-Prifas n° 66/2001, Centre de coopération internationale en recherche agronomique pour le développement (CIRAD), Montpellier, France. 50 p.

International Training on Bioecology & Control of the Central American Locust in México

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The Central American locust (*Schistocerca piceifrons piceifrons*) is distributed from northeast México (states of Tamaulipas and San Luis Potosí) to Costa Rica. This species represents one of the most important and devastating pests of subsistence and industrial crops (maize, sorghum, cotton, soybean, citrus, *Agave*) along its distribution area. Until recently, major damage to agriculture in México was caused by the Central American locust in the southeast (states of Yucatán, Chiapas, Tabasco and Campeche). However, since 1998, locust populations have increased in the northeast region, particularly in South Tamaulipas (Cd. Mante, Aldama, Gómez Farías, González) and San Luis Potosí, where locust swarms are being controlled at present. As part of the locust control campaign implemented by the States' Plant Protection Services an "International Training Course On Bioecology, Management, and Control Techniques of the Central American Locust" was carried out from 5 to 7 November, 2001. The course, organized by the Instituto Tecnológico de Ciudad Victoria and el Comité Regional de Sanidad Vegetal del Sur de Tamaulipas, was conducted in Altamira, Tamaulipas, close to the infested areas. Major objectives were to: 1) provide technical information and update technology for surveying and locust control; 2) train technicians and farmers on theoretical and practical aspects of locust biology, ecology and management of locust plagues.

Major topics included an overview of the locust problem in México, detailed information on bioecology of the Central American locust, surveying and campaign organization, ULV spraying techniques, principles of insectide use (mode of action, DL_{50}, toxicity and resistance), production, formulation, and operational use of *Metarhizium* for locust control, an overview of the locust problem and its management in Australia, locusts and grasshoppers of economical importance in Brazil, and environmental impact of locust control, among others.

Field work included surveying of locust populations, calibration of equipment and assessment of fipronil to control the Central American locust. Two doses were evaluated: 5 and 3 g.a.i./ha on 5^{th} to 7^{th} instar nymphs and young adults. Both provided excellent results (> 95% mortality five days after treatment) in water and soy oil formulations.

We appreciate the participation of our invited speakers: David Hunter from the APLC, Richard Milner from CSIRO, Wanderlei Dias Guerra from Ministry of Agriculture Brazil, Víctor Hernández Velázquez from CNRCB, and Othón Javier González Gaona and Pablo García Salazar from México. All academic work and arrangements were coordinated by L. Barrientos-Lozano and logistic aspects by Manuel Martínez Elizondo. We wish to thank all those who attended the training course (60 technicians and farmers), the invited instructors, funding institutions, and all those who contributed in one way or another to the success of the course.

Worldwide Conference on Orthopteroid Insects: A Swarm of Scientists Invades France

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This conference took place in Montpellier from 19 to 22 August 2001. This eighth international meeting of the Orthopterists Society was organized by the CIRAD-Prifas team. It gathered 180 congressmen of 40 different nationalities. The conference was a great success, as evinced by the level of the scientific papers, the satisfaction expressed by all the participants, the profitable contacts between personalities of very diverse backgrounds, and the strong media coverage showing the importance of the different topics. Forty oral presentations and 130 posters gave a good overview of the research undertaken in the world on orthopteroid insects, in the fields of control, biology, ecology, and systematics. In addition, many students were present at the meeting. Complete information on this congress as well as the summaries of the various presentations submitted is available at: http://os2001.cirad.fr.

GAY P.E., 2000. *International Conference on Orthopteroid Insects, Montpellier, France, August 19-22, 2001 /Conference internationale sur les Orthoptères, Montpellier, France, 19-22 Août, 2001*
Online: http://os2001.cirad.fr 61 p., in English and French.

AAAI Provides Global Market Analysis for Aventis

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Aventis contracted with the *Association for Applied Acridology International* to conduct a global analysis of acridicide markets. Six Associates/Affiliates from Australia, France, Russia, Senegal, and the United States worked for three, 12-hour days to discuss and write the 62-page report on eight major markets consisting of 27 market sectors. For each market sector, the report summarized: size, dynamics & sustainability, appropriate products, and opportunities & constraints. The report was summarized at a meeting with Aventis in Lyon, where an entire day was devoted to the analysis. Although the details of the report are proprietary, having been produced under contract, the Associates/Affiliates certainly gained a tremendous understanding of the complexity and scope of grasshopper and locust control on a world-wide basis. This project demonstrates the sorts of truly unique and powerful services that AAAI can provide to Sponsors and clients, and we look forward to future opportunities to work with agencies, governments, and industries.

COMMUNICATIONS: PUBLICATIONS AND ELECTRONIC MEDIA

"One Century of Locust Control in Africa" by J. Roy: Lessons from a Great Acridologist

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This book constitutes a history of the French interventions in locust control carried out during the 20th century, mainly in Africa. It evokes primarily the programs undertaken or financed by France to develop research or to support the control campaigns, separately or jointly with other countries or in support of the international initiatives. Control of the desert locust, the main pest locust, constitutes the main part of the book. But other species are also addressed, including the migratory locust and the red locust. In addition, there is mention of the French assistance in control of grasshoppers, whose chronic but less spectacular devastations have had a heavy impact on the food production of many African countries, in particular in the Sahel. The work is written by one of the principal actors of locust control during the second half of the 20th century. The author -- former officer-in-charge of the locust and emergency operations group of FAO in Rome -- was the creator of the federal locust service in French West Africa and was the person in charge for many years. This work is the first to synthesize the French works in the field of locust control. It shows the continuous efforts carried out by France in this field since the beginning of the 20th century and seeks to draw useful lessons for the future organization of locust control.

ROY J., 2001. *Histoire commentée d'un siècle de lutte antiacridienne en Afrique. Contributions de la France.* Coll. Les acteurs de la science, L'Harmattan, Paris. 286 p. [in French]

Russian Orthopterans go Online: The First Website Dedicated to Orthoptera in Russia

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The first Russian website devoted to the orthopteroid insects is now online at: http://fen.nsu.ru/acrida This website features a diversity of data, including general information about the main pest species and their pictures. We hope to develop this website and in the future create its English version.

Coming Soon! New Book on Locusts and Grasshoppers of Central Asia

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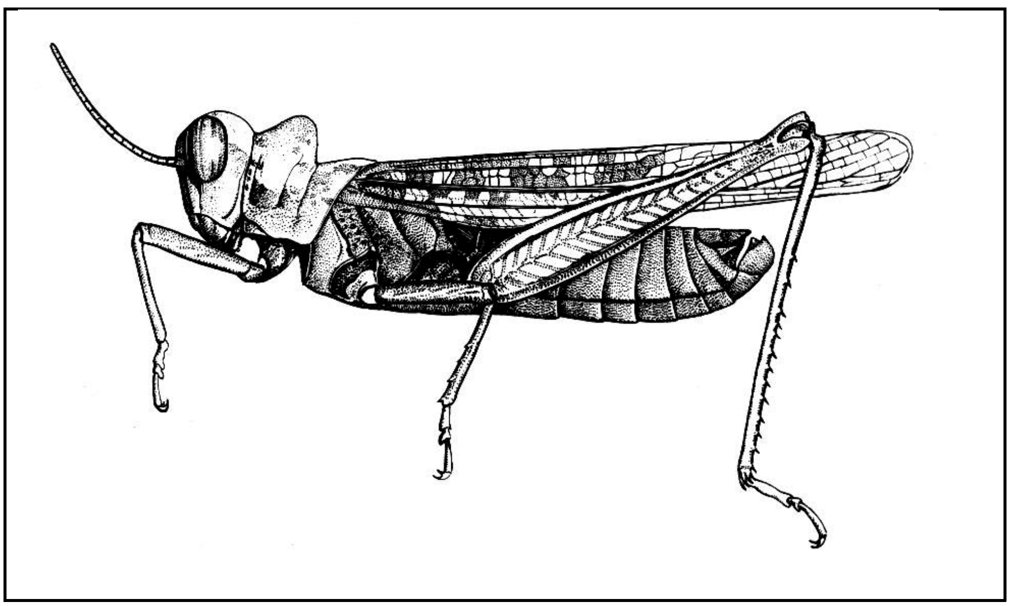
A book entitled *"Guide to the Acridids of Kazakhstan, Central Asia and Adjacent Territories"* is being prepared for publication in Russian by the Association for Applied Acridology International in conjunction with the University of Wyoming. The book (*ca*. 400 pp.) is a collective, several-year effort of scientists from four countries: Russia (M. Sergeev and M. Chernyakhovskyi), Kazakhstan (M. Childebaev and V. Kambulin), Uzbekistan (F. Gapparov) and the United States (J. Lockwood). It is edited by A. Latchininsky (Russia-United States).

The *Guide* covers >400 species of acridids of Kazakhstan, Uzbekistan, Tajikistan, Turkmenistan, Kyrgyzstan, and the adjacent areas of the Russian Federation. It includes chapters on acridid taxonomy and geographic distribution, biology, ecology, natural enemies, main economic species, current acridid situation in the region, and methods of population management. These are followed by identification keys to acridid egg-pods (>100 species) and adult insects. Many illustrations are original (see below), and prepared especially for this edition. For the first time in the Russian acridology, color photos of >50 acridid species complete the guide. The funding for the publication was provided by the University of Wyoming, Association for Applied Acridology International, Russian Academy of Sciences, and Aventis. The book is scheduled for publication in May 2002.



Dericorys tibialis (Pall.), male. Original drawing by M.S. Baitenov
(from the *Guide to the Acridids of Kazakhstan, Central Asia and Adjacent Territories*)

Australian Website Continues to Set a Standard for Applied Acridology

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As a "model" for how agencies, institutions, and companies might develop a highly navigable and informative website, consider the Australian Plague Locust Commission's site. This website can be accessed at: http://www.affa.gov.au/aplc

International Society for Pest Information: An Invitation to Applied Acridologists

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The International Society for Pest Information (ISPI) promotes information exchange with the aim to contribute to the development of pest management methods which are effective and safe for humans and the environment. We have started to assemble and maintain databases which contain lists of pests, beneficials and literature, as well as addresses of relevant research institutes, companies, organizations, scientists and professionals. The information is disseminated through the internet and on CDs. Currently our main activity is the preparation and distribution of the 'Pest Directory' database as a CD.

We are currently updating our database of scientific literature on locust and grasshopper control. We would like to encourage all AAAI members to contribute to our database. It will be to the benefit of all of us. For more information, check the ISPI website: www.pestinfo.org, or contact us: Jürgen Langewald (J.Langewald@cgiar.org) or Hans Wilps (Hans.Wilps@fao.org).

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Associate, Affiliate, and Partner Updates

CIRAD-Prifas Recruits a New Acridologist

M. Lecoq, CIRAD-Prifas, France: lecoq@cirad.fr

The CIRAD-Prifas team was reinforced in 2001 by the recruitment of a new acridologist, Alex Franc. Alex is stationed in Madagascar, within the new national Anti-locust Centre. He has been appointed as head of the French project supporting locust control in Madagascar, financed by the Service for Cooperation and Cultural Action of the French Embassy.

CIRAD-Prifas Moves to the International Baillarguet Campus

M. Lecoq, CIRAD-Prifas, France: lecoq@cirad.fr

Prifas, the research team in operational acridology of CIRAD, moved in 2001 to new buildings on the international campus of Baillarguet, within a few kilometers in the north of Montpellier. Its new address is as follows:

CIRAD - Dépt. AMIS - Programme Protection des cultures - Prifas
TA40/D, Campus International de Baillarguet
34398 MONTPELLIER CEDEX 5 - FRANCE
Phone : 33 (0)4 67 59 39 34   Fax : 33 (0)4 67 59 38 73
E-mail : prifas@cirad.fr   Internet : http://www.cirad.fr/web/prifas/acridiens.shtml

Acridological News from the Grasshopper Group in Wyoming

J.A. Lockwood, University of Wyoming, USA: lockwood@uwyo.edu

We are delighted and proud to announce that Alexandre Latchininsky earned his Doctor of Philosophy in entomology in 2001. Dr. Latchininsky's dissertation was "Environmental factors governing population dynamics of rangeland grasshoppers: The first application of GIS and remote sensing to Russian acridology". He is currently working as a grant-funded postdoctoral Research Scientist at the University of Wyoming. In addition, it is our pleasure to report that Kirk VanDyke will defend his dissertation in May of 2002. The soon-to-be Dr. VanDyke's research was on the genetic structuring in populations of alpine grasshoppers at the meadow, watershed, and mountain range scales. We are also pleased to note that Mr. Alexander Chernysh joined our laboratory and is pursuing his Master of Science in entomology. A graduate in Agroecology from Saratov State University, Mr. Chernysh's thesis will focus on strategies to enhance the efficacy and economics of *Beauveria bassiana* as a mycopesticide for grasshopper control. We are also most pleased to report that Mr. Douglas Smith, a graduate of the University of Wyoming in entomology, is continuing his studies at the graduate level. His thesis research is addressing the non-target effects of standard, blanket applications of insecticides and Reduced Agent-Area Treatments for grasshopper control, using carbaryl, diflubenzuron, and malathion. Our Research Associate, Mr. Scott Schell, continues to play a central role in our field research, including developing the concept and practice of ground-based applications and educating pest managers (including co-leading a statewide workshop on grasshopper management for Weed & Pest Districts involving 40 participants). Finally, our other Research Associate, Mr. Spencer Schell, continues to update and refine the "Grasshoppers of Wyoming and the West" website (http://www.sdvc.uwyo.edu/grasshopper/), among his other duties. The website has received two national awards for excellence in scientific education.

INDEX OF ORGANIZATIONAL ACRONYMS

ADB	Asian Development Bank
AGRHYMET	Centre for Agro-hydro-meteorology, Niger
APLC	Australian Plague Locust Commission
BCP	Biological Control Products, South Africa
CEPAVE	Parasitological and Vectors Research Center, Argentina
CERES	California Environmental Resources Evaluation System, United States
CILSS	Standing Committee Inter-States of Fight against the Dryness in the Sahel, Burkina Faso
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement, France
CLAA	Centre de Lutte Antiacridienne, Mauritania
CLCPANO	Commission de Lutte Contre le Criquet Pelerin en Afrique de Nord-Ouest
CNA	Centre National Antiacridien, Madagascar
CNRCB	La Commission Nationale de Reconnaissance des Cols de Belgique
C-PAS	Centre for Pesticide Application and Safety, Queensland
CSIRO	Commonwealth Scientific & Industrial Research Organisation, Australia
CTA	Technical Centre for Agricultural and Rural Cooperation, Mauritania
DLCC	Desert Locust Control Committee
EMPRES	Emergency Prevention System (FAO)
EPHE	École pratique des hautes études, France
FAO	Food and Agricultural Organisation of the United Nations, Rome
GTZ	Gesellschaft für Technische Zusammenarbeit, Germany
IITA	International Institute of Tropical Agriculture, United Kingdom
ISPI	International Society for Pest Information, United States
LUBILOSA	Lutte Biologique contre les Locusts et les Sauteriaux, Benin
NGO	Non-governmental organization

NLU	Institut für Natur- Landschafts- und Umweltschutz, University of Basel, Switzerland
NOAA	National Oceanic and Atmospheric Administration, United States
NRI	Natural Resources Institute, United Kingdom
OCLALAV	Organisation pour la lutte antiacridien et anti avaire, Senegal
OPR	Operations Performance Review, Mauritania
SAGARPA	Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food of the United Mexican States
UNLP	La Plata National University, Argentina
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
ZOPP	Ziel Orientierte Projekt Planung, Germany

Association for Applied Acridology International

Our Mission:

As pest management techniques, perspectives, and products have become increasingly sophisticated in the last 20 years, our capacity to adapt and transfer the methods and knowledge has declined. Formerly effective programs have dramatically diminished their roles in assisting afflicted regions. While the ability for any single nation to sustain a critical mass of expertise in acridid (grasshopper and locust) pest management has diminished, the quality of geographically dispersed experience and knowledge is extremely high.

The *Association for Applied Acridology International* has brought together the world's leading practitioners in this field to develop and provide unbiased analyses along with culturally, technologically, economically, and environmentally appropriate methods for managing locust and grasshopper outbreaks. The *Association* is the first and only humanitarian-based, NGO of entomologists in the world, providing expert advice, training, and applied research to people and nations in need. The demonstrable capacity of grasshopper and locust outbreaks to reduce the standard of living, displace human populations, induce famine, and erode environmental quality demands the highest level of practical expertise and experience in order to rapidly build the capacity of agricultural communities to implement safe and effective prevention and control programs. The *Association* consists of 35 Associates/Affiliates from 24 nations, representing more than 300 years of collective experience and 13 Institutional Partners/Participants comprising the world's best organizations dedicated to the study and management of acridids (see inside, back cover).

The purpose of the *Association for Applied Acridology International* is to form a coordinated, operational pool of world experts, thereby creating opportunities for collaboration and enhancing access to this expertise by governments, agencies, and companies. This goal is captured in our motto:

Solutions without Limits
by Scientists without Borders

For more information, select *Association for Applied Acridology International* from the left-hand frame at http://www.sdvc.uwyo.edu/grasshopper/

ASSOCIATION FOR APPLIED ACRIDOLOGY INTERNATIONAL

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Jeffrey Lockwood	USA
Alexandre Latchininsky	Russia/USA
Richard Brown	South Africa
James Everts	Netherlands/Senegal
David Hunter	Australia
Carlos Lange	Argentina
Michael Sergeev	Russia

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Igor Sokolov	Russia	Ecotoxicology (non-targets)
Peter Spurgin	Australia	Management, Application techniques
Hans Wilps	Germany/Africa	Management, Logistics

Affiliates

Ludivina Barrientos Lozano	Mexico	Biological control, Ecology, Management
Furkat Gapparov	Uzbekistan	Ecology, Management, Logistics, Operations
Victor Hernández	Mexico	Management, Ecology
Christiaan Kooyman	Kenya	Operations, Logistics, Biological control
Jurgen Langewald	Benin	Capacity building, Survey, Biological control
Bernard Maiga	Mali	Operations, Management, Logistics
Richard Milner	Australia	Biological control, Management
Tahar Rachadi	France	Application techniques, Capacity building
Harizo Rasolomanana	Madagascar	Ecotoxicology, Management
Matthew Thomas	United Kingdom	Ecology, Ecotoxicology, Biological Control
Garba Yahaya	Niger	Logistics, Operations, Management

Partner/Participant Institutions

Australian Plague Locust Commission (APLC)	Australia	Graeme Hamilton
All-Russian Institute for Plant Protection (VIZR)	Russia	Vladimir Pavliushin
Centre for Agriculture and Biosciences International (CABI)	United Kingdom	Geoff Waage
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Chinese Academy of Sciences	China	(pending)
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LOCUSTOX Project of the United Nations FAO	Senegal	James Everts (pending)
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