

LU·BI·LO·SA 3

The Newsletter of Phase 3 of the LUBILOSA Programme LUBILOSA - Lutte Biologique contre les Locustes et Sauteriaux The Biological Control of Locusts & Grasshoppers

Issue No. 4 December 1997

WELCOME

The publication of this issue marks the full annual cycle since the production of the first issue of LUBILOSA 3. We are now having to print 400 copies per issue to meet the current demand for this newsletter. The year has seen many advances within the programme: the verification of the efficacy of the LUBILOSA mycoinsecticide through comparative trials with fenitrothion and approval for use by the FAO Pesticides Referee Group, new standards set for ecotoxicological tests with lizards, successful collaborative field trials with our partner countries in West and East Africa and with PPRI in South Africa - to name but a few. The high standard of scientific endeavour has continued with this years field trials in Maine Soroa, Niger.

The large-scale trials carried out in Maine Soroa again this year confirmed last season's results that fenitrothion treated areas are quickly re-invaded after an initial decline and grasshopper population size increases over time to levels greater than those in the *Metarhizium* treated areas. Waiting for the results this year had us sitting on the edge of our seats in anticipation because we had reduced the application rate to the low rate of 0.5 litres per hectare - but we shouldn't have worried! When the results came through, we had still achieved excellent levels of control even at this incredibly low application rate.

The LUBILOSA scientists were once again taking a leading role in promoting mycoinsecticide R&D in their presentations at this years SIP conference, held in Banff, Canada. The conference provided a great opportunity for the LUBILOSA scientists to discuss the work of the programme and we came away with the feeling that the progress of LUBILOSA is being closely followed with interest by the wider scientific community and the commercial companies involved in producing mycoinsecticides. The issues of production and the role of commercial companies in the manufacture, marketing and sale of the LUBILOSA mycoinsecticide is discussed in an article in this issue written by Roy Bateman entitled "The Two Technologies".

A smaller but no less influential group of scientists met as the Expert Advisory Committee to review the LUBILOSA programme in late September. In this issue, we report on the meeting in only general terms since we need to await the full report to the Programme Management Committee before publishing the recommendations in detail.

LUBILOSA is funded by the Governments of Canada (CIDA; Canadian International Development Agency), Switzerland (SDC; Swiss Development Cooperation), the Netherlands (DGIS; Directorate General for International Cooperation) and the UK (DfID; Department for International Development).

LUBILOSA Contact Names and Address

International Institute of Biological Control
Silwood Park, Buckhurst Road, Ascot, SL5 7TA, UK.
Fax: 44 1344 875007
Tel: 44 1344 872999
E-mail: D.Dent@cabi.org
Contact: Dr. David Dent, Programme Manager

International Institute of Tropical Agriculture
Plant Health Management Division,
B.P. 08-0932, Cotonou, Benin.
Fax: 229 350556
Tel: 229 350553 / 350188
E-mail: IITA-BENIN@CGNET.COM
Contact: Dr. Chris Lomer, Programme Leader

CILSS-INSAH
BP 1530, Bamako, Mali.
Fax: 223 225980
Tel: 223 224681
Contact: Dr. M.S. Sompo-Ceesay

CILSS-AGRHYMET
BP 12625, Niamey, Niger.
Fax: 227 732237
Tel: 227 732181
E-mail: AGRHYMET.CENTER@HIS.COM
Contact: Dr. J. S. Oliveira

GTZ
Postfach 5180
65726 Eschborn, Germany
Fax: 49 6196 79 7413
Tel: 49 6196 79 3289
E-mail: Stephan.Krall@gtz.de
Contact: Dr. Stephan Krall

THE TWO TECHNOLOGIES

One of the debates within the LUBILOSA Programme has centred around the level of technology necessary for mass production and formulation of mycoinsecticide products. The concept of "cottage industry" production has obvious attractions from a developmental point of view. The production of *Beauveria bassiana* in P.R. China has been quoted as a model, but it is revealing that LUBILOSA scientists have been invited there recently to collaborate on improved mass production and formulation methods.

The Programme has maintained an open minded, "two technology" policy to date over these issues:

1) The development of a *labour intensive*, "intermediate technology" for small scale mass production and formulation. This provided us with:

- a "public service" technology with all information on the preparation of an ultra-low volume (ULV) suspension (SU) formulation, with a proven efficacy and based (if necessary) on locally available substrates and formulating oils. This technology is being released to the public domain and has generally been met with approval by African counterparts.
- a pilot production plant (constructed at IITA, Cotonou, Benin) that has been essential for carrying out field testing in the Programme, culminating in an 800 ha aerial treatment against the Senegalese grasshopper in Niger.

2) *Capital intensive* mass production and formulation, including "high technology" where necessary. This includes industrial scale developments to:

- the mass production system in order to benefit from economies of scale, facilitate quality assurance and improve the conversion of substrate biomass into product.
- the manufacture of improved formulations such as an oil-miscible flowable concentrate (OF) developed by the Programme to ease operator handling and therefore more appropriate for large scale acridid control than the use of pure spore powder or the SU formulation.

Wherever possible, simple equipment was used in the pilot production plant in order to develop an appropriate technology that could be imitated by small enterprises in Africa. The labour intensive approach has been shown to be more economical for very small mycoinsecticide markets and may have limited use for:

- target pests such as *Zonocerus* where different isolates of *Metarhizium* must be used - especially where the insect can be effectively controlled at a greatly reduced dosage
- preparation of inoculum for situations where the mycopathogen can act effectively with secondary cycling and thus act more as a classical biological control.

However, it has become clear that the widespread adoption of mycoinsecticides is most likely with option (2). Over the past few years, Programme scientists have become particularly aware of the elevated level of technology (with implications for equipment costs and qualified staff time) needed to achieve a high quality mycoinsecticide product for safe and reliable ULV application. Desert locust swarms individually may occupy > 1000 km² and even other less notorious species require large scale interventions, such as the Senegalese grasshopper which infested 7000 km² in Mali alone during 1985. Large scale mycoinsecticide treatments will not be possible with facilities modelled on the IITA production plant which has the capacity

to supply approximately 20 km² per year at current rates of production and application.

Capital intensive production facilities could still be constructed in developing countries near the target pest problems and the existence of high quality beer (or soy sauce) factories are popularly quoted as models. A factory in Reunion produces 'Betal' (a *Beauveria bassiana* preparation) using a relatively "high technology" process. This level of technology generally reduces the risk of operator error. Therefore it may be more appropriate than labour intensive systems in developing countries and in other areas where there are skills shortages.

EAC EVALUATION

The LUBILOSA Expert Advisory Committee (EAC) met to review the programme between 29 September and 1st October at IIBC, Silwood Park, UK. The event brought together LUBILOSA scientists from far and wide to meet and discuss their work with the committee of Dr Wendy Gelernter (PACE consultant, USA), Dr David Rhodes (ZENECA, UK) and led by Dr Paul Wellings (CSIRO, Australia). The review involved a day of formal presentations covering: production (local and commercial), storage, formulation and application, field trials and partner participatory trials, locust and entomopathogen ecology, socio-economics and ecotoxicology. This was followed on the second and third day with group discussions on a range of subjects, during which time the EAC had the LUBILOSA team conducting SWOT analyses and a Features, Advantages and Benefit analysis (FAB). In turn the EAC provided demonstrations of how to conduct meaningful market analyses, to identify key customer values and map out the product distribution chain.

The EAC have produced a number of recommendations for the Programme to implement in its final 18 months. These deal with issues under four headings: technical, socio-economic, commercialisation and project management. The recommendations raised by the committee will undoubtedly make a significant contribution to the final success of the LUBILOSA programme. All of the LUBILOSA team who participated in the review found the experience wholly constructive and positive and look forward to implementing the recommendations proposed.

A full report of the review will be presented by Paul Wellings, pictured below, to the Programme Management Committee (PMC) when they meet in December.



LUBILOSA FIELD TRIALS

The initial results of the 1997 field trials with *Metarhizium flavoviride* have again indicated the effectiveness of the LUBILOSA mycoinsecticide. In Maine Soroa, Niger, grasshopper populations consisting mostly of *Oedaleus senegalensis* were reduced significantly, following treatment with an aerial application of *M. flavoviride* at the incredibly low rate of 0.5 l/ha. Populations treated with *M. flavoviride* were significantly lower than the controls after 9 days and 80% control was achieved after 21 days. In contrast, populations treated with the chemical fenitrothion were observed to recover substantially.

Aerial application of *Metarhizium* at 0.5 l/ha



(Photograph by Roy Bateman)

The LUBILOSA programme has carried out trials for grasshopper control in eastern Niger since 1993 using conidia of *M. flavoviride* formulated in oil. Previous applications have usually been at approximately 2 l/ha using ground based equipment and up to 50ha plots. In these trials:

- we used a Cessna Ag. Truck 188 aeroplane belonging to the Plant Protection Service of Niger.
- we used a novel oil miscible flowable (OF) formulation, the supply of which was an operation in itself requiring the production of 90kg of IMI 330189 *M. flavoviride* spores (thanks again due to the Mass Production Team at Cotonou, Benin). This formulation mixed well and no problems were encountered during its application.
- after much discussion, we decided to take the risk of reducing the volume application rate in the *Metarhizium* plot to 0.5 l/ha. This was the "least of all evils" in order to treat the larger 800 ha plots in single sorties, which was all that was possible in a day. Rates of volume application, and therefore work, are an important issue in this competitive market.
- the spray operation went without major hitches using the tried and tested bonfire plus 3 flag vehicles for swath marking.

The results show that, although grasshopper populations treated with fenitrothion crashed within a day of spraying, they subsequently increased so that populations treated with *M. flavoviride* were lower after 10 days, and continued to decline to less than 2 grasshoppers/m² after 16 days. At this stage, mean population densities were approximately 16 grasshoppers/m² in the control plots and 8 grasshoppers/m² in the fenitrothion plots.

Applications of broad spectrum insecticides are known to have a significant environmental impact and there is a recognised need for products such as the *Metarhizium* mycoinsecticide that can be used in environmentally sensitive zones. However,

NEWS IN BRIEF

The Expert Advisory Committee reviewed progress within the LUBILOSA Programme at the end of September. A comprehensive report and recommendations adds momentum to the Programme's move towards commercialisation.

LUBILOSA Programme Management Committee will meet on 10 - 12 December at GTZ Headquarters in Eschborn, Germany.

A second year of successful results from large scale field trials in Maine Soroa comparing *Metarhizium* with the chemical Fenitrothion.

Mission statement helps focus LUBILOSA efforts in the final 18 months - "to focus every effort and resource into achieving all outputs in such a way that registration, commercial production and availability of the mycoinsecticide is assured with the time-frame of the Programme"

it is unlikely that alternative agents will become widely accepted unless the formulations are:

- easy to handle, requiring a minimal amount of preparation before spraying,
- capable of use in treatments at an acceptably high work rate,
- capable of long-term efficacy that is comparable with chemical products.

With these successful results, the LUBILOSA programme will continue the development of mycoinsecticide formulations that will satisfy these conditions. The other major objectives of these trials were to assess the environmental and socio-economic impact of such an intervention. However, the collection and analysis of a large amount of data is not yet complete and the results will be reported in a future issue of LUBILOSA 3 when they are available

We are most grateful to the Plant Protection Service of Niger for their most effective collaboration in the trials and to the spray pilot Mr. Christian Collomb.

- Roy Bateman

The LUBILOSA field team in Maine Soroa, Niger, this year



(Photograph by Roy Bateman)

LUBILOSA PROFILES



Roy Bateman trained as an entomologist and has specialised in pesticide application for more than 15 years, especially in association with IPARC (the International Pesticide Application Research Centre) at Silwood Park, Ascot. He has a particular interest in controlled droplet application and is soon to finish a book on the subject. Before joining LUBILOSA, Roy worked on pest management projects for several crops (especially rice and cotton) in the Philippines, Viet Nam, Zimbabwe and Malawi. His field trial work in Africa formed part of his industrially sponsored PhD on the development of suspension formulations for ultra-low volume application of a carbamate insecticide for bollworm control.

Roy was the first scientist specifically recruited to the LUBILOSA programme, joining the team (and IIBC) in November 1989. He is an invaluable member of the team with his work on the formulations of *Metarhizium* spores in oil which has been essential for the success of the LUBILOSA Programme.

Roy clearly remembers the day early in 1989, when a bearded stranger, Dr. Chris Prior, wandered into IPARC and said "I want to hire a spray man for a project I am setting up to control locusts with fungi". "That won't work," said Roy to himself but he needed a job and after 8 years as formulation and application specialist, he now cheerfully admits "how wrong can one be?"



Ralf Peveling is the Leading Investigator and Research Co-ordinator for ecotoxicology in LUBILOSA and is on a contract with the programme from the Institute for Environmental Research, University of Basel in Switzerland. Ralf is responsible for co-ordinating and conducting research on the environmental impact of mycoinsecticides in locust and grasshopper control and has

pioneered the development of a new toxicity testing protocol for reptiles (see "No impact on reptiles", Issue 3 of LUBILOSA 3 Newsletter).

Ralf obtained an MSc in Biology from the University of Giessen, Germany in 1985. His PhD in Biogeography from the Centre for Environmental Research, University of Saarbrücken, was on the ecology and management of red-billed weaver birds in Somalia. Ralf has gained a variety of experience in the field of environmental impact monitoring and environmental management in the tropics (Africa and Southeast Asia), undertaking projects for both private companies and GTZ. In addition to his LUBILOSA work, he is also responsible for ecotoxicology research in the project Integrated and Biological Control of Locusts and Grasshoppers (BMZ/GTZ) and is in charge of tropical ecology and resource management at the Institute of Environmental Research in Basel.

MISSION STATEMENT

One of the recommendations arising from the EAC review was a need for the LUBILOSA team to have a clear idea of where our work would be heading over the next 18 months to ensure that the Programme achieved its goals. A simple aid to helping teams to do this is what is called in the business world, a mission statement. The following statement sums up our mission:

"To focus every effort and resource into achieving all outputs in such a way that registration, commercial production and availability of the mycoinsecticide is assured within the time-frame of the Programme".

"A scientist who works for the advancement of medicine or agriculture or the improvement of manufacturers can be - often is - in an age of material progress. As such, he will be frowned upon for two different reasons: the first is that which is embodied in the well-known cliché of second rate criticism to the effect that material prosperity entails spiritual impoverishment; and the second, much more serious, is that material progress does not hold out the promise of remedying any of the major ailments that afflict mankind today." - P.B. Medawar

LUBILOSA IN BANFF

The annual meeting of the Society for Invertebrate Pathology was, this year, held in Banff, Canada. LUBILOSA took the opportunity to discuss their work with other scientists working on fungal pathogens at this SIP conference. The LUBILOSA scientists presented six papers, including two plenary papers on "Mycoinsecticide formulation development in the UK" (R. Bateman) and "Application of ecology to the practical use of mycoinsecticides" (M. Thomas).

The papers considered the "evidence for behavioural fever in a field population of the Senegalese Grasshopper" (presented by S. Blanford), the "development of a model to predict the effect of temperature and moisture on fungal spore longevity" (presented by D. Moore), the "fluctuating temperature bioassay for the selection of fungal isolates with superior field performance" (presented by N. Jenkins), and the "biological control of *Zonocerus variegatus* with *Metarhizium flavoviride*: dose mortality time response in the field and the implications of low dose treatments" (presented by J. Langewald).

The abstracts of all these presentations have been bound together and are available free of charge upon request. Please contact Jeremy Harris, LUBILOSA Project Officer at IIBC.

"A peasant will stand for a long time on a hillside with his mouth open, before a roast duck flies in." - C. R. W. Spedding